Does Professional Work Need to be Studied in a Natural Setting? A Secondary Analysis of a Laboratory Study of Software Developers

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Introduction

One way to study the work of software developers is to invite experienced developers to participate in a simulation study conducted in a laboratory environment. In such studies, the participants will be given a task to work on for a period of time. The task will resemble an ordinary activity, and the study participants' working will be recorded. Simulations are contrived, but the participants will have relative freedom within these contrivances to work as they see fit. Simulations are not necessarily experimental, although there may be an element of this. Advantages of laboratory simulations are a) the task will have a relatively clear start and end point, and can be limited to a manageable period of time; b) the researcher has opportunities to make work visible that may otherwise not be (for example by asking participants to talk aloud as they work, or use a whiteboard to write things down) and c) comparable examples can be generated. However, these same advantages also give rise to criticism, particularly that laboratory simulations are a) designed according to the researchers' preconceived ideas about what is important in the work; b) they are shaped according to the demands of generating research data; and c) they may lead to acting or unusual behaviour among the participants.

Simulation data is sometimes treated with suspicion, with preference given to analysing examples of work as it is done "in the wild" (e.g. Crabtree et al 2012; Szymanski & Whalen 2011; Hutchins 1995). For example, in the context of design studies, McDonnell and Lloyd (2009) have recommend that attention be paid to "*authentic design activity as it is practiced in the wild*". They argue "*credible analysis relies on studying design processes and outcomes which have not been initiated by the researcher and where researcher intervention is minimised*". McDonnell and Lloyd, do not specifically exclude the possibility of studying design activities in the laboratory, but clearly, if we are to focus on "authentic design activity", then the contrivances inherent in laboratory simulations are problematic.

This chapter is concerned with the issue of whether, to study professional work practices, we *need* to see them in a natural setting. To address this issue, the chapter looks directly at what might be said to be unnatural about a particular simulation. This is a secondary analysis, drawing upon Conversation Analysis to qualitatively examine video data from a simulation conducted by other researchers. The chapter confirms that this simulation data is contrived, but finds no overwhelming cause for concern about these contrivances. The chapter shows that, even if the study is contrived, the experience and identity of the participants play a key role in their conduct. More broadly, the chapter argues that the naturalness or authenticity of professional conduct in a laboratory study is not a product of the study design but is an achievement of the researcher and study participants in conducting the study.

Background

This chapter presents a secondary analysis of a simulation study of professional software

developers. The study, performed by Baker and van de Hoek (see Baker et al 2012; Petre et al 2010), asked professional software developers to work on a design problem concerning a traffic signal simulator. The developers were asked to work on this problem for up to two hours, to the point where they have a design they would be happy to hand over to programmers. The developers were asked to work in pairs and to use a whiteboard. Baker and van der Hoek's study is certainly contrived; the participants are asked to work in a very particular way (in pairs at the whiteboard), and assumptions are built in about the division of labour in software development (for example that there will be a clear design phase, with the design being worked up from scratch and then handed over to programmers). These contrivances are useful for the purposes of research, in that they enable the videos to stand for themselves as self-contained episodes of design. The contrivances of the study are not as extreme as they might be; for example, the participants are studied in meeting rooms within the organisations at which they work, using the whiteboards already located there. But does this level of contrivance mean that the developers are no longer engaging in what McDonnell and Lloyd call an "authentic design activity"?

Baker and van der Hoek have made three videos from their study available for other researchers to analyse. To date, more than ten papers analysing the videos have been published, and a further thirty working papers were presented at a workshop (see Baker et al 2012; Petre et al 2010). These papers generally treat the videos not just as tasks in which professional software developers participate, but examples of how professional software developers go about designing. One paper is critical of the effectiveness of the approaches the developers take to completing the task (Jackson 2010), but none have directly addressed the more fundamental issue of whether the tasks and the activities of completing them actually resemble how the

developers participating in the study would work in real-world circumstances. This chapter will adopt a sceptical position, exploring how laboratory constraints affect and shape the activities of the study participants. Most of the papers do tie their analysis into the broader, empirical and theoretical literature, and many are written by people with experience in design and development, and so major problems with the data were always unlikely (and indeed are not found). However the ultimate intention of this work is not to attack or undermine the videos, but to address a wider methodological question: in order to understand professional work do we need to study it "in the wild"?

One paper that draws on Baker and van der Hoek's videos is a qualitative study by McDonnell, examining how a pair of developers manage a disagreement (McDonnell 2012). Elsewhere McDonnell has pointed to the importance of research "in the wild" (McDonnell & Lloyd 2009). In her paper converning the simulation data, McDonnell warns: "*the 'laboratory' aspects of the setting are a pervasive influence on what we see.*" (McDonnell 2012, p.46). However, she proceeds with her analysis, putting the laboratory influences to one side with a comment about the study participants' experience and their institutional identities. This chapter will explore the relationship between the laboratory contrivances and the experience and identity of the participants. Rather than directly addressing how the developers work on the design problem, this chapter addresses how their work is constrained and shaped by the laboratory aspects of the study. To do this it examines examples of how the participants orient to features of the study, for example where they talk with the researcher, discuss the camera, and read through the task sheet.

Conversation Analysis

McDonnell's is one of five papers (McDonnell 2010, 2012; Matthews 2010; Rooksby & Ikeya 2012; and Luck & Ikeya 2010) that draw in whole or in part on Conversation Analysis (CA) to analyse Baker and van de Hoek's videos. A further five (Gross 2010; Detienne 2010; Visser 2010; Nickerson & Yu 2010; Nakakoji et al 2010) adopt roughly analogous approaches. This chapter also draws upon CA.

Conversation Analysis (CA) has origins in the work of Sacks (1992) and Garfinkel (1967) (see Heritage 2005; ten Have 1999). Garfinkel broke from mainstream Sociology with the development of a programme of research termed Ethnomethodology. He argued social order is not invisibly imposed on people (e.g. through hidden forms of power or underlying cognitive structures) but is a practical and on-going achievement necessary in everything we do as members of society. His work focused on the routine methods by which people constitute social order; in the words of Heritage (2005), ethnomethodology rejects "*the bucket theory of context*" in which context is anterior to the action; rather "*it is fundamentally through interaction that context is built, invoked and managed*" (p. 109). CA grew out of ethnomethodology, taking on a more strongly empirical character. While mainstream CA focuses directly on conversation, its methods have found wide applicability in studies of work. Matthews (2009) and Housley & Fitzgerald (2000) explain the value and applicability of CA to the study of design. Examples of its application to simulation data include (Suchman 1987; 2007; Francis 1989; and Sharrock & Watson 1985).

Following CA convention (as outlined in ten Have 1999), I have collected and analysed relevant sections of the videos. The convention is to a) review the available data and build a collection of sequences relevant to a chosen theme, and b) transcribe and analyse the collection (ten Have 1999). As such, CA involves a basic amount of coding, but does not involve the development and application of a coding scheme. The aim is essentially to build a very thorough description of some aspect of how people talk and interact. For this study, I began by collecting every sequence in which there was talk between participants and the researcher. Following this I went through the videos again to spot the occasions on which the participants said or did something that was overtly task-relevant but where the researcher was not spoken to. In particular I took interest in the times at which the participants read or discussed the instruction sheet.

An Analysis of Laboratory Contrivances

I have selected six examples (four transcripts and two figures) for inclusion in this chapter. For the purposes of readability, simplified transcripts are used; they are designed to convey what was said but are less precise about how it was said than were the full transcripts produced for the analysis (for example, I have omitted details about laughter, intonations, overlapping talk, and do not time the pauses). For simplicity, I also refer to the videos as study 1, 2 and 3, and to the participants in each video simply as A and B, and the researcher as R.

Contrivance 1: The Requirement to use the Whiteboard

*** Figure 1 around here somewhere ***

To begin, I will discuss figure 1, and transcript 1. These examples concern how the researcher's requirement to use the whiteboard is implemented. These examples do not show that this requirement is unproblematic or has no effect. Rather, they show that laboratory contrivances are not purely resident within the design of a study, but are implemented and oriented to in specific and practical ways during each study.

Figure 1 gives a sequence of images from study 2. The meeting room used for study 2 had a large whiteboard, and so the researcher drew red lines to create a working area that could be captured on camera. Soon into study 2 the researcher had to adjust the camera because the participants would often stand to the side of these lines. The participants used this working area for most of the study, but at one point where they ran out of room they began drawing outside of this. This figure shows that the study is contrived, with the participants not just being asked to use the whiteboard, but a specific area of it. It also shows that the researcher is sometimes led to make practical adjustments and interventions during the study. So while the contrivances may be decided in advance, their specific implementation is contingent on the specific setting of the study and the course it takes. The figure also shows that the participants for the main part comply with the contrivances, but are prepared to break these and make no excuse when they do.

In study 1, the requirement to use the whiteboard briefly becomes a joking matter. In all three videos, after the developers participating in the study have spent about five minutes reading the instruction sheets, they face the problem of when they will start, who will make the first move,

and what this move will be. In the opening turns from study 1 (reproduced in transcript 1) one of the participants asks the researcher "shall we go?" This, and the opening turns from the other studies are points at which the study itself is being discussed. Study 1 stands out because rather than asking her colleague "shall we start?", the participant asks the researcher. This draws the researcher into a revealing discussion (see transcript 1). The researcher seems to be caught off guard when A asks him "*shall we go?*" The researcher splutters "*whenever you're ready*" and then repeats this more clearly. Then there is a silence. The researcher, probably worrying that nothing happened, now begins to direct them to use the whiteboard "…*you should go and use* ..."; but he stops abruptly and repairs what he was saying into something less directive "…*just try to do it at the whiteboard*.". The researcher is then met with laughter and is mocked "*WE CANNOT WHISPER HERE*". The researcher tries to explain but is laughed down. It is not until A finishes laughing at her own joke that the researcher gets to explain that a previous study failed because a pair wrote on paper. Transcript 1 ends where the pair begin discussing the task between themselves.

In this example, the researcher can be seen trying to balance two conflicting priorities: for the participants to work at the whiteboard (visibly, on camera), and for the participants to do things as naturally as they can. It is also interesting that the participants, through their laughter and joking, show that these concerns are obvious to them. The joke plays on following one obvious thing (use the whiteboard) with another (speak clearly). This is not to say that the participants necessarily know and understand everything the researcher wants (in the example a pair that tried to work on paper is mentioned, and elsewhere in the video one of the participants appears to be mentioning electronic whiteboards as if he thinks the researcher is interested in these). The

participants also seem awkward about these constraints. This example shows that the developers are not acting blindly or in ignorance of the fact they are participating in a study; neither the researcher nor the participants are blind to the contrivances of the study.

Contrivance 2: The Task

Transcript 2 details a relatively long example in which the developers discuss and disagree about what the task sheet is asking them to do. A reads out a section from the task sheet that says "you may assume you can reuse an existing package to deal with certain mathematical and statistical functionalities necessary for the simulation software". B jokes, "*Ok, cos I don't wanna code that*", but A is not sure about the scope of what they can assume. A wonders whether they will have to model issues to do with speed and the timing of the signals, but B says "*we can rely on Professor E for kinda the details*" and then "*we don't have enough information here, but there might be packages out there.*" I've then omitted several turns from the transcript (in which B changes the subject), and restart where A steers the subject back to her worry about speeds. A is worried if it can be "*assumed that all of 'a' have the same speed*". By this point, B seems a little irritated, and has started working on something else. He turns to B and replies "*lets assume yes, lets assume its inside a city*". Then, to drive home his point that speed is not within scope, he says "*we'll talk to professor E about it*", and gives a pointed grin.

The task sheet points to the scope of the work expected from the participants, but does not contain a complete description of what must be achieved; the participants must interpret and flesh out what is required (and might not always agree on the interpretation). Wouldn't the simplest way for the developers to figure out the task, and settle disputes about what is wanted,

be to turn to ask the researcher "what do you mean here?" or "what exactly do you want here?" But, the task is treated in terms of what Prof E wants and might say. For the purposes of carrying out the task, it doesn't matter that Prof E isn't really their customer (I am sure the participants know the study will end after two hours and that, even if Prof E exists, there will not be a need or any opportunity to speak to her later). In a sense then, the participants buy into the artificialities of the task, and arguably they make things more difficult for themselves by 'pretending' that they will speak to Prof E later. But in doing so, they are treating the task according to the logics and rationalities of software design. The participants are not naïvely following instructions or doing what is simplest in that particular situation, but are approaching the task as designers would. As could be seen in example one, the developers know what is expected of them; but now we can also see that they still draw upon their ordinary methods and logics. This is not just to act a role, but is involved in things such as settling disputes.

Contrivance 3: The Two Hour Time Limit

The study is run with a two-hour time constraint. At the point where transcript 3 begins, the participants have had a long discussion about traffic modelling, but without coming to anything they felt necessary to write down. The discussion does not seem to be going anywhere. A question from A is dismissed with the answer "*if we even wanted to*". A echoes this answer, and then steps backwards shaking his head. A then suggests an idea for what they might work on next, premising it with the words "*with half an hour left*". A wants them to think about the goal of the task to "*communicate this*", making specific reference to the fact that "*we're playing the role of architect*". He picks up the sheet to read through it, and B does likewise. They discuss the stated goals of the task, saying of the first one "*which we kind of have been doing here*" and

the next "*which we've done here*", essentially checking off what they have done against the study goals. B then states a goal is to "*communicate the interaction UI*", and later says "*one way I've found effective in communicating UI interaction is user stories*." He suggests "*we could come up with a list of user stories*".

For a long period the developers had 'forgotten' the sheet, both in the sense that they didn't need it to do what they had been doing, and in the sense that they had forgotten some of the specific instructions. In this example, they find an occasion on which it is appropriate to come back to the sheet and read it again. The occasion has two key features: having half an hour left, and a new topic being needed to follow an idea that has fizzled out. The lack of available time is referred to specifically, and appears to support returning to the goals of the study as a credible next thing to do (as if this would not be preferable were there plenty of time). Returning to the instructions first involves deciding whether the work done so far satisfies the stated goals. In this instance "*kinda*" is good enough, they are not concerned whether they have precisely fulfilled what has been asked of them. Returning to them also enables deciding a relevant next course of action: listing "user stories". This course of action is not stated within the sheet but is given by one of the participants as an adequate and reasonable response to a requirement that they "*communicate*" their design. I also want to note with this transcript that the participants orient to "*playing the role of architect*". They invoke this role not as something for them to pretend to be as such, but as a referent for what would be the appropriate course of action; *what would an architect do here*?

*** Figure 2 around here somewhere ***

Contrivance 4: The Video Camera

Finally, I will discuss the camera. For the most part in the videos, the participants seem to ignore or even forget the camera is there. In figures 1 and 2, two participants are working together at the whiteboard. The images give a typical scene in that the participants position themselves in such a way that each can see and access the board, and for the most part show little awareness or concern for what is visible to the camera. In the sequence shown in figure 2, one of the participants briefly checks his phone (which had beeped earlier). The participant times this in such a way that the other participant does not notice. When the first participant is writing something, the second person quickly removes his phone from his pocket. As soon as the first participant begins to stand and look back, the phone is pocketed. We can see the participants' primary concern is managing face with the partner, not for how they appear on video; working together can and does take precedence over any acting. However, as transcript 4 shows, this is not to say that the participants are oblivious to the camera.

In transcript 4 the participants wonder if they can take a shortcut because they know that something they've discussed has already been captured on camera and think therefore that there is no real point to producing a written record. The transcript begins with A stating an idea for a user story, and then, with B's encouragement, writing down "I want to create an intersection". They discuss "the way you do that" according to their design. Pointing to the blank area beneath their user story, B says "do we wanna then annotate" and then "or are we letting the video camera capture our description". Essentially B is wondering whether it is worth writing down everything in full. The participants laugh about this idea. The researcher coughs to gain their

attention and says “you don’t have to write everything down”. The participants seem a little surprised at R speaking, and just nod and turn back to the whiteboard.

The participants take a shortcut on the rationale that their verbal description is already on camera. Until now, the camera had never been oriented to or mentioned. It was forgotten for all practical purposes, which is to say, whether of not the participants were aware of the camera they did not orient to it. But here the presence of the camera is made explicitly relevant, and laughed about as a possible determinant of how they will proceed (specifically whether they can omit something from their working). As with example one, joking and laughter feature where the participants directly discuss constraints, perhaps to mask awkwardness or embarrassment. As with example one, the researcher is also dragged into proceedings. The researcher has to make an on the spot decision regarding the study contrivances, choosing this time to intervene. Arguably, the participants themselves minimise the intervention of the researcher, turning to him only briefly. In this example, the participants orient to the contrivances of the study, but in ways that show sensitivity to the researcher’s task (as best they understand it), and in ways that appear to trade working through everything in full against doing it in the two hours available. Perhaps the participants are being a little lazy, but even if so, they are lazy with sensitivity to the study.

Findings

I have discussed four transcripts and two figures in order to examine how contrivances feature in a laboratory study. These examples confirm that the videos are contrived. I will argue, however, that this is not a reason for dismissing simulation as a method of producing data for studies of professional practice.

Laboratory Simulations are Contrived

The examples confirm, firstly, that the simulations are contrived. Simulations are crafted to resemble the design process, but in a tractable way to be captured on camera and to produce examples that can be compared with each other. The examples also show that the researcher and participants are not always comfortable with the contrivances of a study or confident about how to implement them. The study participants would often laugh when discussing aspects of the laboratory setting (such as the camera, that the researcher wanted them to use the whiteboard, and the time constraints). This laughter, I suggest, does not mean they find studies funny, but that they are uncomfortable. The researcher also seemed uncomfortable at times, particularly in transcript 1 where he had to make explicit the requirement to use the whiteboard.

To point out that a laboratory simulation is contrived is *not* to point out something the researcher and study participants don't know. So, if someone complains that laboratory studies are contrived, they are not pointing out something that would be 'news' to anyone involved. This shows, or at least implies, that the presence of contrivances is not inherently grounds for dismissal: if researchers and participants know that a study is contrived why would they proceed with it? I find it more plausible that the researchers *and* participants recognise contrivances and believe they are problems that can be overcome, than that they are somehow in denial that they can't. I also believe that the uncertainties and awkwardness of the researcher and participants signal a need for research that supports and guides the running of simulation studies.

Contrivances are Pervasive but not Controlling

The examples show that the researcher and participants deal with the contrivances on occasion, not at all times. The contrivances may be a pervasive influence on the study, but their influence is not constant. Features of the study such as the task, the camera, and the working arrangement are always present, but they are not of equal relevance at all times. The study participants predominantly just get on with the job at hand and only on occasion talk or worry specifically about what the sheet says, what the camera means, how much time they have left, and so on. They ignore the camera most of the time, worrying more about how they are seen by their partner, than how they appear on video. When they pick up the task sheet with half an hour left they go back through the goals and decide to what extent the work they have done satisfies these. For the most part, the contrivances are forgotten - both in the sense that the participants really don't remember what is in the sheet or that they are on camera, but also in the sense that the sheet, the camera, and suchlike, is not at that moment a relevant thing in what they are doing. This is not to say that the contrivances do not shape the action, but that there is also room for other factors.

Identity and Experience also Shape the Simulation

The examples confirm and cast light on McDonnell's (2012) point that the participants call upon experience and institutional identities. The study participants do not work in ways that are unique to the laboratory context, but which draw upon their experiences and ways of designing. The study participants draw from their experiences of what they have found useful (for example creating user stories), and they take decisions that are professionally accountable rather than

blindly relevant to the situation they are in (for example claiming that they will ask professor E later). The participants are not drawing purely from personal experience, but can be seen to orient to and talk about institutionally relevant identities, for example they orient to how a system architect would communicate something (rather than their own specific experiences in systems architecture), what a user would do, and what a customer might want. This reflects Heritage's (2005) remarks about talk-at-work, that people will select institutionally relevant identities, and that these have procedural consequentiality. This happens in a multi-faceted way in the study, with the developers orienting at times to 'me as a developer' (e.g. *what I've found useful,* or *what I would do in this kind of situation*), at times to what any professional developer would do (e.g *what architects would do*, or *what type of problem this is*), and at times to what characterises the work of their organisation (e.g. *what we do here*, or *how we approach things*).

Practices in a Simulation can be both Professional and Contrived

It is not the case that experience and institutional identity feature in ways that are independent to the contrivances. Experience and identity does not, for example, fill the gaps where the contrivances are 'forgotten'. Rather the examples show the participants choosing their courses of action with reference to a combination of experience, identity and contrivance. For example, the task sheet sets a scope for what is required, but the participants figure out for themselves exactly what this scope is and how they will meet it. The task sheet does not give a set of steps that will get the participants through the task, but they must select courses of action that will address what is asked of them. These courses of action (e.g. to list user stories, to designate something as a question to be settled by the customer, or to sketch an interface) are chosen with relevance to what is asked in the task sheet, with relevance to the time they have remaining, as

well as with relevance to things like their experience as designers. These courses of action can take the developers away from the task sheet, with them spending time doing the thing they have decided to do. But when they later come back to the sheet, they may talk about to what extent what they have been doing satisfies what is on the sheet. There are multiple relevant contexts for the participants, including the simulation itself, but also experience, their own identities, and their wider organisational and professional identities.

Heritage (2005) criticises what he calls "*the bucket theory of context*". He argues that context is not something enfolding and determining action, but that it is fundamentally through interaction that context is built, invoked and managed. In this study, we have seen that neither the laboratory constraints nor the professionalism of the developers are anterior to their practices; both are oriented to, drawn upon, reasoned about and sometimes thrown out, all in the course of the simulation. From this perspective, laboratory contrivances should not be thought of as something that exist in the design of the study, but are features that are implemented in contingent ways during the course of the study. The professional practices too, are implemented in the course of the study, and in ways that are tethered to the contrivances. This means that while the study participants can be seen to draw on professional practices, these practices are drawn upon in ways that are specific to the simulation. Rather than seeing professional practice in a professional setting we see it in the laboratory. This practice cannot be isolated from the laboratory just by throwing away simulation specific talk. But this is only a problem insofar as the settings in which developers work may see them drawing upon experience and identity in quite different ways. So the laboratory simulation can tell us about professional practice, but does not necessarily tell us about what happens "in the wild", and might in places tell us

something specific to practice in the laboratory.

Conclusion

Even though the study discussed in this chapter is contrived, it cannot be dismissed as unnatural. The study participants have been shown to act according to their identity and experience. However, they draw upon and implement experience and identity in ways that are specific to and intractable from the simulation. So while laboratory simulation can serve to reveal aspects of professional practice, research must remain sensitive to how such practice is simulation-bound. Three general, overlapping recommendations that can be derived from this chapter are a) the naturalness or authenticity of practices in a simulation is not a direct result of the way a study is designed but is a practical problem encountered by participants and the researcher during the conduct of a study, and therefore in order to understand how and why the participants work in particular ways we need to pay attention to the work itself; b) simulation specific talk and action (e.g. researcher-participant interaction) ought not and often cannot be omitted from an analysis of their practices; and c) methodological support for simulation might better address not just how to design a study, but how to conduct it.

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Appendix

These transcripts have been simplified slightly for readability. ((Double brackets indicate notes)). Underlined text relates to the adjacent screen grab from the video.

Transcript 1: Study 1 (AmberPoint, 00.05.48 – 00.06.15)

A Shall we go?

R Eh? Whenever you're ready.

Whenever you're ready

A Yeah

B Okay

((1 second pause))

R Yeah you should go and use tha-. If you want to write anything,

just try to do it at the whiteboard

A h huh huh ((continues laughing))

B huh huh huh ((continues laughing))

R It helpful for us ((drowned out by laughter))

A WE CANNOT WHISPER HERE huh huh huh.

((brief pause))

R Some people want to draw on paper and that just makes it difficult for us.

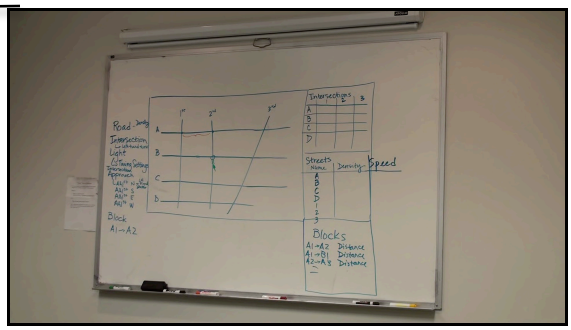
B Yeah

A Uhuh, uhuh

((3.5 second pause))

B Well, I mean, so, so, the end users, seem to be the students and the professor.

Transcript 2: Study 1 (AmberPoint, 00.22.14 to 00.25.02)



A Yeah ((reading task sheet)) If you wish you may assume that you will be able to reuse an existing software package that provides relevant mathematically functionality such as statistical distributions, random number generators. Yeah but that

B OK cos I don't wanna code that ((laugh))

A No ((laugh)) Yeah but that doesn't really necessarily tell you

B No thats not really a drawing package

A Yeah

B Its more a

A No but it also doesn't say, uhm, you know that if you have two streets that are, you know, a mile long and the average speed is twenty five, the best timing

B Yeah, I think we're gonna have to rely on professor E for kinda the details about, how that, the theory of how that works. I mean, we might have to code whatever her understanding is of, of

A Uhuh

B traffic light theory into it. But we don't have enough information here. But. There might be packages out there, I don't know. But. Does that make sense?

[*Omitted 23.09 to 23.42*]

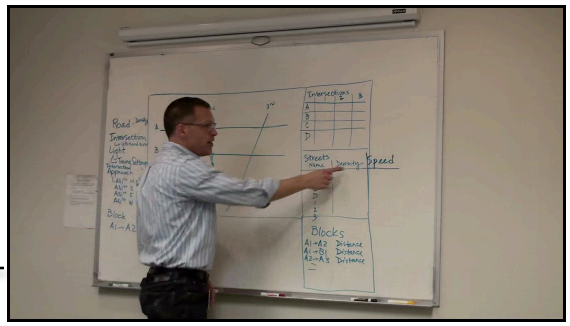
A So the user is dragging, drawing these things, placing intersection, uhm, and now they have, this grid. Uhm. That's the hard part, that I'm not quite

B Which part? Over here? ((points))

A Yeah the part about settings actually. In other words, if you want to simulate it, you have to know exactly the distance between each intersection, you have to know how fast is the maximum speed that the cars possibly, could be going

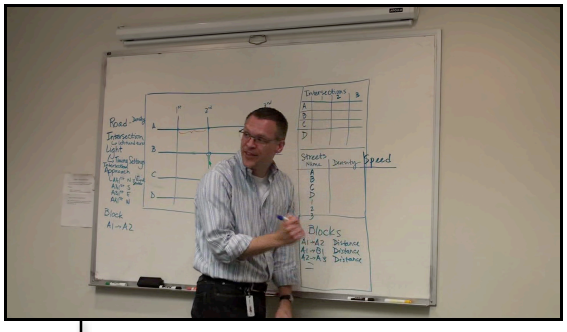
B Right

A So ha how long does it take to get from one intersection to another, so if you left at a green light, from one point.



B Oh yeah that would be nice so if we ((walks to whiteboard pointing at part of diagram)). That's kind of good down here, if the speed on this street is twenty five miles an hour, how, adding green light, long should it take you to go the distance, this distance?

A So this can get thoroughly complex very fast ((slight laugh)) because you suddenly you know have all these intersections and if the. Hhh. That's the thing, are the speeds to be assumed that all of A has the same speed?



B Which one are you

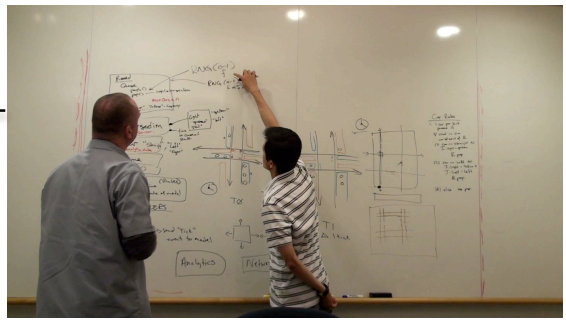
A You know, and is it the same as B?

B Lets assume yes ((turns to Face F)), lets assume it's inside a city so ((turns to whiteboard))

A Ok uh

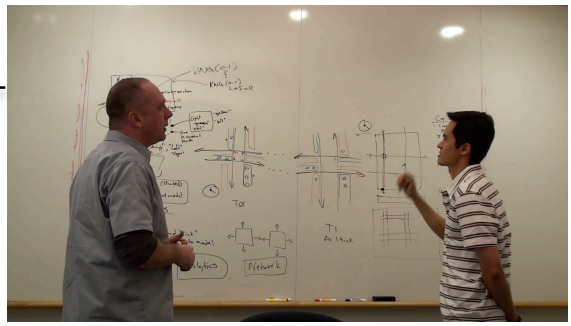
B ((Turns to F)) We'll talk to Professor E about it ((grins))

Transcript 3: Study 2 (Adobe, 01.17.35 – 01.19.40)



A Yeah right now we've said. Yeah. Right now we've said if you can control ((points at part of their design)) the frequency of the car creation on that road, what about the, how do you, how do you uh

B If we even wanted to



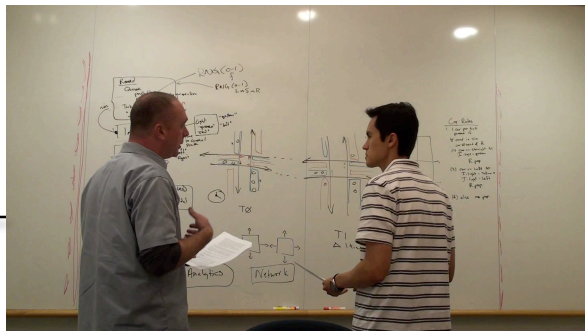
A yeah if we even wanted to that's, that's ((steps back and shakes head to say no))

B ((Waving pen)) I'm wondering with half an hour left if we need to uh, think about how to. Cos I think one of the, ((reaches to pick sheet up, as does A)) goal here is to communicate this to, if, if we're playing the roles of architect, how to communicate it to. ((looks at sheet)) so we ((looking through sheet))

((7 second pause, both participants looking through their information sheets))

A So two things, design the interaction, which we've, kind of, have been doing here, design a base, basic structure of the code. Which we've done here ((points)), maybe we should more formally.

B ((reading from sheet)) You should design the basic structure of the code, okay so really the desired outcome right, so we need ta, communicate the interaction UI. But then we need to, design the basic structure of the code that will be used to implement the system.



((3.5 second pause)) So I'm thinking, maybe, uhm, ((3.5 second pause)) so, maybe uh ((1 second pause)) one, one way that I've found effective in communicating, UI interaction is uh, is user stories. So we could come up with a list of user stories around, uh I as a s:i. Err, uh I as a user of the system, want to uhm, create a, a, a, a road in my simulation, so that I can see traffic flow across it

A Yeah

B And then come up with progressively, start with the simplest user story and then…

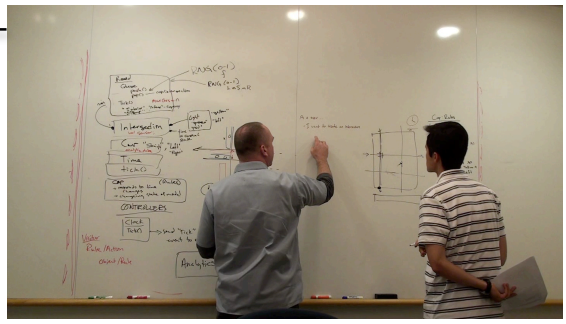
Transcript 4: Study 2 (Adobe, 01.22.18)

A Right, so as a user I want to ((1 second pause, gestures toward whiteboard)) create intersection ((turns to B))

B Ok

A ((Writes a user story on whiteboard "I want to create an intersection")) Currently, the way you do that, is, ((pointing at areas of diagram)) you, uhm, click on the edges, to create roads. And then, where the roads meet, you have an intersection.

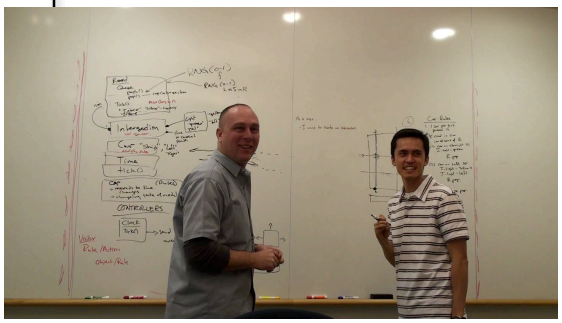
B Right ((4 second pause)) so. Ok, so, I want to create intersection. So do we wanna, do we wanna then annotate ((points at area beneath where the user story is written)), or are we letting the video camera



A ((laughs))

B capture our description? I think we can assume that we have a video camera rolling ((A laughs)), and we'll go through user stories

R ((clears throat)) To ((A and B turn to face R)) some extent you should just be able to explain it, you don't have to have everything written down



B Written down ((nods and turns back to whiteboard)) I see. Ok. Right.

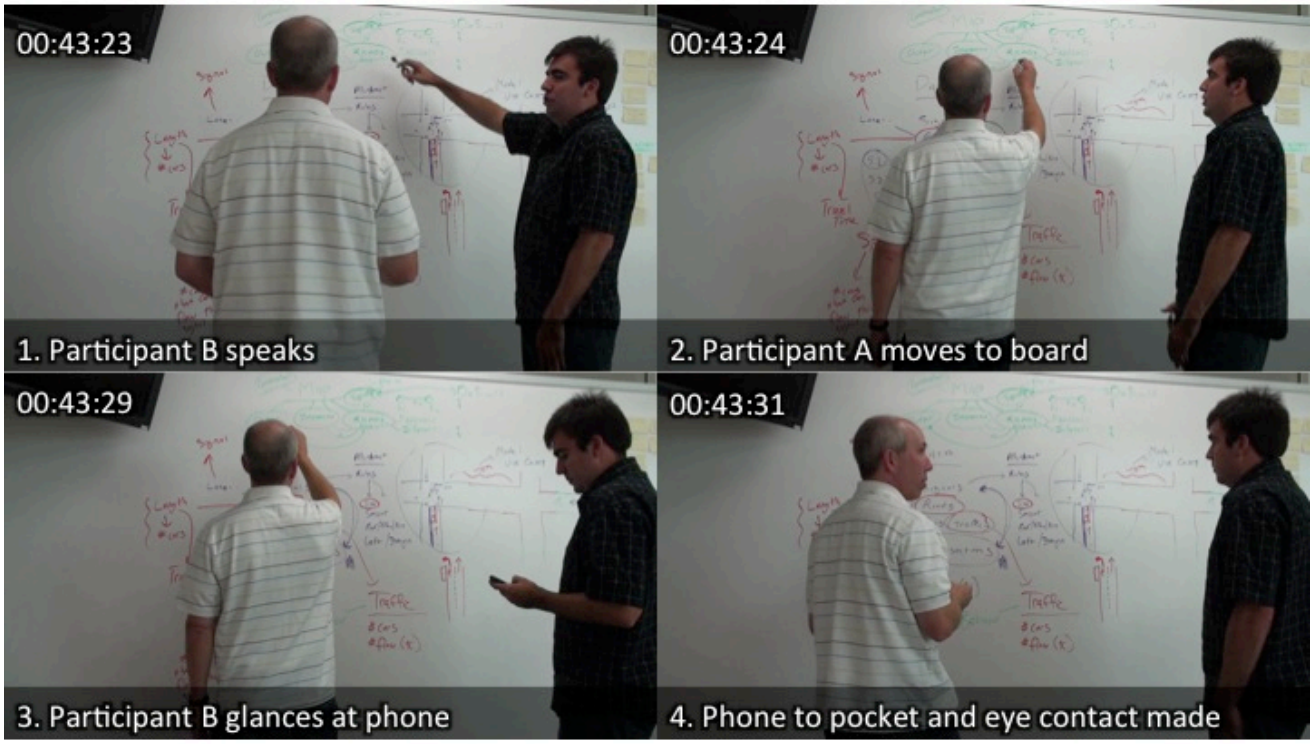


Figure 2: The developer on the right briefly checks his phone.

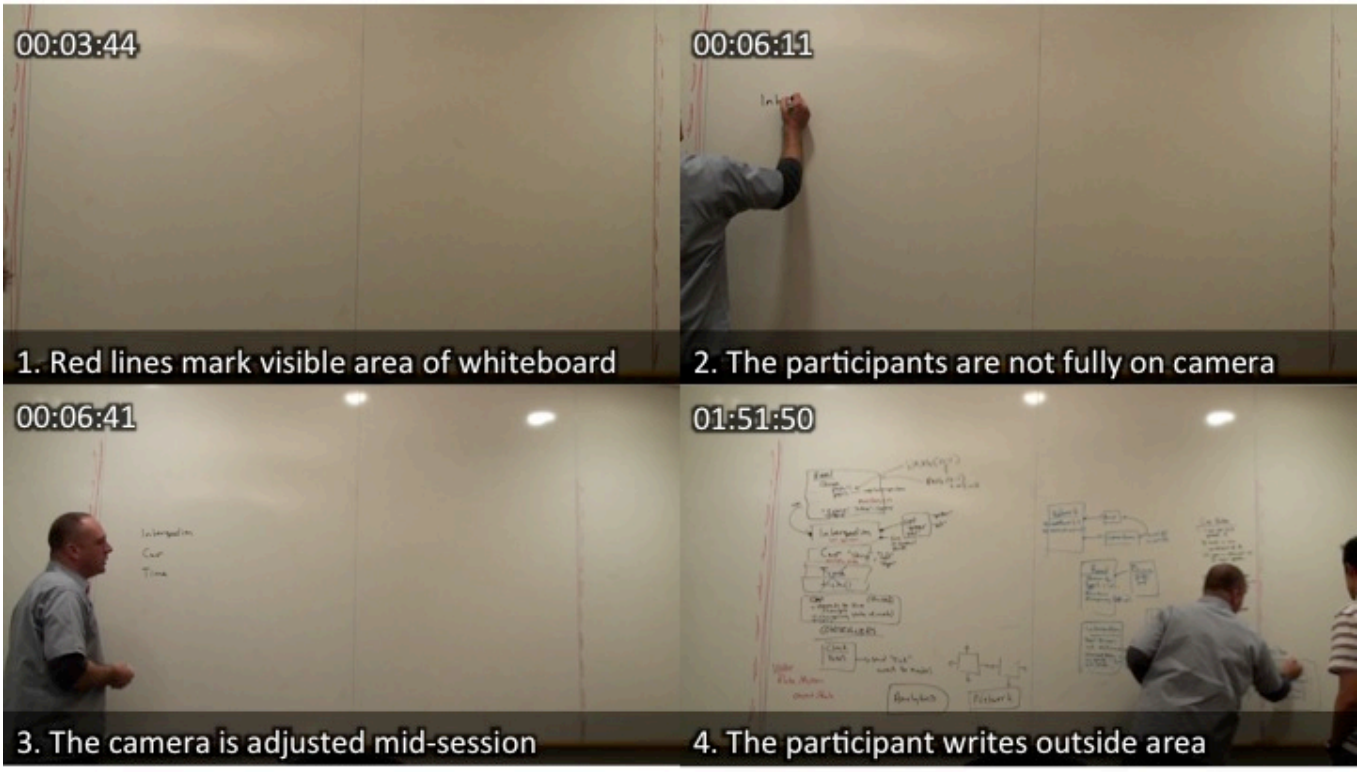


Figure 1: The designated working area