VIDEO SENSE-MAKING WITH SCALE-MODELS

JACOB BUUR
UNIVERSITY OF SOUTHERN DENMARK
BUUR@MCI.SDU.DK

AGNESE CAGLIO
UNIVERSITY OF SOUTHERN DENMARK
AGNESE@SDU.DK

ABSTRACT

Video recording has proven immensely successful for acquiring field data for design work: data about technology in use and about future contexts for innovative products and services. While new, small camera types make recording almost unproblematic, the task of making sense of video for design is still a challenge.

This paper discusses a method of re-enacting the actions observed on video, with objects in a scale environment. The case we work with concerns the activities of forklift truck drivers, and in particular, how they build skills of manoeuvring trucks in a 'social environment' of many other trucks working at the same time. This method helps design teams to make sense together as a precondition for creating design proposals grounded in contextual understanding, e.g. of improved safety equipment or truck guidance systems.

We first describe how the method emerged through a series of experiments, and subsequently analyse how scale models are employed during a sense making session involving designers. Based on the analysis, we will discuss how re-enacting with scale models sets particular foci for sense-making, provides ownership of the material, and encourages design team members to investigate opportunities for change to the situation observed.

INTRODUCTION

Video recording has proven to be extremely successful for acquiring rich field data for design work. However, in design processes a big challenge remains in understanding emerging practices around new technologies in use, while maintaining a pace that allows multiple iterations in the design of new products. This calls for fast approaches for analysing and describing what 'happens'.

One available approach, interaction analysis (Jordan & Henderson 1995), draws increasing attention as a powerful research method for understanding activities and social processes. Originating from Ethnomethodology and Conversation Analysis, this method aims to make sense of data 'from within' – that is, it looks at naturally occurring (social) interactions and focuses on how people themselves make understandings visible, thus avoiding interpretation of the data based on preconceived theories (Sacks et al. 1974, Heritage & Clayman 2010). Interaction analysts rely heavily on video data for their analysis, making the data "workable" through use of transcripts that allow them to track speech, body movements, gestures or other relevant features of the interaction (Goodwin, 2000). However, one of the challenges that often arise when integrating such detailed analysis in the design process is related to how to share these transcripts, descriptions and findings among members of the design team, some of whose might be looking for "implications" (Dourish 2006), or might be less experienced with analysis and uncomfortable with the complexity of transcripts. Instead of a traditional model of 'analysts communicating findings to designers', it has been argued that video can be regarded as a 'design material' with which designers collaboratively 'build

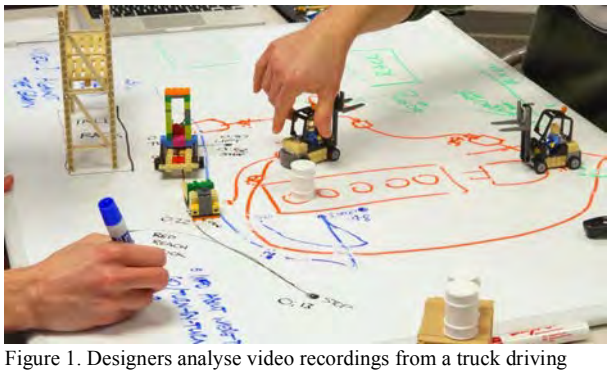

Figure 1. Designers analyse video recordings from a truck driving school by re-enacting actions with toy truck models in scale.

Figure 2. Video footage of 'social' forklift truck operation in a truck driving school.

meaning', rather than as 'hard data' that support design decisions through appropriate analysis (Buur et al. 2000). In extension of this position, we prefer the term 'sense-making' to 'analysis', as the sole purpose of the sessions we are facilitating is to create 'better' designs, not to develop understanding or theory for its own sake. Hence we are less occupied by the 'findings' of the analysis in its own right, more with the 'sense' it makes to designers.

The work presented in this paper is an attempt to address key questions related to video sense-making: Is it possible to translate the complexity of video data into easily understandable forms, enabling faster engagement with video data? Can this activity be shared among team members, facilitating communication? Can video sense-making be fun?

FOCI FOR INTERACTION ANALYSIS

Our work is particularly influenced by Jordan and Henderson (1995), who proposed to make interaction analysis collaborative through the concept of *Interaction Analysis Labs*, in which researchers (with cross-disciplinary backgrounds) look at the video recordings together. This practice, widely used also in Conversation Analysis in the form of data-sessions (Have 2007), encourages multiple points of view to meet, and possibly allows for a broader and less distorted look at what is happening in the data. The Interaction Analysis Lab concept has gained wide acknowledgement in design circles, likely because of the mixed backgrounds in anthropology and computer science of the authors, and their affiliation with the Xerox PARC environment. As a guideline to initially approaching video material, Jordan and Henderson provide a list of possible *foci for analysis* – such as how people participate and take turns, how people occupy space, etc. These foci act as 'entry points' to the data by guiding a first look, in order to identify elements to be further investigated with deeper and more detailed analysis. Inspired by this idea of 'entry points', we experiment here with using objects, acting as tangible tools to make video analysis engaging and support specific foci. In this case, we work with a focus on the *spatial organisation of activities*, where attention is drawn to '*the physical co-presence of persons is always managed by socially recognized (although often unstated) expectations regarding occupancy of space, interaction with others, use of objects and resources, display of physical presence, and voice'* (p. 72). One important aspect of spatial organisation is the *ownership of territory* that '*affects the mobility of participants – whether they can move around at will or have to ask for permission*' (Jordan & Henderson 1995, p. 74).

SKILLED FORKLIFT TRUCK DRIVING

The method presented here is the result of a series of design experiments over two years with various materials, deployed with different groups of industrialists, researchers, and graduate students, who make sense of a range of video recordings. In this paper, we build on a case of studying skilled forklift driving in collaboration with Crown Equipment Corp.

Crown Equipment is a manufacturer of material handling equipment used in warehouses, manufacturing facilities, and outdoors. The corporation has a powerful design department that in the past has contributed significantly to truck innovations. The most common type of material handling equipment is the counterbalance forklift truck. Operating a forklift truck requires a high degree of precision and skill to be productive and efficient, while remaining safe. Past research suggests that operators value visibility, control precision, comfort and performance. While the forklift truck is a fairly standardised product, fresh perspectives and a deeper understanding of operator driving practices might uncover opportunities for design improvements – a hypothesis that led to the collaboration with our university.

Within the past two years, Crown's design research group has conducted an extensive ethnographic study of forklift truck practices around the world, to better understand how drivers perform their everyday activities. The intention of the study was to identify potentially unmet needs and opportunities for innovation. However, one challenge the design research group encountered was how to make sense of the ethnographic data for or with other departments.

It is in this context that we set ourselves the challenge to develop a tool that can support sense making of how the work of truck drivers is spatially organised, and do so in a collaborative manner for designers untrained in video analysis. We also conducted an ethnographic study ourselves, where we video recorded skilled truck drivers performing their everyday tasks, and unskilled drivers while learning in a truck driving school (Figure 2).

UNDERSTANDING TRUCK DRIVING WITH SCALE MODELS

We address the sense-making challenge with simple, tangible tools that support hands-on collaboration. We rely on a tradition of research, which sees objects as central to participation, reflection and exploration of alternative views (Brandt, Messeter & Binder 2008, Cross, 1982). One aspect that we found particularly intriguing in the field recordings is how operators learn

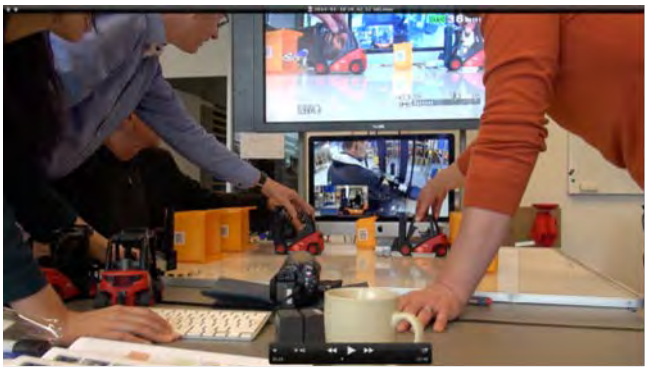

Figure 3. Participants of a video sense-making session in action. Three participants each operate a toy truck to re-enact social behaviour.

to navigate their trucks in shared workspaces; how they drive in and out between one another without accidents. We came to talk about this as the 'social truck' skills. Apparently without explicit rules about right of way, professional truck operators seem to sense each other's positions and movement patterns at an incredible pace. But how do they develop this skill? Is it possible to track this development, and use it as a source for truck innovation?

Scale-Model Sense-Making in all its simplicity relies on participants re-enacting the activity observed in the video – in this case with scale model toy trucks. The participants build a scale model of the workspace in front of the video screen and drive the truck models around in sync with the video running (Figure 3). To enhance the effect, there's an extra screen and a video camera recording the toy truck action from a vantage point similar to that of the fieldstudy camera (Figure 4). Even if not a professional truck driver, the re-enactment of movements will convey a deeper sense of what is going on.

Prior to the sense-making (Weick, Sutcliffe & Obstfeld 2005) session, facilitators choose two or more sequences of videos to analyse, preferably containing similar activities, for instance, of the same task performed by novice and routine operators. Video sequences of 1 to 5 minutes' length can be analysed effortlessly with the tool, depending on the level of granularity that participants want to achieve. In our case, the bulk of video footage was first analysed using the Video Card Game method (Buur & Soendergaard 2000), which helped us define the theme of 'social trucks' (i.e., how drivers manoeuvre their machines in a shared workspace) and enabled us to assemble a cluster of suitable video clips.

For every video sequence, the sense making session runs in four phases of 10 to 15 minutes each (or more if needed).

1. Recreating the scene. In the first phase, the participants focus exclusively on the physical environment that sets the limitations of the workspace. Using various materials they establish the workspace layout in scale on the board.

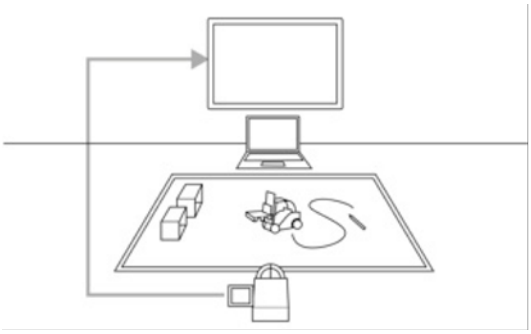

Figure 4. Schematic of the Scale-Model Sense-Making setup. The lower screen shows fieldstudy video, the upper shows camera view.

2. Tracing movements. Next they concentrate on the routes that each driver takes and draw lines to indicate truck routes on the whiteboard. The video may be slowed down, stopped or reviewed whenever participants feel the need.

3. Re-enacting actions. In the third phase, participants place toy trucks corresponding to each truck in the video on the board, and try to run them through the stipulated routes (Figure 3). Each participant can handle no more than one truck, and this takes a bit of training to get right. In the process, the participants will typically notice things that otherwise would have stayed unnoticed.

4. Reflecting observations. In the fourth phase, participants reflect on the experience and relate their observations for general discussion. After several videos this will naturally include comparisons between the different practices observed.

Most likely these steps will lead to discussions of innovation: Which redesigns may alter the situation to a 'better' one? This is true in particular for the sessions with industrialists, who develop forklift truck for their profession.

DESIGN RESEARCH ITERATIONS

We developed the concept of *Scale-Model Sense-Making* through a series of design experiments with a range of materials and concepts, where the spatial organisation of human activity emerged as our main focus of interest. Each tool design was tried out in one or more video sense-making sessions 'in the field' (Koskinen et al. 2001). For such sessions we invited

Figure 5. Analysts re-create an excavation site in scale to understand the movements of people and machines.

Figure 6. Materials used for re-creating the forklift truck environment of a loading bay with containers and pallets.

researchers (interaction designers and conversation analysts), industrialists (industrial designers and engineers), or graduate students (interaction design, communication design). The tools were used to analyse various video materials, including backhoe loader operation on building sites, forklift truck driving, and design workshop activities. The experiments were documented on video (top and side views), and the participants were invited to reflect on how the tools worked for them. For some of the experiments, simple reflection was sufficient to improve or abandon the tool concept. For others, transcription and interaction analysis was necessary to understand how the different materials facilitated video sense making. In the following sections we will highlight three iterations of our research process – and what they helped us see.

1ST ITERATION: RE-CREATING THE SCENE

In scenario design it is well known that the mere activity of recreating the physical use environment (in scale or full-size) is a rich source of learning about use context. For instance, Burns et al. recreated a hairdressing saloon for acting out scenarios to understand how new augmented technologies might enhance hairdresser work (Burns et al.1994). In our first experiments with re-creating movement scenes, we provided wooden bricks and other simple, abstract pieces for participants to try rebuild the environment (Figure 5). While this certainly had an effect on the analysis detail, the materials were too simple to create real engagement. Lego, on the other hand, made participants spend too much time in trying to reach a naturalistic image of the environment. Hence, in our present version, we strive to provide look-alike materials in approximate scale of the toy trucks (Figure 6).

Figure 7. Participants trace movements on paper with 'tracing tokens' (left picture), then simulate the movements (right).

Figure 8. Researchers re-enact how participants in the design workshop on video shift around post-its on a strategic diagram.

2ND ITERATION: TRACING MOVEMENTS

Tracing lines of people's movements on the floor plan as part of work efficiency studies, as ridiculed in the Norwegian movie 'Kitchen Stories' (Hammer, 2004), does serve a purpose of enhancing attention to spatial activities, however tedious these diagrams may seem. Our first experiments with movement tracing of trucks had a similar nature. We devised small, arrow-shaped tokens with a fixture for a felt pen to be used as 'tracing tokens' on white paper to analyse the movements of backhoe loaders on a building site (Figure 7). The sense-making session was successful in terms of attention to spatial details in the video, but participants found it troublesome to regularly have to erase lines, when they were found not completely correct. Hence in our latest iteration, we use a horizontal whiteboard to sketch out truck routes.

3RD ITERATION: RE-ENACTING ACTIONS

Inspired by Turner's work on *performing ethnography* (1987) we have experimented with the value of *re-enacting* what people do in our field videos. Turner's point was that the 'kinetic characteristics' of, in his case, cultural rituals cannot be adequately conveyed in ethnographic text, but need to be re-enacted. In an early sense making experiment, we studied the role of post-its in strategic decision making of the kind *which-idea-do-we-choose*. In several projects we had employed a similar method of asking participants to collaboratively arrange post-its with design idea names in a two-by-two matrix of 'innovation potential' vs. 'belief in success'. As we had noticed a fair deal of moving post-it notes around until agreements were reached, we challenged colleagues to re-enact these processes to see if we could gain a deeper understanding of the phenomenon (Figure 8). The participants felt highly engaged, and reflected that the re-enactment helped them experience roles of the people on video and their engagements/ disengage-ments; the 'energy' in the moves.

In the sessions with the toy truck sense making, very consistently the session participants stand up, when the re-enactments start (Figure 3). Partly, this may be for better reach across the board to drive the trucks, but we see it as much as a sign of engagement and high spirit. This is where video sense making becomes fun!

HOW DOES THE METHOD HELP?

We will now discuss the final iteration of the method, and describe more in detail some aspects of how it was used during sense-making sessions. We draw on four video recorded sessions of 30-40 min each, two of them with industrialists (who have a clear focus on 'making' innovation), and two with researchers (conversation analysts and design researchers, who more dominantly focus on 'analysis' of driver behaviours). We are particularly interested in understanding where either enactment or scale models are treated as relevant for the sense making, and what kind of activities the participants actually use the objects for.

Generally speaking, with its different steps the activity allows participants to look at data by gradually placing the focus on specific actors/trucks or activities. This prompts different kinds of conversations around the data, from an unfocused looking in the first part, when just looking at the video, to truck-focused tracking in the later phases.

BUILDING TO SCALE

In the first phases the participants get an overview of the different activities carried out by the drivers and of the relations between drivers' actions, other drivers, timings and context. The scale is already a crucial discussion for participants, who actively engage to establish a reliable system for defining spaces and trajectories. For example, one researcher team found it relevant to start defining how racks are sub-divided, and even their numbering system (Figure 9a). This in turn helped them define the starting locations of the drivers and their movements. In one of the industrialists sessions, the scale also draws much attention, as the participants re-adjust routes and drawings. In one case, a designer is prompted by his colleagues to redraw a rack, in order to proportionally fit the truck sizes and paths (Figure 9b).

When the truck models are brought into play, they encourage participants to focus on what is important in the video extract. Faced with the challenge of having too few models for representing seven trucks in the video, one industrialist team starts discussing which are the 'important' trucks, and which ones just play a 'peripheral role'. The scale models are used repeatedly to demonstrate hypotheses and routes, alternating between looking at the screen and moving the toys. Even while the 'enactment phase' has not officially started, participants already describe what happens in the scene, while building it.

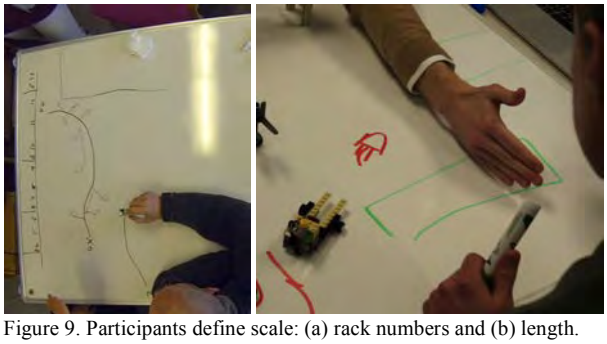

Figure 9. Participants define scale: (a) rack numbers and (b) length.

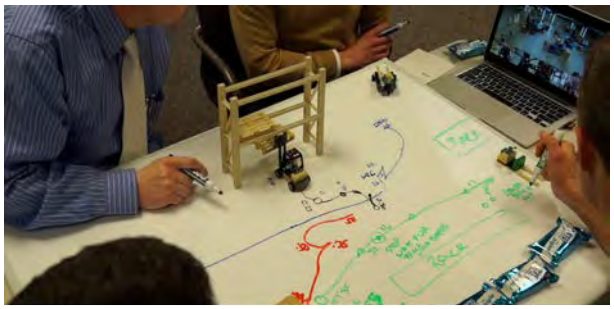

Figure 10. Tracings of paths and activities in the scale model. The "oversized load truck" is the one in the centre.

This case is more prominent in the industrialist case, and one of our hypothesis for this difference is related exactly to scale problems: In the researcher case, one participant noted how the mismatch between the boards' size and the relatively too big size of the toy trucks created problems in recreating the environment. In the industrialist case the scale proportions between the drawing board and the toy trucks seemed to be good enough for them to proceed and test hypotheses on drivers' trajectories, also in relation to other drivers actions. But what, more precisely, do participants look at during the tracing phase? In one of the researcher cases, tracking movements and intersections brought into the discussion the role of eye gaze, which was then drawn on the board as small arrows along with the trajectories of the trucks (Figure 9a). Industrialists, on the other hand, focused on pace of movements, stops, turns and waiting sequences. (Figure 9 and 10)

TRACING TRUCK RULES

In the following extract from the tracing phase, we look at the case with four industrialists, analysing a video from a training day in a truck driving school. At the beginning of the activity, the group has already been provided with a whiteboard, markers, scale racks and LEGO-built trucks, which they have arranged so as to reconstruct the scene in scale. We look at a moment when they have already completed the drawing, each of them tracking the movements a particular truck and coding time, direction and main action accomplished in a specific location (Figure 10).

> D (11:14) "The guy with the oversized load. He either is not competent or is very worried about having a load"
>
> A: "Which one?"
>
> D: "The guy that I've got ((points at the truck in front of him)) right at the centre ((points at the screen)) the guy with the blue load ((opens arms wide))"
>
> A: "OK"
>
> D: "Because basically he waits a long time for moving, he moved out and then he waits a lot"
>
> A: "Yeah"
>
> D: "Cause people are largely driving around him"

At this point, after the tracing, the participants are trying to summarise, gesticulating, talking and looking at the video, how the different trucks behave. One first

observation we can make is how following the tracing, in discussing the scene, the participants refer to the truck they had assigned, for example in this case with D bringing in the perspective of a driver with a big load. We see this as a simple, but telling example of how already just by following, with a pen, the movements of a particular truck, participants intensely focus on it, and hypothesise the reasoning of why the driver would move in a certain way rather than another.

In another session, participants take the "waiting" actions of the drivers as a departing point to look for the rules that govern how the truck drivers take turns:

> D (25:40) "I'm trying to figure out what the rules are; like when one stops, the other stops. It doesn't play out."
> D (27:28) "I also had the idea that, when I first saw them together that the person to the right has some kind of right-of-way. But that didn't work either (as a rule)."

We can see therefore how the tracing phase already brings up conversations around relevant elements connected to forklift driving including both individual skill and loads, and the wider perspective of the social coordination of the activity.

ENACTING OWNERSHIP OF TRUCKS

The design of the activity requires the participants to enact, in real time with the video, the trajectories of the trucks, each of them "driven" by a different participant. This particular activity is usually silent, and interrupted rarely by comments either on the performance, when loads fall, or when tracks, arms and directions overlap ("we have a worse traffic jam!"). In some cases participants comment about the activities they enact (for example repeating "moving" while moving the truck, or saying "stopping" when the truck stops).

However, this is not the only form of enacting with scale models we find in the sessions. We can in fact observe two different kinds of enactments, heavily used particularly by the industrial teams aside from the silent one just described: A first one where participants use models to demonstrate to each other, or explain, the different movements of a particular truck driver by sort of "splitting" the complexity of the data in chunks, or in slower sequences with comments while happening. Describing or isolating the activities in this way, the participants discuss drivers' intentions and decisions in relation to the particular issue they are addressing, for example, when stopping to wait for another truck to pass. A second use of the enacting is for making hypotheses, talking about what could have been, or what could be, with typical 'what if' statements. Such statements have been recognised as central for design practice (Cross 1982).

In the case of the enactment, is easy to observe that participants come to identify with 'their' truck. When asked in one team, if they like to swop trucks for a second run, the response is negative: *"Because we moved into that character; I am that truck!"*

Figure 11. Truck drivers operating in shared spaces on a loading deck.

REFLECTING OBSERVATIONS: SOME EXAMPLES

When we look closer at the conversations around the toy trucks we notice how the researchers gradually come to make sense of skilled forklift truck driving. They first search for metaphors to 'make the strange familiar'. For instance, they compare what they see with a dance:

> D (21:05) "Well, I think probably what you have is like in dancing or in music: Your count. You count beats. On one, one does this, on two I do this, I move, on three I stop. Everyone has to score. And then hopefully, if everyone counts the same way, then it syncs up."
> D (25:15 after second trial) "I think we are getting better at it. I mean you get a sense of the choreography of it."

In another team, the researchers compare truck driving to something they know well: cars, motorbikes:

> J (36:15) "if you drive a car, you are not staring at other cars. Once there's something going on, you are focusing on those.
> C (36:30) "This is much more intricate, there is much more interweaving of movement. With cars, you hopefully stick to one side or the other side of the road, right? (…) It's a bit like bumper cars in a fair! They can do the same, you can almost turn round on yourself."
> J (41:07) "Like a motorbike driver, you've got to look at where you want to be, not where you are!"

The other researcher team had the same thought, when discussing if truck driving is similar to car driving. There is quite a discussion about how routine drivers look, and what they look for:

> J (41:50) "He just checks with one view, if there's space to back up."
> J (51:50) "It's more of a glance than a look. If they even do look, I think a lot is going on in the peripheral vision."
> H (27:50) "What about the position of the forks?"
> K "I think it tells the other drivers something, because when his forks are up high, I might move now. This sense of coordination."

So it seems experienced drivers depend heavily on a skilled peripheral vision, and when they look, they know precisely which clues to look for. In both teams the researchers are focused on the space that the trucks seem to inhabit (Figure 11):

C (1:01:17) “I’d say they are constructing a space around them as they interweave. Its very much an interweaving we saw this time (the professionals), whereas the first one (the learners) was much more hesitant. The flow element is much more prevalent in this.”

K (50:05) “But isn’t there some kind of orientation, compared to the other one (the learners), we have our individual spaces, and we need to use the shared spaces, but then we do it as quickly as possible, in order to get out.”

Independently both teams reach the conclusion that professional forklift truck driving is likely governed by the operator’s ability to *project* spatial organisation of actions:

C (1:04:25) “They are almost projecting actions into the future as well as spatially.”

D (28:30) “What does the driver need to know? He needs to know where the other driver is, and what is their next move? And what is my next move?”

With such an enhanced understanding of what forklift truck driving is about, the participants may start to look for innovation opportunities: Can one enhance the sense of shared spaces? Of projecting future actions?

THE METHOD AS ANALYSIS TOOL

When asked to reflect on what this method actually offers, there’s discussion, in particular among the conversation analysts:

D (58:05) “It builds a better memory. ‘Cause you’ve done it. And this may be hard, when you have something untranscriptable as this. (…) Before you can do analysis you have to have the memory of it. You have to have some record, somewhere. You can’t do a simultaneous analysis. Its just too fast. You have to freeze it in some fashion in order to make it tangible in some way.”

J (33:16) “What it doesn’t do compared to any form of recording, transcription or what ever, is it is not permanent. I cannot take it away and do analysis on top of it. Its gone in the moment you are done, its gone.”

D (1.00:10) “The other thing is (…) to do kind of ‘what-if” things: What if he had done this, what would he have done (pointing to the two trucks) The counter-factual, the ‘what-if’ scenarios. That you can’t do in the film, you can only do it this way.”

There seems to be agreement that the embodied action, and the opportunity to investigate alternative actions, support sense making, although the tool doesn’t as such provide a permanent ‘transcript’ as for example in the Conversation analysis tradition. However, the sessions are video recorded for further discussion and analysis.

DISCUSSION

With this tool, our intention is to find an engaging way for designers to incorporate analysis in their process: to offer a detailed look to complex data, but also to provide space for imagining alternative actions. While an analytical discipline is interested in describing and understanding a particular phenomenon, design by nature is interested in phenomena in order to change them. The phenomena are explored as opportunities for developing new interventions, or inspiration for design work. With the tool we address the issue of sense-making from this perspective. While we do not claim that this tool can substitute more thorough kinds of analyses, we see its contribution for the design process.

Firstly, the method allows a focus on particular aspects of the data. This is done through the tool itself, which with the development of a scale environment encourages looking at that particular configuration of spaces and activities. For example, the observations from researchers concerning ‘shared spaces’ and ‘projection’ indicate that the tracing and toy truck driving provides a clear sense of spatial organization of activities that would be difficult to achieve solely by watching the video. More in detail, it allows focus also on a deeper level by assigning specific tasks to each participant. Secondly, it allows for an easy exploration of what happened, what could have happened, and what could be in the future, in line with what Schön (1992) described as a “conversation with the material of a situation”. In the cases we studied, the participants, for instance, came to discuss if more firm ‘traffic rules’ for truck driving should be introduced to prevent accidents or block-ups, or if trucks should have indicator lights that more precisely signal to other drives which path they are about to move along.

LIMITATIONS OF THE METHOD

In the development of the Scale-Model Sense-Making tool we are struggling with challenges on several levels:

(1) The sense-making of physical/spatial actions is a challenge, as they are difficult to describe and represent. This is a dilemma of transcription. Depending on the focus of their observations, the participants need to invent their format of transcription as they move along. The tracing of where the trucks move gets expanded with stops, with gaze (where does the operator look, can he see if the fork of the other is up or down?) and with areas (where are the overlapping work areas that require coordination?).

(2) The involvement of several people in collaborative sense-making. Collaborative sense making ensures better analysis (as there are more perspectives in play) and provide ownership to results. But it multiplies the number of man-hours spent. This is a dilemma of communicating results vs. ownership. We see some very intense moments of collectively trying to figure out what goes on in the video, and why operators move and coordinate the way they do. Several suggestions for ‘rules’ are discussed, tried out and rejected. All the resources are in play at the same time: video on loop, several tracing pen colours, several toy trucks, loads, containers.

(3) The transformation of analysis findings into ideas or requirements. Video analysis in design needs to amount to something. This is a dilemma between video as design material and ‘analysis results’ to be communicated.

CONCLUSION

Is it possible to translate the complexity of video data into easily understandable forms, enabling faster engagement with video data? We believe we have shown that it is possible to create an engaging and fun format for industrialists and researchers alike to engage with quite complex video segments of how humans organise spatial actions in a social context. From our experiences with a spread of contexts of human actions, we believe the method is generalizable beyond the analysis of forklift truck operation – although the toys naturally will need to be replaced with fitting ones.

Can ownership of the material be shared among team members, turning analysis into an absorbing and effective activity that facilitates communication? We did see some very relevant discussions come out of the analysis sessions, even with some good ideas for future truck designs.

This work is part of an endeavour to create a full programme of video analysis tools with the use of tangible materials that respond to Jordan and Henderson's list of Foci for Analysis (1995), and thus more broadly support the use of video for designing new interaction concepts and the corresponding human skilled practices (Buur et al. 2013, 2014).

ACKNOWLEDGMENTS

We thank research colleagues and industrial partners engaging in the video sense making experiments, and in particular we are indebted to the students of the IT Product Design graduate program for developing some of the early tools described in this paper. Nanami Nakamura assisted with transcriptions and interpretations. Moreover we would like to thank Crown Equipment for their strong support in the research.

REFERENCES

Brandt, E., Messeter, J. & Binder, T. (2008). Formatting design dialogues – games and participation. *CoDesign: International Journal of Co-creation in Design and the Arts* 4(1): 51-64.

Burns, C; Dishman, E; Verplank, W. and Lassiter, B, (1994). Actors, Hairdos & Videotape –Informance Design. In: CHI '94 Conference Companion, ACM, Boston.

Buur, J., Beuthel, M. & Caglio A. (2013). Designerly analysis of participation structures. Nordic Design Research Conference (NORDES '13), Copenhagen, Denmark.

Buur, J., Binder, T. & Brandt, E. (2000). Taking video beyond 'hard data' in user centred design. *Proceedings of Participatory Design Conference (PDC '00)*, New York, USA.

Buur, J; Caglio, A. and Jensen, L.C. (2014). Human Actions Made Tangible: Analysing the Temporal Organisation of Activities. *Proceedings of Designing Interactive Systems DIS 2014*, Vancouver, Canada

Buur, J. & Soendergaard, A. (2000). Video card game: An augmented environment for User Centred Design discussions. *DARE 2000, Proceedings of Designing Augmented Reality Systems*, New York: ACM, pp. 63-9.

Cross, N. (1982). Designerly ways of knowing. *Design Studies* 3(4): 221-7.

Dourish, P. (2006) Implications for Design. Proc. ACM CHI, Montreal, pp. 541-550.

Goodwin, Ch. (2000). Action and embodiment within situated human interaction. In *Journal of pragmatics 32(10):* 1489 – 1522.

Hammer, B. (2004). *Kitchen Stories.* IFC Films

Have, P. Ten. (2007). *Doing conversation analysis: A Practical Guide (2nd ed.).* London: Sage Publications. Pp. 140-141.

Heritage, J. & Clayman, S.E. (2010). *Talk in Action: Interactions, Identities and Institutions.* Boston: Wiley-Blackwell.

Jordan, B. & Henderson, A., (1995). Interaction analysis: Foundations and practice. *Journal of the Learning Sciences* 4(1):39-103.

Koskinen, I., Zimmerman, J., Binder, T., Redström, J. & Wensveen, S. (2011). *Design Research Through Practice: From the Lab, Field, and Showroom*. Waltham, MA: Morgan Kaufman.

Sacks, H., Schegloff, E. & Jefferson, G. (1974). A simplest systematics for the organization of turn-taking for conversation. *Language* 50(4): 696-735.

Schon, Donald A. "Designing as reflective conversation with the materials of a design situation." *Research in Engineering Design 3.3 (1992): 131-147.*

Turner, V. & Turner, E. (1987). Performing Ethnography. In *The Anthropology of Performance. (V. Turner, ed). 139-155.* New York: PAJ

Weick, K., Sutcliffe, K. & Obstfeld D.(2005). Organizing and the process of sensemaking. In *Organization Science 16(4):* 409-421.