Interaction in motion: Embodied conduct and movement in emergency teamwork

Monika Büscher
Department of Sociology, Lancaster University , UK.
Email: m.buscher@lancaster.ac.uk

Abstract: Emergency situations demand fast, effective multi-agency collaboration. Communication is crucial, but often difficult under immense time pressure, in extremely complex and often very dangerous settings. This paper explores the role of embodied conduct and movement in making sense of the changing situation and in coordinating emergency teamwork. It presents ethnographic observations with emergency service professionals during training exercises for major incidents and ethnomethodological analysis.

Key words: *embodied conduct, motion, coordination, emergency teamwork*

This is the print version of an online publication. Readers can find multi-media content at TBA

1. Introduction

Gesture research has always recognised the interdependence of language, embodied conduct and the material environment in social encounters (Kendon, 1976; Lebaron, & Streeck, 1997; Goodwin, 2003). But for the most part, researchers have concentrated on 'focused encounters' (Goffman, 1961) where small groups of participants are oriented towards each other and their environment. Larger scale, more peripheral and multi-participant aspects of the role of embodied conduct have only infrequently come under scrutiny – most notably at airports (Goodwin, & Goodwin, 1996), in control rooms (Heath, & Luff, 1992), and museums (vom Lehn et al., 2001). The study at hand contributes to this line of inquiry by examining interaction in the context of emergency response training exercises. Detailed analysis of data from video recorded participant observation during the one hour on site part of a training exercise in Aarhus, Denmark (Figure 1), shows that people's movements and embodied conduct, and the movement of victims and equipment is socially organised and a crucial resource for coordinating the large scale and fast paced coordination of work that is required in emergencies.

Figure 1: Video stills from start to end of the on site part of the exercise. Names of staff have been changed and the faces of 'victims' have been blurred to safeguard anonymity. Roll your cursor over the image to hear a sound collage (or click here). Click on the image to see a larger version. Click ⟳ Back to return to this page.

In the exercise scenario a school-bus has collided with a train carrying hazardous chemicals. A group of emergency training officers have staged this collision at the harbour. They call 112, the number used for all emergency calls in Denmark and notify the police. This is a 'live' exercise, which means that the accident will be reported as real on the online police system, which is integrated with communication systems in emergency control and dispatch centres, fire stations and hospitals nationwide. The exercise is meant to test and train the readiness of regular on duty personnel, and it is soon correctly classed as a major incident, which means that several different agencies will be involved. Within seconds the first members of an even-

tually over 30 persons strong team arrive: three police officers, a fire crew, and an ambulance with two paramedics. A medical team, a second fire crew and a crew of 'incident assistants' arrive later. Eight school children are trapped on the bus, some (made up to look) severely injured. It soon becomes clear that this is not a real incident, but an exercise. Nevertheless, most of the personnel take the situation very seriously.

The seriousness and realism of exercises like this reflects the difficulty of achieving a coordinated response across different agencies and locations. On the incident site, police, fire services, and medical personnel need to continuously assess the situation, secure the scene, create access routes and ensure they are kept free; categorise, treat and transport victims; handle hazardous materials or deal with contamination; and coordinate work with colleagues in emergency vehicles, dispatch centres, and hospitals. Each professional and each team must make their own decisions and get urgent work underway, in a way that is sensitive to decisions and activities elsewhere. Coordination is difficult, under immense time pressure, in complex, often chaotic and dangerous settings. Exercises serve to test equipment and familiarise people with its use and help staff to put training and emergency response plans into practice and thereby evaluate their efficacy (Peterson, & Perry, 1999). But perhaps most importantly, exercises train people's awareness and collaborative decision-making skills, to minimize response times and maximise the appropriateness of the response.

Effective communication has been recognised as a key factor for awareness, collaboration and decision making in emergencies and some key insights from research in this field will be reviewed briefly in the next section. There is very little analysis of embodied conduct. Yet, a close look at the first few minutes of the emergency personnel's response to the incident at Aarhus harbour highlights the significance of embodied conduct and motion. An audio-visual ethnographic report is provided in section three. The discussion in section four draws out key features of large scale, fast-paced, peripheral and multi-agency emergency teamwork.

2. Background

Most studies of emergency work focus on control centres, where emergency calls are received and response teams are dispatched. Nevertheless, some important insights can be gleaned. In their recent review, Pettersson et al. (2004), for example, highlight ambiguities, awareness and economy as key features of emergency communication. They show that it can be difficult to communicate and understand the exact location of an emergency. Moreover, judgements about the seriousness of incidents and the availability of response teams must be made fast, and often with inadequate and complexly interrelated information (see also Martin et al., 1997). To add to the confusion, several different witnesses may report the same incident. The call takers, who may be distributed across large control centres, must realise this quickly in order to avoid dispatching duplicate resources to the same incident. Awareness is achieved through a range of sophisticated verbal and non-verbal means, many of which are intricately tied to material resources (e.g. screens or maps) and the environment of the control centre. Heath, & Luff (1992), for example, describe how talk, but also repeat embodied 'performances' (e.g. a worried, prolonged gaze at a display board on the wall) are designed to draw attention to problems. Such almost theatrical, exaggerated forms of embodied conduct may also serve to reach into the peripheral perceptual fields of busy colleagues whose monitoring of activities around them must necessarily be cursory (see also Heath, 1986, p. 72). Embodied behaviour is a crucial contributor to the 'economy' of interaction aimed at achieving an appropriate emergency response efficiently and swiftly. It is important to note that although researchers may describe talk and behaviour as designed and economical, they also stress that hey are usually routine and 'automatic' rather than deliberately planned and executed in these particular ways. 'Fitness for purpose' and economy are effects of ordinary

action. They evolve over time. People fine-tune their grasp of material affordances, and their own and their fellows' human capabilities through everyday, hands-on interaction with tools, technologies, materials, environments and other people.

More recently, a few studies of emergency communication 'on the ground' have been published. They focus almost exclusively on verbal communication. Dunn et al. (2002), for example, examine data from training exercises around a chemical spill scenario, involving fire and rescue service personnel. Rather than study the practical resolution of ambiguities, Dunn et al. posit that the more information people are able to exchange, the better the chances for good decisions. They argue that because communication takes time that could otherwise be spent on urgent tasks, patterns of communication emerge that allow people to juggle talking about what should be done, and doing it. Constant exchange strategies that are unaffected by the demands of the tasks at hand seem to be more conducive of an appropriate response than patterns where communication is more periodic. While Dunn et al. (2002)seem to suggest that work and talk, or responding and coordinating are separate, almost incompatible activities, Landgren (2005, 2006) is more sensitive to the way in which both, work and coordination, are achieved by and through talk. He describes sense-making en route to a fire incident and maps out rhythms of talk during mobilization, intervention, situational adjustment and incident completion. Landgren, too, focuses on verbal communication as the primary tool for coordination, but also highlights the 'documentary' role of talk, not only with a view at the production of records after the event, but also, and more importantly, with regards to the role that overhearing and seeing colleagues talk plays in mutual awareness. On-site communication between different agencies and overhearing are made difficult by noise and chaos as well as the use of different radio frequencies (Kristensen et al., 2006), hampering coordination work done in and through talk. Landgren's ethnographic approach (2006) is part of a technology design project, and his analysis informs the design of a tool that seeks to provide an audio-visual 'map' of talk to emergency staff en route to, or already on the site, which could be used to support awareness of ongoing work and decisions.

The study at hand is similarly motivated by a desire to inform the design of new technologies that can support the work of emergency personnel. Together with several of the staff involved in the exercise I am a member of an interdisciplinary team concerned with the design of ubiquitous and mobile computing (PalCom). Our ethnographic work is ongoing and the results presented here are exploratory in nature. Design ideas and implications are discussed elsewhere (Büscher and Mogensen, submitted 2007, Kristensen, 2006), and will not be considered in this paper, in order to give room to a discussion of emergency teamwork.

3. The study

While speed is of the essence in emergency situations, appropriateness of response ranks even higher. Responsibility for an accurate threat assessment lies particularly heavily on the shoulders of those arriving at the scene first (Perry, & Lindell, 2003). I therefore examine the opening few minutes of the harbour emergency exercise, to gain a sense of how first-on-the-scene staff assess the situation and coordinate an appropriate response in practice.

Figure 2: A first threat assessment on arrival at the accident scene.
Click here to view a short video clip.

Peter and Michael, two regular on duty paramedics, have been called to the accident at the harbour (Figure 2). As they step out of the ambulance, they see a police officer looking at the train as a fire fighter runs towards it, both also looking at them. Screams from the bus are muffled by generator noise. Peter runs towards the fire fighter and the police officer. Although only one side of this first coordination effort is on the video, we see that it is interactionally organised not only through talk and the normal means of embodied orientation and gaze, but also in and through motion.

Figure 3: Coordination in and through motion.

As Peter strides towards the police officer, the orientation of his body suggest that he is already half on his way back (Figure 3). He is ready to put on the surgical gloves which re in his right hand, making it obvious that he is keen to attend to victims on the bus. He asks 'is it safe?' and before completion of the police officer's 'no, no', produced in overlap, Peter takes another stride forward, and repeats the gesture. Movement and gesture question the police officer again, this time without words, publicly documenting trouble in a noisy environment. Hearing part of an explanation (inaudible to the observer) Peter echoes the 'no'. While looking at the police officer who is still explaining, Peter co-produces the end of the explanation and starts to turn his back on the police officer. He is now joined by his colleague, Michael, who saw the 'performance' of trouble and now overhears the reasons for it.

However, that it is not safe to go in the bus takes a while to sink in. They are the first ambulance to arrive on the scene, which means one of them has to act as the ambulance manager. In Figure 3, Michael is just putting on a vest that says 'ambulance manager'. They stop turning, step back, look at the bus, at the train, at each other, begin to walk off in opposite directions, then – in mid step – Michael changes direction, and follows Peter. For some seconds, it is evident that confusion reigns (Figure 4).

Figure 4: Animation. Confusion reigns (here in slow motion). Click here to see videoclip.

Michael and Peter both return to the ambulance and get out helmets. They check briefly on two children who have come out of the bus, but cannot begin transporting or treating victims until the risk area and the nature of the threat from the chemical spill have been defined (a task led by the fire brigade manager), they are drawn into participating in the threat assessment (Figure 5).
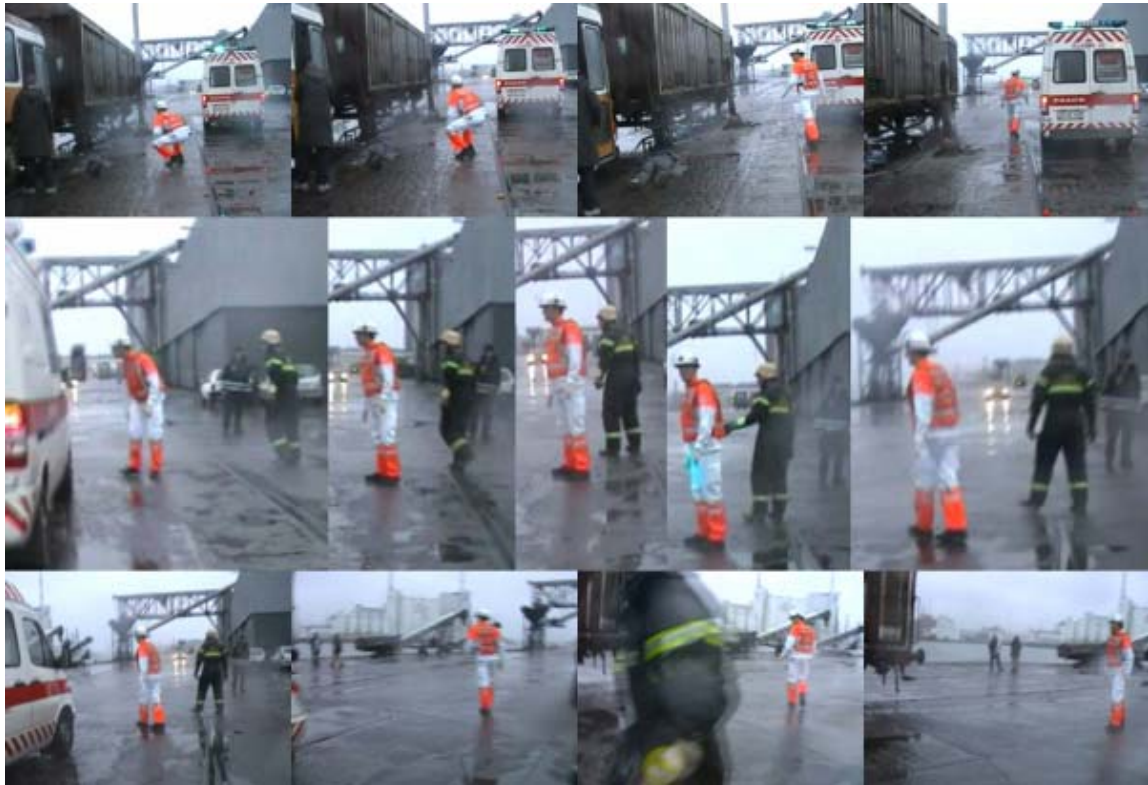

Figure 5: Multi-agency collaboration in threat assessment. Click to view video clip.

There is 'smoke' (created with dry ice) coming out from under the bus, blowing off to the back. It looks like its source is on the other side of the railway carriage. Michael walks across to take another look from a safe distance.

This is picked up by a passing fire fighter, who briefly mirrors the pose. It could be that the paramedic has noticed something important. The fire fighter looks towards the police manager, the other fire fighters and the fire brigade manager who are outside the video frame, and then walks off, while the paramedic hesitates whether to take a closer look at the railway carriage.

Glancing to his left, Michael now sees the doctors' van arriving, and Lars, the fire brigade manager, coming his way (Figure 6). He greets him: 'Good day Lars', but Lars does not return the greeting. Instead he says 'There is a spill on the other side' and keeps walking.

Figure 6: Inspecting the source of the smoke. 'CORV' stands for 'Chemical and Organic Rescue Vehicle'.

Click here to watch video clip.

So far, Lars has been told that the spill is of a dangerous acid. Later, as we will see, it turns out that the level of danger requires breathing equipment. At this point, however, there is no way of sensing that danger, which is why Lars and Michael approach without protective equipment. Simulation of chemical (and radiological or biological) dangers is notoriously difficult. It is virtually impossible to produce realistic symptoms (smells, colours, chemical reactions), let alone simulate interaction with atmospheric and geographical forces. Lars and Michael rush to look at the spill together (Figure 6). Michael's question about a Chemical and Organic Rescue Vehicle emphasises the uncertainty about the nature of the chemical agent (and the intentions of the exercise organisers). Part of their retreat is a collaborative gesture in motion. This gesture is, again, a mirror production (Figure 7).
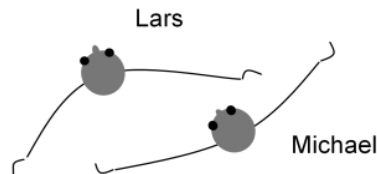

Figure 7: Michael reflects Lars' protective gesture.

Research in social psychology suggests that mirroring like this plays an important role in establishing and documenting rapport (Lakin, 2003). Good rapport is of vital importance in emergency situations, where many different actors need to work together – fast. Some of them, like Michael and Lars, might know each other, but many will have never met before.

Good rapport also helps convey professionalism and efficiency – something that emergency services are increasingly keen to communicate in the light of public criticism, for example about the rivalries between police and fire units on 9/11 (National Commission, 2004).

Based mainly on laboratory experiments, social psychology shows that mirroring affects both, the participants' ability to collaborate and observers' perceptions of their performance. However, the question that is most interesting for sociological inquiry (and for the design of technologies to support collaborative action) is not addressed. To understand mirroring one must ask how it is achieved practically, and by looking closely at some key moments in this example, we can gain some sense of this (Fig. 8).
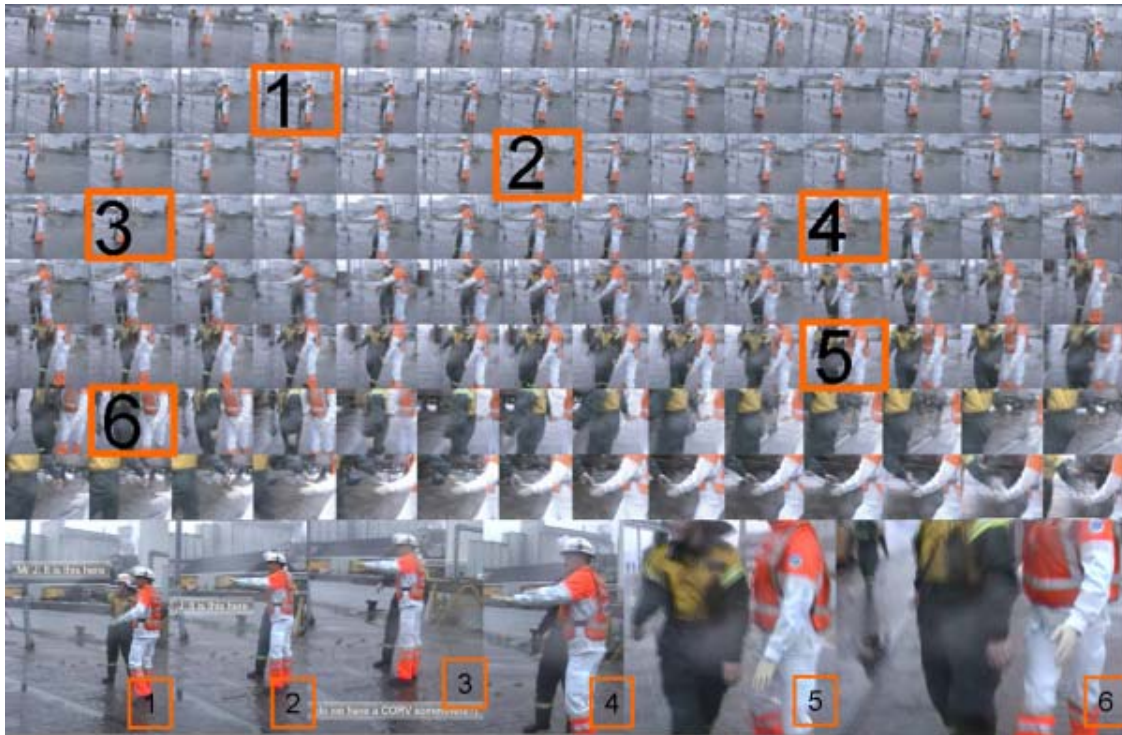

Figure 8: Key moments within a frame-by-frame breakdown of the sequence of actions during an episode of collaborative threat assessment.

As soon as Michael and Lars get to the other side of the railway carriage, their arms, hands, legs and feet mirror, forming a position that is held for quite a while. They also mirror what they are saying: 'It is this here' (Figure 8, 1&2). When Michael asks whether they have a Chemical and Organic Rescue Vehicle, Lars does not answer but starts to end their inspection of the spillage and this mirror position by dropping his hand (3). He lifts his right foot, and Michael, very subtly, makes room for him to lead the way: while completing his utterance and holding his arm outstretched, he moves his left leg back and turns ever so slightly (4).

To really make way, one would take a step back, but Michael stands, leaning slightly forward, arms akimbo and the palm of his left hand (maybe also his right) pointing backwards (5), but allowing Lars to pass and lead the way. A few steps later, Lars starts to shield Michael from danger (6), while Michael turns his palm to reflect Lars's (Figure 9). It is hard to say whether Michael anticipates Lars's conduct or whether Lars mirrors Michael.

Figure 9: Animation. Click here to view video clip.

This collaborative sequence embodies professional skill, the delicate dovetailing of responsibilities, and the lived assessment and awareness of danger. Analysis clearly shows that mirroring is not something one person does mimicking another. The mirrored and the mirrorer work together. In fact, the division of labour between mirrored and mirrorer might change, and there are different modes of mirroring (Figure 10): imitating, anticipating, but also genuinely reflecting other people's conduct.

Figure 10: Imitating, anticipating, reflecting other people's conduct.

But embodied conduct like this does not only echo other professionals' conduct, it also reflects the 'conduct' of other important and potentially very active actors (e.g. victims whose medical conditions change dramatically) and agents (e.g. a fire, chemical agents). Moreover, embodied conduct documents agreements, disagreements and decisions about these actors and agents for the participants in the interaction (see also Hindmarsh, & Pilnick, 2002), but also for a larger audience. Embodied conduct is 'broadcast communication', and Lars and Michael's assessment now propagates.

Their movement and gestures have formulated the spillage as dangerous with the range and degree of danger as yet undetermined. Michael asks Peter to move the ambulance (Fig. 11).

Figure 11: Risk area identified, moving the ambulance. Click here to view video clip.

We are four minutes into the arrival of the first ambulance. The uncertainty about the spill is holding up the rescue effort. Michael is pacing up and down. Until a rescue strategy is in place, he and Peter cannot do anything. This is Lars' decision and he is on the radio now, providing a status report for staff in the control centre, and receiving further information about

the (intended) danger of the chemical spill. Michael sees and overhears this, walks backwards, synchronising his movements with Lars', in effect 'catching' his attention (Figure 11).

While Lars is talking on the radio, Michael crouches down. Lars mirrors his movement. But Michael is already getting up again, before he has reached the final crouching position. He notices Lars' mirroring and returns to a crouch. This also makes the passing fire man look in that direction. Michael and Lars then part ways. While Lars walks over to his fire crew, giving them a chance to overhear his communication with the control centre, Michael continues to pace up and down, now eyeing the bus, now turning to see what is happening elsewhere, amongst other things keeping an eye out for 'huddles'.

The noise and chaos of the accident site that makes it difficult for the different agencies to share information, together with the fragmented nature of radio communication underpin the frequent formation of 'ecological huddles' (Goffman, 1961), where medical, police, rescue and fire brigade managers share and review information and make decisions. Michael spots such a huddle (Figure 12) and joins it. A split second later, Lars approaches, too. He is finishing his call to the control centre, when Peter and the medical team coordinator decide that they will request another four ambulances, five altogether (note the hand gesture in Fig. 12).

Figure 12: Huddles form and important decisions are made and overheard.

The end of Lars' call (in Danish and hardly audible for the ethnographer) is overheard by all. He has been told that the chemical spill is more dangerous than it seems and requires breathing equipment. The end of his call now marks the start of on-the-ground decisions about the risk area and the rescue operation (Figure 13). Michael anticipates the end of the call and walks ahead.

Figure 13: Defining a risk area and a corridor for the rescue.

Click here to view video of animation and here to see video clip.

Lars walks towards the corner of the railway carriage, and turns to point at an area in the far corner. This is where they should take and treat the injured. Peter reiterates that they have ordered five ambulances to transport the injured off. Lars replies 'just a moment' and walks towards the ambulance where he meets a fire fighter with a breathing mask and oxygen: they can begin to get the injured out and transport them to the waiting area. These are 'symbiotic gestures', that is, gestures that can only be understood in their relation to the environment and the activities at hand (Goodwin, 2003), in this context including previous (overheard) conversations and (observed) actions. In turn, the current talk and gestures renew and shape people's understanding of the environment and the activities at hand. The actual risk area, the corridor for the rescue operation and hand-over points emerge and are defined further through people's movements and actions (Figure 14).

Figure 14: Forming a chain to bring victims to safety (schematic animation).

Click here to view video of animation and here to view video clip.

Soon, 'severely injured' children are being handed safely into the waiting area, where they can be treated and prepared for transportation.

4. Discussion

Good coordination in multi-agency emergency response is not just a matter of the right person(s) being in charge of a well organised command chain. As Quarantelli (1997) lucidly observes: 'control is not co-ordination'. Instead, coordination requires rich and dynamic awareness of a changing situation and equally rich and dynamic mutual agreement on how to carry out tasks. Emergency response practitioners and researchers recognise that communica-

tion is key to successful coordination. However, current research has a bias towards control centres and verbal communication and neglects important aspects of emergency work. The observations above show clearly that embodied conduct and movement on the incident scene are socially organised and a key resource for the social organisation of a well coordinated and appropriate emergency response. Four issues seem particularly significant.

First, the way people move around on the incident site matters. Movement can attract attention and reach into the peripheral field of colleagues whose attention may be focused elsewhere. People may 'perform' trouble through movement, making it possible for others to expand their 'online' analysis of multimodal practices (Mondada, 2006) to large scale interaction. Attempts to 'scale up' mutual orientation to the social organisation of interaction is evidenced in the example above by the fact that staff continuously try to take in more than the immediate focus of their attention by moving around, pacing up and down, turning to see what is happening elsewhere. While they may not always be able to overhear communication, they can often see roughly what is being talked about and how it is perceived.

This raises the second issue - the 'broadcast' character of embodied conduct in motion. Social interaction is 'scenic' (Jayyusi, 1988), and a short glimpse at Lars and Michael's collaborative gesture in relation to the chemical spill, for example, would indicate that threat assessment is well underway, and that one should stay away from there, while seeing a huddle of incident managers may suggest the need to participate in the discussion. Thus the fact that 'knowledge of the environment undergoes continuous formation in the very course of [our] moving about in it' (Ingold, 2000, pp. 226, 230) takes on a particular urgency in emergency situations. The economies of interaction that have evolved here seem to rely on frequent, often repeated, very pronounced (sometimes exaggerated, even theatrical) embodied conduct.

Third, the investigation of mirroring behaviour shows that 'rapport' is not just the result of some inexplicable affinity between individuals. Also, it is more than a subconscious, almost reflex-like response elicited through social-psychological stimulation. Mirroring requires fast and precise local coordination, while being publicly visible. However, although clearly a collaboratively organised phenomenon, the definition and sequential relation of moves and mirror moves are fuzzy. Further analysis is necessary, but the observations above suggest that a reason for this fuzziness is the degree of reflexivity in the interaction, and that this has a bearing on the practical achievement of coordination. Conversational moves are reflexive, that is, each turn defines the shape and status of the other, one prospectively, the other retrospectively (Mondada, 2006). Thus questions are recognisable units that usually project answers, which through their timing and shape reflexively confirm the status of the previous turn as a question. When mirroring, in contrast, a person's first 'turn' (e.g. a palm facing backwards) may only become a noticeable 'unit' by virtue of the fact that someone imitates or reflects it. Embodied interactional moves can thus have far less definition, implicative force and 'direction' in terms of a next move than turns in talk. In addition, next moves may be ambiguous even in regards to being meant as a next move. Michael and Lars' collaborative threat assessment gesture, for example seems to develop through extremely subtle interpretations of possibly physiologically automatic embodied conduct as meaningful. The high degree of reflexivity, or mutually determining character, of such very subtle (and very fast) movements requires heightened sensitivity to the other's body in relation to its environment. As such, the gesture helps Michael and Lars achieve a mutually very sensitive alignment.

Moreover, now turning to a fourth important issue, this alignment is publicly observable. This has implications for our understanding of the decision making processes during emergency response. It indicates not only collaborative, but joint (and bodily joined) sense making activity. Synchronicity of movement thus not only creates a sense of mutual engagement. In many

of the examples above, people put themselves in a position where they can see what others are seeing. Such publicly performed shared views of events document and produce a common understanding. Against the backdrop of such a dynamically produced common understanding of the situation it becomes obvious that decision-making is not just a matter of gathering and making sense of predominantly verbal information. Decisions are collaboratively formulated through talk, but also through embodied conduct and the movement of people and equipment in relation to the material environment and the many actors and agents within it. They emerge. As Lars and Michael demonstrate, shared understanding can be produced through and folded into embodied conduct and movement to formulate and simultaneously display decisions over what is being experienced: it is dangerous, I will provide, and I will accept protection. The latter aspect amounts to a public production of a working division of labour. Through his willingness to accept protection (which is one of the fire crew's main tasks) Michael also implicitly accepts potentially negative consequences for his own task (e.g. a delay in the rescue operation). Such 'rapport' greatly facilitates a coordinated response.

5. Conclusion

This paper presents an audio-visual ethnographic account of large scale, fast-paced, peripheral and multi-agency emergency teamwork. Analysis focuses on the role of embodied conduct and the practical achievement of a coordinated and appropriate response to an emergency staged for a training exercise for regular on duty staff. The observations highlight that embodied conduct and movement play a vital role in decision-making, the establishment of rapport, and the dynamics of a shared understanding of events.

References

Büscher, M., & P. Mogensen. (submitted 2007).Designing for material practices of coordinating emergency teamwork. *ISCRAM 2007 - Intelligent Human Computer Systems for Crisis Response and Management, the 4th International Conference on Information Systems for Crisis Response and Management*, May 13th-16th 2007 Delft , The Netherlands. Available from m.buscher@lancaster.ac.uk.

Dunn, J.C., Lewandowsky, S., & K. Kirsner. (2002). Dynamics of communication in emergency management. *Applied Cognitive Psychology 16(6)*, 719-737.

Goffman, E. (1972 [1961]). *Encounters. Two studies in the sociology of interaction*. Aylesbury: Penguin University Books.

Goodwin, C. (2003). The semiotic body in its environment. In J. Coupland & R. Gwyn (Eds.), *Discourses of the Body* (pp. 19-42). New York: Palgrave/Macmillan.

Goodwin, C., & Goodwin, M.H. (1996). Seeing as a Situated Activity: Formulating Planes. In Y. Engeström & D. Middleton (Eds.), *Cognition and Communication at Work* (pp. 61-95). Cambridge: Cambridge University Press.

Heath, C., & P. Luff. (1992). Collaboration and control: Crisis management and multimedia technology in London Underground control rooms. *Computer Supported Cooperative Work 1(1-2)*, 69-94.

Hindmarsh, J., & Pilnick, A. (2002). The tacit order of teamwork: Collaboration and embodied conduct in anaesthesia. *The Sociological Quarterly, 43(2)*, 139-164.

Ingold, T. (2000). *The perception of the environment. Essays in livelihood, dwelling and skill*. London: Routledge.

Jayyusi, L. (1988). Toward a socio-logic of the film text. *Semiotica, 68 (3/4)*, 271-296.

Kendon, A. (1976). The F-formation system: The spatial organization of social encounters. *Man-Environment Systems 1976(6)*, 291-296.

Kristensen, M., Kyng, M., & Palen, L. (2006). Participatory design in emergency medical service: Designing for future practice. *Conference on Human Factors in Computing Systems (CHI), Proceedings of the SIGCHI conference on Human Factors in computing systems,* ACM Press, 161 – 170.

Lakin, J.L., Jefferis, V.E., Cheng, C.M., & Chartrand, T.L. (2003). The chameleon effect as social glue: Evidence for the evolutionary significance of nonconscious mimicry. *Nonverbal Behavior, 27(3)*, 145-162.

Landgren, J. (2005). Supporting fire crew sensemaking enroute to incidents. *International Journal of Emergency Management 2(3)*, 176-188.

Landgren, J. (2006). Making action visible in time-critical work. *Proceedings of the international conference on Computer-Human Interaction (CHI). Conference on Human Factors in Computing Systems (CHI), Proceedings of the SIGCHI conference on Human Factors in computing systems,* ACM Press, 201 – 210.

Lebaron, C.D., & Streeck, J. (1997). Built space and the interactional framing of experience during a murder interrogation. *Human Studies 20*, 1-25.

Martin, D., Bowers, J., & Wastell, D. (1997). The interactional affordances of technology: An ethnography of human-computer interaction in an ambulance control center. In H. Thimbleby, B. O´Conail & P. Thomas (Eds.), *People and computers XII, Proceedings of HCI´97* (pp. 263-281). Springer-Verlag.

Mondada, L. (2006). Participants' online analysis and multimodal practices: Projecting the end of the turn and the closing of the sequence. In T. A. Van Dijk (Ed.). *Discourse Studies*, [Special issue on Discourse, Interaction and Cognition], 8 (1). (pp.117-130).

National Commission on Terrorist Attacks Upon the United States. (2004). *The 9-11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States* (Official Government Edition). Claitor's Law Books and Publishing Division.

PalCom Project. (2003). Retrieved March 6, 2006 from http://www.ist-palcom.org/

Peterson, D.M., & Perry, W. (1999). The impacts of disaster exercises on participants. *Disaster Prevention and Management* 8(4), 241-254.

Pettersson, M., Randall, D., & Helgesson, B. (2004). Ambiguities, awareness and economy: A study of emergency service work. *Computer Supported Cooperative Work* Kluwer Academic Publishers 13 (2) 125-154.

Quarantelli, E.L. (1997). Ten criteria for evaluating the management of community disasters. *Disasters 21(1)*, 39-56.

vom Lehn, D., Heath, C., & Hindmarsh, J. (2001). Exhibiting interaction: conduct and collaboration in museums and galleries. *Symbolic Interaction 24(2)*, 189-216.