A User-Centred Design Approach to the Development of Simulator-based Training

Kjell-Morten Bratsberg Thorsen

Master of Philosophy in Psychology

Department of Psychology, University of Oslo

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Abstract

Motivated by the challenge of combining psychological theories and methods with high-tech gaming and simulating technology, a project was carried out to develop a simulator that could train people in the skill of negotiation. An analysis of the existing theory, interviews with experienced negotiators and observations of negotiation in action formed the basis for a User-Centred Design process. Through the application of Contextual Design methods, traditional qualitative methods, and a Usability test, this process has currently resulted in the overall design of a training program and an early design prototype. As well as this, the project served as a testbed for an exploratory study of the application of User-Centred Design methods to the development of a training simulator. This type of development poses new requirements for user-centred methods, as the simulator will support a different context of use than the one analysed to inform its design. The study suggests a possible approach to user-centred development of simulator-based training, founded mainly on Contextual Design and Cognitive Work Analysis.
Table of contents

Simulating Skills—exploring skill development through the design of a game-based training simulator ................................................................. 5
Benedicte Biørnstad, Kjell-Are Furnes, Paul Andreas Lundeby, Ina Kook Rambøl, & Kjell-Morten Bratsberg Thorsen

User-Centred Development of Simulator-based Training ....................... 55
Kjell-Morten Bratsberg Thorsen
Simulating Skills
—exploring skill development through the design of a game-based training simulator

Benedicte Biørnstad
Kjell-Are Furnes
Paul Andreas Lundeby
Ina Kook Rambøl
Kjell-Morten Bratsberg Thorsen

Department of Psychology, University of Oslo, Norway
Preface

This document is the end result of a research project conducted by five master’s students in Psychology. As individuals we were united by the common wish to use the thesis as an opportunity to produce something other than the traditional research we had worked on earlier in our academic careers. We saw a need for a more practical approach to research within the field of Industrial and Organisational Psychology at the University of Oslo, a need we strongly wanted to address. Doing research that would apply psychological theory to an everyday work situation was something that was important to us, as well as developing a product that could benefit an end-user.

There are many areas where this type of research is needed but seldom carried out, which served as an inspiration for us. It is not difficult to speculate as to at least one of the reasons why this type of research is so seldom done. The level of innate insecurity is high, demanding that any researcher throws him/herself out into the unknown without a safety net. For us this knowledge served not as a hindrance but as something exhilarating. Knowing that we would be able to carry out exploratory research and break new ground within our academic field was an inspiration to all of us. In addition to breaking new ground theoretically, embarking on this journey as a group was an innovation in itself. We knew that this would allow us to acquire skills within the area of teamwork and at the same time to develop and grow as individuals.

In the document “Simulating Skills—exploring skill development through the design of a game-based training simulator” the group’s work is described, giving a detailed picture of both what we did, how we did it, and why we chose the methods we did. The document is divided into two, with the first section detailing our activities in chronological order. In the spirit of Action Research this part is important in order to fully comprehend our focus on the procedural aspects of our work. The processes were in and of themselves considered part of our project and therefore explaining them is of central importance. The second part of the document is dedicated to presenting the methods we used in the development of our product. The User Centred Design process that was gone through is described, as well as the methodological choices we made throughout the project period.
# Table of contents

**From idea to simulator** ................................................................. 8  
  Initiating the project ................................................................. 8  
  Deciding on an idea ................................................................. 9  
  Exploring the idea ................................................................. 11  
  The contours of a simulator emerge ........................................... 13 

**Development through User Centred Design** .................................. 16 
  Two iterations of development .................................................. 16  
  First iteration ............................................................................. 17  
  Understand and specify the context of use ..................................... 17  
  Specify the user and organisational requirements ......................... 23  
  Produce design solutions .......................................................... 23  
  Evaluate designs against requirements ......................................... 27  
  Second iteration ........................................................................... 27  
  Understand and specify the context of use ..................................... 27  
  Produce design solutions .......................................................... 32  
  Wrap up of the second iteration ................................................... 32  

**Final thoughts** ............................................................................. 33  

**References** .................................................................................. 34  

**Appendix A** ................................................................................. 38  

**Appendix B** ................................................................................. 40  

**Appendix C** ................................................................................. 43  

**Appendix D** ................................................................................. 46
From idea to simulator

Initiating the project

On February 8., 2006 a group of seven master’s students were presented with an idea for a possible master thesis project at a meeting at the Department of Psychology, University of Oslo. Associate professor Thomas Hoff initiated this gathering, having met the students through his work as a lecturer in Work- and Organizational Psychology on the master’s degree. At the meeting he presented the concept of developing a game-based work simulator founded on relevant psychological theory, through User Centred Design methods\(^1\). On the basis of this raw sketch six of the students committed themselves within a few weeks to this project, and formed the group MOP (Master Oppgave Prosjektet)\(^2\). During this spring the students met regularly as MOP in addition to finishing their obligatory courses in Work- and Organizational Psychology and Quantitative- and Qualitative Methods. The students met again after summer break and early that autumn we decided to change our name to Simoveo, which is the name of the group today.

At the first meeting we were presented with the idea of developing a work simulator based on gaming technology. The question in focus was whether it would be possible to combine high-tech simulating technology with basic organisational theory, cognitive psychology and human factors. In his presentation Hoff used as examples large international companies as potential users of such a simulator. It was suggested that the simulator could be sold to the end users in the different firms. After extensive simulator training the employees would develop skills they could use in their professional lives. This concept was presented both as a research project and as a potential business idea.

Three ideas as to the content of the simulator were introduced; negotiation technique, decision making, and conflict management. At the group meetings of spring 2006 additional ideas were developed and worked on. The concept of making a simulator in order to learn or practice on different skills was the foundation for the group’s further work on developing and brainstorming new ideas. Spanning as wide and broad as possible the group wanted to

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\(^1\) These methods are described in a later section of this document.

\(^2\) The group was later reduced to five students and this will be elaborated on later in this document.
explore the academic and business potential of the different ideas and also explore the excitement the different ideas evoked in the group.

Additionally and in parallel with developing different ideas concerning the simulator, the group members started to orientate themselves towards different areas of individual focus. This process started off with a workshop in mid-April 2006 where the group members were invited to reflect upon their possible future roles in the project. Three main focus areas were outlined: business, management, and sales; design and development; and the theoretical and scientific content of the simulator. This workshop put focus on important topics and aggregated questions that the group had to spend time discussing and working on during this spring. It was important to decide what roles the different members should have, and how and in what ways the different group members could complement each other. Should the different theses be dependent or independent of each other, dependent or independent of the product? Who wanted to write about what? The dynamics of this process developed over time. The result of this is reflected in the individual sections of the theses.

**Deciding on an idea**

The group had its first official meeting in the middle of August. We picked up on the work we had started before the summer break and continued the process of developing ideas for the simulator and individual suggestions for master’s theses. (For a detailed plan of our work, see Appendix A.)

During the summer the University had made a decision to allocate one of its rooms to innovation, and they put this room at our disposal for the duration of the project. The innovation lab contained working areas for all of the group members, presentation and technical equipment, as well as plenty of wall space suitable for our creative processes.

A workshop was arranged in order to focus on the process aspects of the groups’ work. It was important to reach a decision concerning the roles of the different members of the project, as well as spending time on deciding on rules for intra-group interaction. In order to facilitate this work, our focus was to compose a group statement that included this information as well as decision-making protocols, visions and future goals.

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3 An illustration of the importance of the walls will be given in a later section of this document.
In the process of developing ideas for the content of the simulator, the group made a list of different criteria regarding the development of the simulator. Our goal was to attempt to develop a product within an area that would not be considered controversial in the sense that psychological theory would be used to take advantage of or manipulate specific groups. In addition, the developed product needed to be firmly grounded in academic theory. The project had to be manageable within the scope of the project period and within the existing knowledge in the group and/or the knowledge within the reach of the group for instance through the network of personal contacts of each group member. It had to be manageable regarding technology as well, and the use of technology should be looked upon as valuable in itself. There also had to exist a demand in the marketplace for the simulator and a potential for profit. Additionally, it was important for the group to carry out a project we believed in and one on a topic we considered fun. We wanted the project to be meaningful both for each of the group’s members but also serve a greater purpose. The reason for this list was to ensure that we at all times focused on what we regarded as important and that we continuously included these reflections in our work.

As already mentioned, the group had taken on a broad perspective and aimed widely in their work on developing ideas for the simulator. To this end the group had several brainstorming sessions where lists of potential ideas for the simulator were the end product. From this list, that at one point contained over twenty ideas, the group considered each idea thoroughly in order to eliminate the ones that were of least interest. This elimination process resulted in a list of eight ideas. At one point it was decided that the group should split into three teams and rotate the different ideas between them. Inspired by parallel design (Nielsen, 1994), this was carried out to expand on the different ideas as effectively as possible, and also to avoid anyone having personal favourites. In order for the different teams to inform each other about the different findings and developments of ideas, the group had dedicated meetings where we all gathered and new material was presented, evaluated and elaborated on with pros and cons. The different ideas were also evaluated against the list of criteria already mentioned. The goal of this process was to eliminate ideas or try to incorporate parts of the eliminated ideas into new ones. The core activity was consolidating ideas with the ultimate aim of ending up with three main ideas. These three would represent an aggregate of the best of the whole pool.
At the same time as the group developed the different ideas they continuously consulted research literature and different references and Internet sites in order to find out what had already been done in the different areas and on the different topics. This included a presentation of a similar project conducted by a research group in the U.S. (Aldrich, 2004).

In parallel with the work detailed above, each group member worked on his or her individual project description that was to be handed in mid-September. The members presented their outlines to each other in order to coordinate their writings with the group.

Early in September, three weeks into the semester, the group was reduced from six to five members as one of the students decided to quit the project. It was then up to the rest of the group to make a decision on which one of the three remaining ideas to move forward with. A panel of in-house experts was invited to give us input on the remaining ideas and comment on which of the three was the one with the greatest potential. The panel’s evaluation coincided with the evaluations of the group itself, and when choosing which of the three ideas to develop, the decision fell unanimously on the negotiation simulator. Developing a negotiation simulator was from now on the main focus of the group’s work.

Exploring the idea

Different topics and questions emerged as the group started working on the negotiation idea. Important questions were how many users should be able to play the game simultaneously—one or many users at the same time, whether the user(s) should be alone in the game or interact with some of the other users in order to achieve a common goal or not, or just play against the machine, or perhaps both? The group discussed the possibility of making different versions of the negotiation game implementing different alternatives to the issues that were discussed. Additionally the question regarding whether we should have one or more moderators and the degree of their involvement, was addressed. We also focused on what the main learning outcome of the simulator training would be, and brainstormed ideas regarding the best technical solutions. As well as that, we decided to implement some of the most promising features of one of the other ideas that we had already eliminated. Our aim was to implement as much psychological theory as possible both in the simulator itself and in the training course package.
The group then repeated the successful method of dividing itself into smaller groups in order to work on different topics regarding simulation and negotiation in parallel. One group focused on negotiation and explored the literature in order to gain an overview of the main theories and research. The other group researched the topic of simulation and learning effects of using simulators in training. An extensive literature search was needed in order to gather information about these topics. Evaluating these searches as well as identifying literature of particular interest was focused on (Aldrich, 2005; Allen, 2003; Balachandra, Bordone, Menkel-Meadow, Ringstrom, & Sarath, 2005; Max H. Bazerman, 2006; Cohen, 2002; Dreyfus & Dreyfus, 1986; Florea et al., 2003; Gentner, Loewenstein, & Thompson, 2003; Gillespie, Thompson, Loewenstein, & Gentner, 1999; Hunsaker, Whitney, & Hunsaker, 1983; Poole, 2004; Quinn, 2005; Reeves, Wellman, & Grososf, 2002; Reilly, 2005; Schweitzer & DeChurch, 2001; Stark, Fam, Waller, & Tian, 2005; Suchman, 1987; Vecchi, Hasselt, & Romano, 2005; Watkins, 1999). Several books were also summarised in presentations, in an attempt to discover the overarching themes and directions within negotiation (M. H. Bazerman & Neale, 1992; Fisher & Ury, 1981; Karass, 1970; Kochan & Lipsky, 2003; Kremenyuk, 2002; Marsh, 1984; Plous, 1993; Pruitt, 1981; Raiffa, 1982, 2002; Rubin & Brown, 1975; Steele, Murphy, & Russill, 1989; L. L. Thompson, 2001; Von Neumann & Morgenstern, 1953; Walton & McKersie, 1991). The results of these searches were presented to the group with the aim of keeping all the members fully apprised of each other’s findings. Several presentations were held by the group members, for instance on the topic of the McGill Negotiation Simulator used at the University in Canadian by the same name (Ross, Pollman, Perry, Welty, & Jones, 2001; Roston, 1994) and articles or books considered to be of particular interest to the group at the stage we were; trying to introduce ourselves quickly to the central themes in negotiation research (Boven & Thompson, 2003; Brett & Gelfand, 2004; Loewenstein & Thompson, 2000; McAndrew & Phillips, 2005; Nadler, Thompson, & Boven, 2003; Poitras & Bowen, 2002; Shapiro, 2002; L. Thompson, 1990a, 1990b).

Literature searches, reading and updating on articles, books and journals were part of ongoing processes that involved all members of the group.

As well as familiarising ourselves with the literature we needed to get to know the future users of the simulator. In accordance with the User Centred Design paradigm, we carried out a workshop in order to define our typical user. Our target user was defined as male/female and of 25 to 45 years of age. Nationality would be primarily Norwegian and he/she would speak both Norwegian and English, having completed high school. His/her field of
occupation would be as a professional, primarily but not exclusively within the field of advertising, consulting, telecoms, accounting, law, sales, media, IT, or human relations. The relevant segments would be management, employees and even whole departments. Regarding experience with the domain of negotiation, the user would not need to have any academic background and could have varying practical experience. In the area of technological skills the user would need some basic computer skills and need to be familiar with the Windows and/or Macintosh interface. S/he would not need experience with games.

When it comes to the motivation for wanting to use the simulator, our main group of users would most likely participate in order to learn skills they consider to be useful and important. Some participants, however, would be there because their employers would send them. The group had a discussion regarding how to best balance the pure entertainment effect of playing a game with the seriousness of a scientifically developed training device, and consequently how to best ensure an optimal learning effect combining these two. All these needed to be continuously taken into consideration at all times during the development process. Additionally the group decided not to develop a game that necessitated a heavy manual in order for the user to master it—we wanted a game the user could simply sit down and start playing with minimal instruction.

This focus on the user made it necessary for us to consider the marketplace. We considered whether our end-user was in a position were he/she would be interested in, and willing to pay for, a product such as ours. We investigated whether similar products in the area of simulators already existed and found very few that could even be said to resemble what we were developing. At the same time we looked into different training alternatives in the area of negotiation. Here we found that there were many different alternatives, although most of them seemed to be different versions of the same idea. In most cases lecturing about the topic of negotiation was interspersed with group exercises and role-playing activities. We considered our product to be different enough from these that there could be a market for it.

*The contours of a simulator emerge*

At the end of September the group started planning and making the necessary preparations in order to conduct interviews with professional negotiators. This was done in order to gain access to practical information that would complement the theoretical information the group
already had. The interviews were carried out over a period of six weeks. This included identifying potential participants, recruiting them, developing an interview guide, and analysing the results.\(^4\)

The group had to consider whether the design of the project would call for an application to the ethical committee REK, in order to get an approval of our research. However, we found this not to be necessary. The primary reasons for this were that the research would not target any vulnerable groups, and would not entail misleading or manipulating the participants. The decision was made in close cooperation with academic advisors. This process lead us to be more aware of this topic area and spend a substantial amount of time developing detailed consent forms as well as briefing and debriefing the participants thoroughly.

In addition to looking at literature on the topic of negotiation the group decided it was important to immerse ourselves in gaming. To this end the group obtained an X-box game console, taking time to familiarise ourselves with the different types of game categories available. We got a hold of the simulator game developed by Aldrich and his colleagues based on their research mentioned earlier. It was our goal that the whole group would familiarize itself with this game. As well as this we had a workshop with an avid Internet gamer in order to gain insight into massive multiplayer online role-playing games (MMORPGs) that are gaining ground globally.

Over a period of a few days the members had presentations for each other of the different individual literature reviews\(^5\) and at the same time did a recap of the knowledge the group had on negotiation theory and research, gaming-, simulation- and learning theory.

January 2007 started off with a period of design and paper prototyping based on the findings of the interviews conducted in November 2006, in accordance with User Centred Design (Beyer & Holtzblatt, 1998; Faulkner, 2000; Nielsen, 1994). The group worked on designing

\(^4\) For details see the specific section later on in this document

\(^5\) These literature reviews are a compulsory activity in the master’s degree, and must be approved in order to successfully complete the degree. It is expected that the students hand in approximately 40 pages detailing the literature that makes up the theoretical background for their theses. These documents are considered separate from the thesis and are therefore not included in this document. The literature reviews were to be handed in at the beginning of December.
low-tech parts of the simulator and simultaneously wrote scenarios in order to be able to test the usability of some main ideas. The result of this work was a cardboard mock-up. Using this mock-up, the group conducted a series of Usability tests that provided useful feedback. At the same time, a second period of data collection was prepared. This was an observational inquiry into how professionals actually negotiate. In the same way as our earlier experimental enquiries this entailed designing the experiment from scratch, with participant recruitment, script development and data analysis.⁶

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⁶ Both of these experiments are detailed in specific sections later on in this document.
Development through User Centred Design

Two iterations of development

A premise for this project was that the simulator should be developed through User Centred Design methods. We based our analysis and design process on *Human-centered design processes for interactive systems* (ISO-13407, 1999), which describes four phases in an iterative and incremental development process (fig. 1): Understand and specify the context of use, specify the user and organizational requirements, produce design solutions, and finally evaluate designs against requirements. The four phases are repeated in an iterative process until the result of the evaluation phase is that the design fulfils the requirements.

![Fig. 1: The Human-centered design process for interactive systems. Reproduced from ISO-13407 (1999)](image)

Within this framework, we based our activities on general methods from Usability Engineering (Faulkner, 2000; Nielsen, 1994) and, to a greater extent, on specific techniques from Contextual Design (Beyer & Holtzblatt, 1998). Contextual Design (CD) is an approach to User Centred Design, developed and refined over many years as a response to difficulties faced when working with design teams. Our reason for choosing CD was mainly that it offers specific techniques for analysing user data for the purpose of design, as well as an approach to the entire design process. We wanted to gather data about how people negotiate and base our design on this, so CD was a natural choice. In such an analysis, where the goal is well-grounded ideas for design, and not statistical significance or external validity, CD is better suited than more conventional research methods. Furthermore, CD is developed with teamwork in mind, and the results of its analysis and design methods are both produced and presented in ways that supports collaboration—its artefacts are mostly large and tangible. We also considered other methods, like Cognitive Work Analysis (Vicente, 1999), but we saw CD better suited for an innovative group effort like ours.
We considered that a project of this size could not be completed within one year, but we planned to get through at least two iterations. In this section, each of these two iterations is described. Within each of the iterations the activities of the four main phases are outlined, as well as descriptions of the different techniques we used.

First iteration

Understand and specify the context of use

We discussed three possible ways of getting data from negotiations. In CD, data are gathered from the context of use through the technique Contextual Inquiry, where members from the design team observe the relevant tasks being done and ask questions to understand what the involved people do and why. In our case, this would imply that we had to get access to real life negotiations, or we could also set up our own constructed sessions with experienced negotiators as participants. The third possibility was to conduct more conventional interviews where we got negotiators to tell us about their experiences.

At this point, we concluded that it would be better for us to get access to negotiators for interviews than asking to observe them. Also, conventional interviews could give us a broader understanding of the topic, and a chance to compare the views of real life negotiators with the theories we have found through literature search. We could instead consider doing observations in the next iteration.

Getting participants. The process of getting participants for the interview started with a brainstorming session with the purpose of mapping potential negotiators. This mapping was done without any form of restriction such as availability, status or such of the participants, and the list contained names of lawyers, brokers, politicians, peace mediators, and representatives from both unions and employer organisations, some of whom were well known figures in Norway. The only requirement for getting on the preliminary list was that they had negotiations as an integrated part of their work. We composed a joint e-mail that we sent out to a group of the people on the list, made up of the professionals that we considered

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7 To clarify, the iterations mentioned here are full iterations around the cycle of The Human-centered design process for interactive systems (ISO-13407, 1999), not the design–test cycles mentioned in literature on Usability Engineering (Faulkner, 2000; Nielsen, 1994), which are a part of the Produce design solutions phase.
most attractive. The e-mail gave a brief description of the project we wanted them to participate in. Of the 35 professionals we e-mailed, 26 were willing to take part in our study. We got almost only positive feedback, and those who did not participate did not do so more as a result of other obligations than lack of interest.

*Preparing the interviews.* The interview was designed and conducted using several methods, such as Contextual Interview and Cognitive Interviews, along with suggestions from qualitative methods in general. We worked out some overall goals and lay down a plan for the structure of the interview to ensure that we touched upon all the different aspects of the predefined goals. This was a dynamic process were both the overall plan for the interview was embedded, but also more specific questions. The interview guide (see Appendix B) went through several rounds of testing and critical evaluation by the different group members. On the one hand we wanted the questions to be as broad as possible in order for the participant to freely express their thoughts on the topics without being tied to a specific context or without being lead by us. On the other hand the questions had to be specific to the degree that they gave us information that was not solely on a meta-level, but include details on topics we wanted to explore further. This is the reason we selected a method that included a semi-structured interview.

We prepared an interview guide that started with a section constructed with the purpose of “warming” up the participants, and to put them in the right state of mind for reflecting on their overall relationship to negotiations. Here we included questions on their background in terms of negotiation experience, their overall education, and what the participants found interesting and intriguing by negotiations, but we also wanted them to give us their definition of negotiations. Our reasoning behind asking them for their definition was to be able to find potential differences between the definitions provided by theory and the definitions provided by experience, and therefore have a more applied approach to negotiations. Through this we would also be better able to understand the interviewees’ background and point of view.

Contextual Inquiry inspired the next section of the interview guide. As we obviously would not be able to observe negotiations in an interview, we included a question instructing the participants to visualize and verbalize a newly experienced negotiation they had participated in, and to be as detailed and specific as possible. In the next step, the participants would “walk us through” the negotiation all over again, equally detailed and specific, but this time
with the perspective of another participant. This technique was influenced by the Cognitive Interview (Memon, 1999), with the intention of getting as close as possible to actual negotiation experiences. Our role as interviewers would be to ask questions on what they did and why, to get to details on how they negotiated, as we would have done in a Contextual Inquiry.

The next section of the interview guide focused on the participants’ own reflections on different areas of negotiations such as – in your opinion, does there exist a core in negotiations? Along with – are different strategies used deliberately? These questions were broad and non-specific in order to encourage them to think freely on these topics without facing the risk of anchoring the participants to any specific mindset.

The next questions in the guide encouraged the participant to continuously reflect on negotiations per se, exploring their thoughts and experience concerning group size/group composition and the use of mediators in a negotiation. The final section concerned whether or not negotiations can be taught, with questions such as - what makes a good negotiator? Are there in your opinion expert negotiators? Do you consider yourself an expert? These questions were included in order for us to get the participants to reflect on the questions as to whether or not it is possible, or to what extent it is fruitful to combine theory with practice.

We did one pilot interview in order to ensure the logical structure, and to get some feedback on questions that the participant had a hard time understanding. This input lead to some small adjustments to the original interview guide.

Conducting the interviews. The interviews were conducted “on site” at the interviewees’ work place, with two interviewers. The latter was done to ensure a natural flow, to minimize the risk for interviewer errors, and to be better suited to ask follow-up questions. These two interviewers alternated between asking the questions so that when there was a change in interviewer there was also a change in the topic or focus in the interview. The interviews lasted for about one hour, and the few times the interview exceeded this length, we asked the participants if it was ok for us to finish the interview. Every interview was, for several reasons, recorded after getting the participants consent. First, we wanted to be able to go back and listen to the tapes in order to for us to clear up any potentially misunderstandings. Second, taping gave us the ability to fully direct our attention toward the participant without being
preoccupied with taking notes. Finally, recording ensured us a degree of detail richness we otherwise would not get by simply taking notes.

At the start of the interview the participants were given general instructions where we repeated the reason we wanted to interview them. They were told that we already had a theoretical approach to the study of negotiation, and that we wanted a more applied approach. We then tried to put the interview in a broader context in order to make them understand that we were interested in their input in light of their practical experiences with negotiations. We told them we were not interested in testing their knowledge or comparing their knowledge to any of the other interviewees’. This was done to put the interviewees at ease and lessen any possible evaluation anxiety.

According to proper conduct regarding ethical issues, we then informed the participant that they were free to terminate the interview at any point without any explanation, and that we, if they allowed us, would tape the interview. Finally we asked them to sign a document to this effect.

This way of conducting an interview demanded that the participants were able to verbalize different settings and to walk us through a negotiation setting they had been in recently. Our participants displayed this ability in various degrees—some had little to say, while some talked mostly in general terms about what they usually did in negotiations. In addition, this way of conducting an interview required, to a great extent, that the participant was conscious about his or her own negotiation skills, and further that they felt secure enough to reveal their thoughts on the various topics to us. Many of our participants were able to do just that, to be specific, and they were eager to share their experiences with us.

After the interview was completed we debriefed the participants, told those who were interested more thoroughly about the project, and opened up for any questions they might have. Finally, we asked the participant if it was ok for us to contact them again for follow up questions. This gave us the opportunity to maintain the good relationship we had established, and have access to participants at a later occasion. We also followed up the participants through e-mail, thanking for their participation.
**Analysing data.** After conducting all interviews, data was analysed in order to use it in the design process. CD proposes two conjunct techniques for this: Interpretation Sessions and Consolidation Sessions. In the former, each interview is analysed individually and summarised in several models and a list of key statements. Through Consolidation Sessions, all interviews are compared, leading to models expressing commonalities across interviews and an Affinity Diagram where all key statements from all interviews are grouped and structured hierarchically to give a comprehensible picture of the data.

In the spirit of CD—the design team using the method is encouraged to adapt the techniques as needed in its design process. We decided to use two of CD’s models to analyse our interviews, namely the Sequence Model—in our case used to describe the steps taken through a negotiation, and the Culture Model—describing the actors involved and their influences and attitudes towards each other.

We started out with an Interpretation Session of the first of 26 interviews with the entire group present, as is recommended in CD. One group member talked us through the interview, two asked questions, one wrote down key statements, and one drew models. This first session with the whole group was an important way of getting everyone familiar with this method of working, but we could see that it would not be an efficient way of analysing all of our interviews. On the other hand, an important effect of using this technique is to let all team members get an insight into and a common interpretation of all interviews. Our solution to this was to do Interpretation Sessions in the dyads that had conducted each interview, and then present the models and the key statements to the entire group.

After writing our individual Literature Reviews, we started up the teamwork again with Consolidation Sessions in the beginning of December. Our first task was to organise all key statements from the Interpretation Sessions on our walls in an Affinity Diagram.
We printed out all the key statements and glued them onto post-its, and then tried to find those that said something similar about negotiation and put them up on the wall together (fig. 2). As groups of statements were formed, we wrote green post-its that summarised each group in one sentence (fig. 3). We then organised these groups again under orange post-its with questions that the green post-its answered (fig. 4). Finally, we organised groups of orange post-its under blue post-its, which named the theme of the groups (fig. 5). As an example, the blue post-it named “Trust” spanned the orange post-its “What part does trust play in negotiations?”, “How to create trust?”, and “[What are the] preconditions for creating trust?”. Under the second one of these were the following green post-its: “Show that you understand your opponent”, “Show that you are willing to find a solution”, “You can expose yourself to build trust”, “Clarity can promote trust”, and “It is not always possible to create trust”. And under these were the original key statements from the interviews that led us to create this hierarchy.

Our initial goal was to do this rather quickly—CD recommends doing it in one or two days because this process can be taxing on the group when drawn out over a longer period of time.
But with more than 1500 key statements, many of these rather general or fuzzy, and only five people to organise them, the process lasted for eight working days. This was an intense process that gave us a good foundation for the design process as well as an intimate understanding of the interviews (fig. 6).

The next three days were spent on consolidating the Sequence and Culture Models. Similarities in the accounts of negotiations given by the different participants in the interviews resulted in a consolidated Sequence Model (fig. 7). The Culture Models were a bit harder, as the different negotiations involved very different configurations of people and groups, but we managed to condense and combine these into one Cultural Model (fig. 8).

**Specify the user and organisational requirements**

At this point we had the Affinity Diagram on our walls, as a picture of what our interviews had revealed about negotiation, the Sequence Model describing the general phases and steps in negotiations, and the Cultural Model showing the influences and attitudes that may exist between persons and groups involved in negotiations. Together these formed a description of the main aspects of the field we were going to develop a simulation of, and were therefore a set of requirements for our simulator. We also had the user profile created earlier.

In addition, each team member made a list of requirements for his or her area of focus, and this resulted in a tentative list of requirements to be explicated in the further process.

**Produce design solutions**

*Design.* This phase of the process involved creatively producing design solutions as a response to the data we had gathered. We continued to use the methods proposed in Contextual Design, in which the next step is to create a common vision for how our simulator and training course could be. In CD, a “vision” is a drawing of the product to be designed and
the way it would be used. The focus is not on details, and the overall picture is drawn in
simple sketches. It is important in CD not to design a product only, but to design a new way
of working, and that should be reflected in the vision. In our case, we were not just designing
a simulator, but a new way of learning to negotiate, and our vision should include the design
of the simulator and the entire training course.

We started by “walking the wall” (Beyer & Holtzblatt, 1998, p. 275), i.e. going through the
hierarchy of the Affinity Diagram to remind ourselves of what we had found. As we got ideas
or questions from the data, we wrote them on post-its and put them next to the data that had
triggered them. We did the same with the Sequence and Culture Models.

Then we went through the ideas and wrote a list of the most central ones. With these ideas as
starting points we drew different visions of the simulator and training course. We
brainstormed and drew sketches on a board. Some visions incorporated several ideas, while
others were based on only one. When all ideas had been drawn out, we went through them
again, writing positive and negative aspects for each of our 27 different visions.

Our next task was to incorporate these into a common vision. In fact, it was decided to make
two visions—one for the training course and one for the interaction with the simulator. As
suggested by CD, we tried to combine conflicting visions by using the positive aspects from
both instead of picking one vision over the other. For example, in one vision a training course
included several different negotiation exercises based on the same scenario, and would then
allow us to use this scenario as a theme for the day, where the participants could really get
into their roles of for instance being employees of an imaginary firm, wearing t-shirts with
the firm’s logo etc. On the other hand, we had a vision that made a point out of having
different scenarios for each negotiation exercise, to give us more flexibility in tailoring
scenarios to the specific learning outcomes of each exercise. Instead of choosing one of these,
our common vision consisted of independent negotiation exercises, to give us the flexibility
of the second vision, while at the same time allowing us to make a set of exercises that fit
together as a theme course as in the first vision.

The next step in Contextual Design is to draw out storyboards based on the vision. A
storyboard is in essence a sequence of drawings visualising one possible trajectory through
the system being designed. We wanted to get through at least two iterations before the end of
the project period, and at this point in the project we knew we were running short on time. Therefore, we decided to do only one storyboard on the simulator to elaborate on our vision and generate more specifics for a Usability test. We also chose to focus on the simulator and not the entire training course to limit our focus in the first test. We spent the next two days on this, with an imagined case of an employee negotiating a contract with his potential new boss. We drew the interaction between a user and the simulator as it could play out in this scenario like a cartoon, where each frame represented an action from the user or a response from the simulator. At each frame we asked ourselves what actions the users might take, how to make the interaction natural, and how the simulator would respond. We tried to incorporate several of the ideas from our common vision, and ran into issues that we had not thought of in the visioning process and also came up with solutions to a lot of them.

After only one storyboard session we had a sketch of a user interface for the simulator and a much clearer idea of how the interaction could work, and we decided to make this the object of a usability test.

Usability test. Since our first prototype was more concerned with the user interface than with the simulated negotiation, we reasoned that it was not important for the participants to have any formal negotiation experience, and we recruited five master students for a usability test. This was considered a large enough sample to discover usability problems and to get an impression of whether the participants understood the general concept. Again our aim was to generate inputs to the design process, not to design an experiment with validity or statistical significance in mind.

We spent the day before the test making a cardboard prototype of the simulator interface as we saw it at this point. The prototype consisted of a main screen showing the opponent on the other side of a table, and a smaller screen with controls and buttons for interacting with the simulator. The screens were going to be touch screens, so the user would interact by pushing the controls directly, as opposed to using for instance a mouse, a keyboard, or a stylus.

The prototype was based on a scenario similar to the one in the storyboard, where the user was to negotiate a contract with a potential employer. We wrote a script for the test (see Appendix C), and in order to limit the number of sentences and interface parts we had to
prepare, we chose a set sequence of events through the negotiation. We printed out the sentences of the possible dialog and other interface parts, and glued them onto cards.

As the prototype was made out of paper, one of the team members would have to act as the “computer” and manipulate the prototype in response to the participants’ actions—a technique known as “Wizard of Oz” (Faulkner, 2000). The participants would be instructed to treat the mock-up in front of them as an actual computer screen.

Before the test, we conducted a pilot test with one of our team members, who had had limited contact with the mock-up, as the test subject, both to test the script and the mock-up and give the test leader and the one acting as the computer a chance to practice.

We used a very simple test setup. The participants were presented with the prototype in a room with a table and a video camera, and in the adjacent room the team members not conducting the test observed the events on a TV screen while taking notes of the problems discovered and other interesting incidents. The tests were recorded so that we could look at the tests later, if needed.

After an introduction, each participant was shown the screens and asked to tell us what they thought of the screens and what they believed they could do with them. They were then asked to use them as they would have had it been a finished computer-based simulator (fig. 9). Most participants hesitated in the beginning, but after a little while, they pressed the buttons on the control screen and waited with interest while the “computer” laid out the interface parts representing the response of the simulator. In accordance with User Centred Design methods, they were continuously asked to think out loud and explain their actions and reasoning as well as they could. At each point in the dialog they would tell us what they wanted to do, complete that action, or if they sketched out an action that had not been completed in the mock-up, the test leader sitting next to them would direct them to the choices that had been prepared.

Fig. 9: The Usability test
The test gave us the impression that our design worked rather well—the participants quickly understood what was going on and how they could manipulate the interface, except for some confusion with minor parts of the interface. Also, it seemed that they got an experience of having a conversation with the virtual opponent in the prototype, but they reported that the conversation was too much to the point—they wanted to involve more small talk with the opponent. This is a potential by-product of us not having had the opportunity to develop all the alternative statements the participants could choose.

**Evaluate designs against requirements**

This first iteration through the design process was ended on February 2., 2007 with an evaluation of our design against the requirements. We first went through the requirements we had written down for our different focus areas. For most of these we were either on track or at a place in the development where the requirement was not relevant, but we saw that we sooner or later would have to specify what the learning outcomes for the simulator and training course should be. We had implicit learning outcomes, but needed to get more specific and concrete in order to have a set of intended outcomes to evaluate against.

We also went through the Affinity Diagram, Sequence Model and Cultural Model, to see if there were central issues we had overlooked this far. We made a list of some topics that we would have to include when continuing the design in the second iteration.

This marked the end of the first iteration, with the conclusions from the above evaluation, the results from the usability test, and the current design of the simulator as outputs to the next iteration.

**Second iteration**

In the second iteration, we worked with three issues in parallel; preparations for an inquiry to observe negotiation in action, further design based on the inputs from iteration 1, and investigations on the business aspects of our project.

**Understand and specify the context of use**

In the second iteration we wanted to get access to, or arrange, a situation that would allow us to observe how professionals negotiate in practice. Through the interview data in the first iteration we had a substantial amount of information on how they represented their own
negotiation skills in an interview, making it interesting for us to observe this behaviour as well. Also, the interviews had given us an overall picture and a framework for the simulator and training course, and now we wanted to fill this with more detailed data to base our simulation on.

Through planning this observation as part of an inquiry that also included a dialogue with the professionals about their behaviour we hoped to gain an even deeper insight into negotiation. Therefore the goal of the experiment became to design a method that would allow us to observe the professionals while they negotiated, and then follow that up with a Contextual Inquiry session.

*Getting participants.* It became clear early on in this process that in order to get as much information from the participants as possible the inquiry would take quite some time to conduct. Because of this the group decided to aim to conduct at least two sessions, each including two participants and lasting for about three hours. This meant finding professional participants that would put themselves at our disposal for three hours, allow us to film them as well as observe them while they negotiated something that we set up, and then let us interview them separately while taking them through the video of their negotiation. In the earlier interviews we had asked the participants if they would consider helping us in the future, and almost all of them had eagerly agreed. Three weeks before the inquiry we sent out questions to those that had agreed asking them whether they would be able to contribute their time, being specific about the time it took and what dates were scheduled. The immediate response was good in that two professionals volunteered to participate, which meant that we had one session covered. Two other professionals replied that they were unavailable but could find someone with experience similar to their own from their own organisation that could take their place. This meant that we had reached the goal of at least two sessions.

Of the four professionals we recruited two were women and two were men. Based on their schedules each session ended up pairing one male participant with one female participant. They were all professionals in the field of negotiation, spending a majority of their workday honing their skills in the area, within law or unions.

*Preparing the inquiry.* Having a place in which to conduct this experiment was important. Even though the office at the University of Oslo could have been used, we approached
NetLife Research; a usability company we knew had a lab in which this type of activity could more easily be carried out. They were kind enough to let us use their lab and offices for the entire experiment, which meant that we had the use of a lab in which the participants could negotiate while being videotaped, an adjoining room where the group could observe the negotiation on a TV, and two areas in which the participants could be briefed before each negotiation session (see script in Appendix D). In addition, the lab and offices are centrally located, making them easy for the participants to find.

Keeping in mind that the central focus of the inquiry was to observe negotiation behaviour it was important to the group to identify a subject matter that would bias or skew the results as little as possible. In order to find this subject matter for them to negotiate about we conducted searches in published literature. The goal was to identify potential negotiation scenarios that would allow the participants to feel that they were negotiating something meaningful while at the same time keeping the subject matter within an area that was equally unusual for them—we wanted to attempt to create a level playing field for the participants. Through literature searches conducted earlier in the project, as well as new ones, we were able to find 3–4 different articles that included clear descriptions of the scenarios that had been used as well as information about how they had been introduced and what tools the participants had been given (Gelfand et al., 2002; L. Thompson, 1990a, 1990b; L. Thompson & Hastie, 1990). The tools that were most useful to us in order to replicate the use of a scenario was the pay-off schedule; the tables the participants were given to illustrate their most desirable outcomes. In the source literature the scenarios had been used for differing purposes, purposes that left the scenarios secondary to what was being investigated. This gave us reason to believe that the scenarios could be used without impacting the experiment, giving us an experimental setting where we could simply observe the negotiation itself.

From the group of scenarios we had found, we considered two of them to be best suited for the experiment. Due to the fact that all of the scenarios were taken from source literature that was in English and had been used in the U.S. it was important to have situations that could most easily be transferred to Norway. For example some of the scenarios we found had issues that we considered would have been too hard for the participants to relate to, focusing on American commodities brokering, while another introduced the participants to aliens on a different planet (Boven & Thompson, 2003; Mannix & Neale, 1993). Therefore, based on our understanding of the scenarios we attempted to select the scenarios we felt the participants
would understand most easily. The scenario we decided to use in the first exercise in order to familiarise the participants with the method and each other was a negotiation of an employment contract between an employer and a potential employee. This scenario gave the participants five categories to negotiate. The second and main negotiation that would form the basis for the contextual interview, was based on the purchase of a car, and included the car-salesman and the potential buyer. In this scenario there were eight categories to negotiate. The reason for choosing two scenarios was that one of them would be a scenario the participants could practice with, something which would make it possible to increase the quality of the data collected in the contextual interview following the second negotiation.

Having selected the scenarios we translated the pay-off schedules and wrote the scripts that we were to follow (see Appendix D). After we had finished the scripts and the pay-off schedules we piloted the observation and the contextual interview. The pilot lead to some minor changes to the scripts, but more importantly served as a rehearsal for the group, helping us become more prepared for the sessions with the professional participants.

*Conducting the inquiry.* On the two evenings when the sessions were held, a dedicated group member guided each participant through the evening. In this way we made the participants feel a little more secure, something which was considered important in case they were inexperienced with an experimental setting or with being filmed. The participants were introduced to the group and each other first and then briefed by “their” group member. They were shown the rooms they would be in for the brief/debrief and the negotiations, as well as seeing the observation room from which the group would observe them negotiating. This was done in order to put them at ease with the situation. In addition, the participants were given a standard consent form to sign, detailing their participation as well as their right to terminate the experiment at any time and without giving any explanation. In both negotiations the participants were given time limits in order to motivate them to reach an agreement. After the first negotiation, which the entire group observed from the adjoining room, the participants were debriefed by “their” group member, and again briefed for the next negotiation. When the second negotiation was finished, the participants were taken through the film of that negotiation separately, each with “their” person and one other group member. In this way we were able to carry out the contextual interview successfully, making sure that the participants both felt debriefed and gave us an insight into their motivations and thoughts throughout the negotiation. Before the participants left we gave them a small gift as a thank-you for participating as well as the source articles for the scenarios, so that they would be able to see
Simulating Skills 31

examples of how other research had been conducted. The day after the experiment the participants were sent a follow-up e-mail repeating our thanks and making sure that they knew they could ask us about the experiment or their participation if they should have questions at a later date.

Both the participants and the group seemed to enjoy the evening, as well as considering it a useful and educational experience. Some of the participants had situations were they were surprised by their own or their opponent’s behaviour, and this was an area we had to ensure that they felt debriefed on. However, the main impression was that they enjoyed themselves, forgetting the cameras within minutes of the negotiations starting. It was clear that some of the participants felt more competitive than others, and most of them were also concerned with the self-development they could gain from the experience.

The participants seemed to embrace their characters, easily becoming the car-salesman or potential employee. It also seemed as though each participant may have incorporated aspects of their beliefs about the role they had into their behaviour, and the group had a discussion when the observations were done as to whether that affected their behaviour in the negotiation. If the goal in this observation had been the reliability and validity of the experimental results we could have repeated the experiment and this time run the contextual interview on several of the scenarios, capturing the participants’ experiences across situations were they had differing roles.

Analysing data. In comparison with the earlier interviews, the data collected through this inquiry was much more concrete, just as we had anticipated, and we got more detailed and clear data about what actually happens in a negotiation situation. Both the data collected through the Contextual Inquiries as well as the wealth of impressions and knowledge the group gained through the observations will be put to use in the further development of the negotiation simulator.

As in the first iteration, we did Interpretation Sessions to analyse the data. First, the team members that had conducted the different Contextual Inquiries went through them, extracting key statements and drawing Sequence and Cultural Models. These were then presented to the entire team, before we went on combining them through Consolidation Sessions. The statements from all four participants were recorded on post-its and added to the existing
Affinity Diagram. At a later stage of development this Affinity Diagram will be re-evaluated using these last results, refining the diagram yet again and confirming its existence as a living, changing tool for the product development.

**Produce design solutions**

Parallel with the preparations for the inquiry, some team members continued on the design of the simulator with the inputs from the first iteration. As mentioned, the first iteration had ended with an Affinity Diagram, two models, a vision, a storyboard based on this vision, a prototype, and inputs from a usability test, and in the evaluation we had written down some issues that we wanted to go deeper into in this second iteration. We started a new storyboard to investigate these issues as well as test some new ideas based on the results from the usability test.

In short, we worked with the storyboard just as we had done in the first iteration, but now we wanted to look at a slightly more complicated scenario, one that involved more issues than last time, so the process took a lot more time and we had longer discussions about each issue. We also felt that we generated more questions than we solved, but through this process we pinpointed a lot of challenges with our design that we did not see when we drew the visions. Some of these challenges were simply choices we had to make, while others were problems with our design that needed to be solved for our simulator to work. At this point in the project we recorded these issues in order to discuss them with the rest of the team later.

**Wrap up of the second iteration**

The second iteration was not completed in the time we had available in our project period, and the rest of the process will be continued if and when the project acquires further funding.

The design part of our project ended with a vision and a prototype of a training simulator for learning to negotiate, grounded in theories on negotiations, interviews with negotiators, and observations of negotiation in practice, and tested on potential users. This also includes a vision of a complete training course based on this simulator. Furthermore, the Affinity Diagram, the Sequence Model, and the Cultural Model will be an important foundation for further development of both the simulator and the training course.
Final thoughts

After having worked with this project over the course of two semesters it is clear to us that our expectations of what the year would include were somewhat correct. However, it would never have been possible for us to fathom the enormity of what we have been able to accomplish, both in our user-centred design process and as a group. This method has allowed us to gather and analyse data from our area of interest in a way that extracts information that is well grounded and rich in detail. This has provided us with an excellent starting point for the creative processes and a solid foundation for development of the product. In addition, the incremental approach has allowed us to immediately incorporate feedback from the user into the design process.

As a group, we have also experienced development. As individuals none of us could have foreseen how much we would mature as a group and perhaps as importantly how much we would learn as individuals. Working as intensively as we have done cannot be compared to anything any of us have done earlier, even in full-time jobs. This has demanded of us a greater insight into our own behaviour and ourselves than anything else could have, and through this we have grown.

We have been able to take the product development far enough to see the contours of a proper product, one an end-user could sincerely benefit from. The feedback we have gotten from the end-users we have been in contact with has been more positive that we could ever have hoped for, confirming our belief in the need for the product, and the product itself. Based on this it is our genuine hope that this work can continue.
References


## Appendix A

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### Task 16-18

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Appendix B

*Intervjuguide til bruk ved samtaler med Forhandlingsfolk*

**Intro:**
Takk for at du har tatt deg tid til en prat med oss. Som studenter har vi kunnskap om forhandling gjennom det fagbøker kan formidle. Samtidig oppleves det intuitivt at forhandling er en kunst som beherskes på sitt beste ved/gjennom å samle seg erfaring. Vi er i gang med et hovedoppgaveprosjekt der vi skal skive om forhandling, og vi ønsker med dette å få førstehånds (ekspertise)kunnskap og erfaring med hva nettopp du opplever å være essensen i forhandling. (det kan tenkes at noen av spørsmålene virker som om de gjentas, men dette er for å sikre at vi dekker alt vi kan).

Dataene vi samler inn i dette intervjuet vil bli anonymisert, de vil bli oppbevart etter gjeldende forskrifter sikkert, og de vil ikke brukes senere til andre formål i andre sammenhenger.

Er du komfortabel med at vi bruker båndopptager under intervjuet? Dette er for at vi bedre skal være i stand til å dokumentere gangen i samtalen og alt som blir sagt. Opptakene vil bli destruert før slutten av prosjektet vårt (dvs. mai 2007). Dersom du ikke er komfortabel med båndopptaker er dette naturligvis helt i orden.

Du står i tillegg fritt til på et hvilket som helst tidspunkt, å trekke deg fra intervjuet uten å måtte oppgi noen grunn, og be om at båndopptageren stoppes og at dataene destrueres.

Før vi begynner kunne du tenke deg å signere på et informert samtykke der du bekrefter at du har blitt informert om hva som skal foregå, hvordan dataene vil bli behandlet, og at du er blitt fortalt at du på et hvilket som helst tidspunkt kan velge å trekke deg fra intervjuet, eller be om at båndopptageren stanses og dataene destrueres?

1) I hvor mange år har forhandling vært en del av ditt arbeid?

2) Og primært innenfor hvilket felt?

3) Hva er, i følge deg, forhandling, kunne du definert det?
4) Hva liker du ved forhandling?

5) Tenk på en konkret forhandlingssituasjon du selv har vært i nylig:
   a. Beskriv hvordan du forberedte deg, hva du tenkte på i forkant av forhandlingen
   b. rapporter alt, fortell hele situasjonen, ta med så mange detaljer som mulig
   c. beskriv situasjonen fra et annet synspunkt enn ditt eget

6) Vil du si at det er mulig å snakke om en kjerne i forhandling? Finnes det ulike komponenter/en struktur/matrise?
   a. Hvis ja; hva tror du denne består av? Hvis du kunne beskrive kjernen i en hvilken som helst forhandlings-situasjon med kjerne begreper, hvilke ord/begreper ville disse være?
   b. Hvis nei; hvorfor ikke?

7) I hvor stor grad tar parter i en forhandling bevisst i bruk ulike strategier?
   a. Hvilke strategier har du erfart?
   b. Gjør det da forhandlingssituasjonen forutsigbar?
   c. Kan du beskrive et eksempel på dette?

8) Har du en fast forhandlingsstrategi?
   a. En plan eller et format eller noen rammer som du alltid bruker?
   b. Baserer du deg på noen former for teorier/metoder/strategier?

9) Innledningsvis sa vi at studenter kjenner forhandling gjennom teori og bøker de har lest, og i innledning til veldig mange av disse bøkene kommer man med utsagnet: ”Alle forhandler vi med hverandre hele tiden”? Er du enig i denne påstanden?
   a. Hvorfor?
   b. Hva er det da som skiller de ulike situasjonene fra hverandre?
      (Egeninteresser/fellesinteresser/økonomiske interesser/andre hensyn?
      Usikkerhet/kontroll/makt/historie (har man forhandlet sammen før/mot hverandre før, hvor godt kjenner man hverandre osv.).)
10) Hva er dine erfaringer med gruppesammensetning i forhold til:
   a. Gruppes størrelse
   b. Antall (forhandlings)parter
   c. Bruk av megler

11) Hva gjør (noen til) en god forhandler? (egenskaper/trekk/personlighet)

12) Anser du deg selv for å være en god forhandler? Ville du anse deg selv som en ekspert?
   a. Hvis ja; hvorfor, og hva vil du si at disse egenskapene består i?
   b. Hvis nei; hvorfor ikke, og hvordan vil du i så fall definere ekspertisekunnskap om forhandlig? Kjenner du noen andre du heller ville karakterisere på denne måten?

13) Kan man lære noen til å bli en god forhandler?

Da er vi ferdige for i dag. Hvordan synes du at det gikk? (Gi personen anledning til å snakke om opplevelsen, en aldri så liten debrief).

Kunne du tenke deg å stille til nytt intervju dersom det skulle bli aktuelt? Eller bli kontaktet på en annen måte om vi har flere spørsmål?

Og kunne du tenke deg å stille til et eventuelt eksperiment dersom det blir nødvendig? Vi tenker oss da å invitere deg til å være en aktør i en forhandlingssituasjon der vi vil observere i den grad det lar seg gjøre, en virkelighetsnær forhandlingssituasjon med andre forhandlere. Disse seansene vil bli videotapet. Dersom du kunne tenke deg å delta i en slik situasjon, kontakter vi deg med ytterligere informasjon når tidspunktet nærmer seg.

Tusen takk for hjelpen! Ha en fin dag!
Appendix C

*Script—brukertest 1. februar*

[Video er av, prototypen ligger ikke framme]

*Introduksjon*

Hei og velkommen! Takk for at du tar deg tid!

Dette er en del av masteroppgaven vår. Vi holder på å utvikle en simulator for å lære forhandling, og dette er første test av hvordan det kan bli. Vi baserer utviklingen på psykologiske prinsipper og er veldig opptatt av å ha brukere med i hele utviklingen. Akkurat nå er vi midt i utviklingen, så det du kommer til å få se er litt halvferdig og enkelt, men det er meningen fordi du kan komme med innspill som vi kan ta med videre i prosessen. Det betyr for din del at du må bruke en god porsjon fantasi og innlevelsesevne og prøve å se for deg hvordan dette vil være som en ferdig simulator.

Evaluering vil ta ca. en halv time.

Kjell-Morten sin rolle: fungerer som datamaskin, prøv å lat som om han ikke er der 😊


Vi kommer til å filme dette, slik at vi i gruppen kan gå tilbake og se senere. Vi vil ikke vise dette for noen utenfor gruppen, og noen av dem sitter ved siden av og observerer nå…

Så må du lese og signere denne consent-formen, for å bekrefte at dette er i orden for deg og at du har blitt informert om at du kan trekke deg når som helst.

[Video på]

*Intervju*

1. Hvilken erfaring har du med data-/tv-spill?
2. Hvis nei, du har aldri spilt noen sånne spill i det hele tatt?
3. Hvis ja, hva spiller du? Og hvor mye spiller du?
5. Hva forstå du med begrepet ”forhandling”?
6. Har du noen erfaring med forhandling? I så fall hva og hvor mye?
Oppgaver


Har du noen spørsmål før vi begynner?
Er du høyre- eller venstrehendt?

Førsteinntrykk

1. Hvis du ser for deg at dette er bildet på to dataskjermer, hva er ditt første inntrykk?
2. Disse skjermene skal være touch-screen (forklar hvis nødvendig), og tanken er at det som er uthevet på skissen kan trykkes på. Hva tror du du kan gjøre her? Hva tror du vil skje om du trykker på de forskjellige?
3. Vil du umiddelbart kunne tenke deg forskjellen på bruken av disse to skjermene?

Scenario

Da setter vi i gang:

[Klistre opp første snakkeboble: “Hva slags avtale ser du for deg?”]

Kan du si noe om hva som skjedde nå?
Se for deg at du nå skal begynne å forhandle. Hva ville du begynt med?

Kan du fortelle at du ønsker deg 450.000 i lønn gjennom simulatoren? (“Jeg ønsker meg 450.000,-”)
Hva tror du skjedde nå?


Kan du si at du kan jobbe 42 timers uke? (“Jeg kan jobbe 42 timers uke.”)

Hva er det det nå forhandles om/hva er det som er på bordet? (450 000 og 42 timer)

[Legg på “Da må du bringe noe mer til forhandlingen.”]


(Hoste knappen med lønn)

Hva skjedde nå?

(Du ønsker å binde setningene sammen…?)

(“Jeg kan gå med på 425.000,-, men jeg ønsker meg en ekstra ferieuke.”)

[Legg på: “Det er en avtale det høres ut som jeg kan leve med. Er vi da enige?”]

Kan du si at du godtar avtalen?

(Legg på: ”Jeg godtar denne avtalen”)

[Legg på: “Velkommen til oss”]

**Debrief**

Hva synes du?

Hva er inntrykkene dine av skissen?

Det som kommer til å skje nå er at vi skal teste noen flere som deg, så vil vi videreutvikle skisse og prøve å inkorporere dine innspill så godt vi kan…

Tusen takk for hjelpen!!
Appendix D

Eksperiment forhandlingssimulering uke 8, 2007

Jobbsøker/selger

Velkommen og takk for at du tar deg tid til å delta på dette, det betyr mye for oss!! Det som nå skal skje er at jeg skal gi deg informasjon om det vi skal gjøre i dag, ca de neste 3 timene. Du skal altså forhandle med NAVN som du nettopp møtte, i et forhandlingsromm der det er satt opp to kameraer som gjør at vi kan observere dere. Dere vil bli presentert to forskjellige forhandlingsscenarier, det første vil være litt kortere enn det andre. Temaene vil også være forskjellige, men strukturen vil kanskje likne hverandre. Scenariene vil bli presentert hver for seg av meg, først det ene, så etter at dere har forhandlet det ferdig, det andre og du vil få muligheten til å stille meg spørsmål om innholdet før du begynner forhandlingen. Gruppen og jeg kommer til å sitte i et annet rom og se på, og samtidig tar vi det opp slik at vi i etterkant kan se på det sammen med deg og snakke om hva som skjedde.

Høres dette greit ut, har du noen spørsmål med en gang?

Her er en samtykkeerklæring på dette…

Scenario 1:

Hensikten med dette eksperimentet er å se på forhandlingsatferd. Du kommer til å forhandle med en annen i en oppgave der det er fem punkter som må avklares. I dette scenariet er du en jobbsøker hos Firmax og skal i ansettelsesmøte hos din potensielle sjef, NAVN. Tenk på at det er denne rollen du har når du går inn i forhandlingen. Som den gode jobbsøker du er har du gjort deg noen tanker om dine prioriteringer og de vil du straks se i en payoff oversikt (interesse oversikt).

Payoff oversikten (interesse oversikt) viser alle de forskjellige måter avtalen kan nås på, i tillegg til å gi en oversikt over hvor mange poeng du får for å oppnå hvert alternative resultat. Målet ditt er å få så mange poeng som mulig, men om dere ikke når en avtale i løpet av 25 minutter avslutter vi scenariet og dere vil begge få 0 poeng. Payoff oversikten er oversatt fra engelsk og det kan tenkes at noen av beløpene/begrepene virker sære på grunn av dette, men prøv å bruk dem allikevel 😊
NAVN får den samme instruksjonen som du får nå, men vil ha noen andre interesser enn deg, noe som vil reflekteres i hans/hennes payoff oversikt. Derfor er det viktig at du ikke viser din til han/henne også.

Spørsmål?

(gi ark)

Ta en titt på oversikten (gi 2 min til det)

Quiz for å sjekke om de skjønner payoff oversikt:

1. Kan du kort forklare kategoriene du ser?
2. Hva er det du får mest poeng for?
3. Hva er det du får minst poeng for?
4. Hva er ditt ideelle resultat?
5. Hvis du skulle forberedt deg og hadde dine vanlige ressurser tilgjengelig for deg, hva hadde du gjort nå? (noter)

Fint! Da skal du få møte din potensielle arbeidsgiver ☺ (pass på at de har med seg oversikten) Alle 4 møtes foran forhandlingsrommet, de to ledes inn og Ina viser dem hvor kameraene står, Benedicte peker på vann/kjeks/evt. annen info.

Da kommer vi tilbake når tiden er ute. Lykke til!

25 min senere...

FPene tas tilbake til hvert sitt rom og roses. Vi skal snakke mer om dette etter at neste scenario er ferdig, men hvordan synes du dette gikk? (KORT, noter)

Gi tom oversikt
Her ser du en tom payoff oversikt som likner på den som ble gitt deg på begynnelsen av denne øvelsen. Nå vil vi gjerne at du skriver inn tallene i denne oversikten for å fortelle oss hvordan du tror NAVN sin oversikt så ut. Du kan bruke din egen oversikt når du skriver inn i den under. Det eneste hintet vi kan gi deg er at det laveste tallet på oversikten deres er 0 og det høyeste er 400.

Fint, da går vi videre til neste scenario.

**Scenario 2:**

Hensikten med dette eksperimentet er å se på forhandlingsatferd. Du kommer til å forhandle med en annen i en oppgave der det er åtte punkter som må avklares. I dette scenariet er du en bilselger hos BESTPRISBILER og vil gjerne selge en bil til, NAVN. Tenk på at det er denne rollen du har når du går inn i forhandlingen. Som den gode bil selger du er har du gjort deg noen tanker om dine prioriteringer og de vil du straks se i en payoff oversikt (interesse oversikt).

Payoff oversikten viser alle de forskjellige måter avtalen kan nås på, i tillegg til å gi en oversikt over hvor mange poeng du får for å oppnå hvert alternative resultat. Målet ditt er å få så mange poeng som mulig, men om dere ikke når en avtale i løpet av 35 minutter avslutter vi scenariet og dere vil begge få 0 poeng. Payoff oversikten er oversatt fra engelsk og det kan tenkes at noen av beløpene/begrepene virker sære på grunn av dette, men prøv å bruk dem allikevel 😊

**NAVN** får den samme instruksjonen som du får nå, men vil ha noen andre interesser enn deg, noe som vil reflektieres i hans/hennes payoff oversikt. Derfor er det viktig at du ikke viser din til han/henne også.

Spørsmål?

*(gi ark)*

Ta en titt på oversikten *(gi 2 min til det)*
Quizz for å sjekke om de skjønner payoff oversikt:

1. Kan du kort forklare kategoriene du ser?
2. Hva er det du får mest poeng for?
3. Hva er det du får minst poeng for?
4. Hva er ditt ideelle resultat?
5. Hvis du skulle forberedt deg og hadde dine vanlige ressurser tilgjengelig for deg, hva hadde du gjort nå? (noter)

Fint! Da skal du få møte kunden din 😊 (pass på at de har med seg oversikten)

Alle 4 møtes foran forhandlingsrommet

Da kommer vi tilbake når tiden er ute. Lykke til!

35min senere...

Fpene vises observationsrommet og hilser på guttene igjen deretter tas de tilbake til hvert sitt rom og roses. Vi skal snakke mer om dette straks, men hvordan synes du dette gikk? (KORT, noter)

Gi tom oversikt

Nedenfor er en tom payoff oversikt som likner på den som ble gitt deg på begynnelse av denne øvelsen. Nå vil vi gjerne at du skriver inn tallene i denne oversikten for å fortelle oss hvordan du tror NAVN sin oversikt så ut. Du kan bruke din egen oversikt når du skriver inn i den under. Det eneste hintet jeg kan gi deg er at det laveste tallet på oversikten deres er – 6000 og det høyeste er 4000.

Fint! Det var de scenariene vi har forberedt, nå vil du få muligheten til å se gjennom opptaket sammen med Paul/KM og meg og samtidig snakke litt mer om hva du tenkte underveis.

Spørsmål? Vil du ha mer å drikke osv?
**Arbeidsgiver/kjøper**

Velkommen og takk for at du tar deg tid til å delta på dette, det betyr mye for oss!! Det som nå skal skje er at jeg skal gi deg informasjon om det vi skal gjøre i dag, ca de neste 3 timene. Du skal altså forhandle med NAVN som du nettopp møtte, i et forhandlingsromm der det er satt opp to kameraer som gjør at vi kan observere dere. Dere vil bli presentert to forskjellige forhandlingsscenarier, det første vil være litt kortere enn det andre. Temaene vil også være forskjellige, men strukturen vil kanskje likne hverandre. Scenariene vil bli presentert hver for seg av meg, først det ene, så etter at dere har forhandlet det ferdig, det andre og du vil få muligheten til å stille meg spørsmål om innholdet før du begynner forhandlingen. Gruppen og jeg kommer til å sitte i et annet rom og se på, og samtidig tar vi det opp slik at vi i etterkant kan se på det sammen med deg og snakke om hva som skjedde.

Høres dette greit ut, har du noen spørsmål med en gang?

Her er en samtykkeerklæring på dette…

**Scenario 1:**

Hensikten med dette eksperimentet er å se på forhandlingsatferd. Du kommer til å forhandle med en annen i en oppgave der det er fem punkter som må avklares. I dette scenariet er du en personalsjef hos Firmax og skal i ansettelsesmøte med en potensiell medarbeider, NAVN. Tenk på at det er denne rollen du har når du går inn i forhandlingen. Som den gode personalsjef du er har du gjort deg noen tanker om dine prioriteringer og de vil du få utdelt i en payoff oversikt (interesse oversikt).

Payoff oversikten viser alle de forskjellige måter avtalen kan nås på, i tillegg til å gi en oversikt over hvor mange poeng du får for å oppnå hvert alternative resultat. Målet ditt er å få så mange poeng som mulig, men om dere ikke når en avtale i løpet av 25 minutter avslutter vi scenariet og dere vil begge få 0 poeng. Payoff oversikten er oversatt fra engelsk og det kan tenkes at noen av beløpene/begrepene virker sære på grunn av dette, men prøv å bruk dem allikevel 😊
**Navn** får den samme instruksjonen som du får nå, men vil ha noen andre interesser enn deg, noe som vil reflekteres i hans/hennes payoff oversikt. Derfor er det viktig at du ikke viser din til han/henne også.

Spørsmål?

*(gi ark)*

Ta en titt på oversikten *(gi 2 min til det)*

**Quiz for å sjekke om de skjønner payoff oversikt:**

1. Kan du kort forklare kategoriene du ser?
2. Hva er det du får mest poeng for?
3. Hva er det du får minst poeng for?
4. Hva er ditt ideelle resultat?
5. Hvis du skulle forberedt deg og hadde dine vanlige ressurser tilgjengelig for deg, hva hadde du gjort nå? *(noter)*

Fint! Da skal du få møte din potensielle medarbeider 😊 *(pass på at de har med seg oversikten)*

Alle 4 møtes foran forhandlingsrommet, de to ledes inn og Ina viser dem hvor kameraene står, Benedicte peker på vann/kjeks/evt. annen info.

Da kommer vi tilbake når tiden er ute. Lykke til!

25 min senere...

*FPene tas tilbake til hvert sitt rom og roses.* Vi skal snakke mer om dette etter at neste scenario er ferdig, men hvordan synes du dette gikk? *(KORT, noter)*

**Gi tom oversikt**

Her ser du en tom payoff oversikt som likner på den som ble gitt deg på begynnelse av denne øvelsen. Nå vil vi gjerne at du skriver inn tallene i denne oversikten for å fortelle oss hvordan
du tror NAVN sin oversikt så ut. Du kan bruke din egen oversikt når du skriver inn i den under. Det eneste hintet vi kan gi deg er at det laveste tallet på oversikten deres er 0 og det høyeste er 400.

Fint, da går vi videre til neste scenario.

**Scenario 2:**

Hensikten med dette eksperimentet er å se på forhandlingsatferd. Du kommer til å forhandle med en annen i en oppgave der det er åtte punkter som må avklares. I dette scenariet er du interessert i å kjøpe en ny bil og snakker med en NAVN hos BESTPRISBILER. Tenk på at det er denne rollen du har når du går inn i forhandlingen. Som den gode kjøper du er har du gjort deg noen tanker om dine prioriteringer og de vil du se i en payoff oversikt (interesse oversikt) straks.

Payoff oversikten viser alle de forskjellige måter avtalen kan nås på, i tillegg til å gi en oversikt over hvor mange poeng du får for å oppnå hvert alternative resultat. Målet ditt er å få så mange poeng som mulig, men om dere ikke når en avtale i løpet av 35 minutter avslutter vi scenariet og dere vil begge få 0 poeng. Payoff oversikten er oversatt fra engelsk og det kan tenkes at noen av beløpene/begrepene virker sære på grunn av dette, men prøv å bruk dem allikevel 😊

**NAVN** får den samme instruksjonen som du får nå, men vil ha noen andre interesser enn deg, noe som vil reflekteres i hans/hennes payoff oversikt. Derfor er det viktig at du ikke viser din til han/henne også.

Spørsmål?

*(gi ark)*

Ta en titt på oversikten *(gi 2 min til det)*

*Quiz for å sjekke om de skjønner payoff oversikt:*
6. Kan du kort forklare kategoriene du ser?
7. Hva er det du får mest poeng for?
8. Hva er det du får minst poeng for?
9. Hva er ditt ideelle resultat?
10. Hvis du skulle forberedt deg og hadde dine vanlige ressurser tilgjengelig for deg, hva hadde du gjort nå? (noter)

Fint! Da skal du få møte bilselgeren 😊 (pass på at de har med seg oversikten)

Alle 4 møtes foran forhandlingsrommet

Da kommer vi tilbake når tiden er ute. Lykke til!

35min senere...

Fpene vises observasjonsrommet og hilser på guttene igjen deretter tas de tilbake til hvert sitt rom og roses. Vi skal snakke mer om dette etter at neste scenario er ferdig, men hvordan synes du dette gikk? (KORT, noter)

Gi tom oversikt

Nedenfor er en tom payoff oversikt som likner på den som ble gitt de på begynnelsen av denne øvelsen. Nå vil vi gjerne at du skriver inn tallene i denne oversikten for å fortelle oss hvordan du tror NAVN sin oversikt så ut. Du kan bruke din egen oversikt når du skriver inn i den under. Det eneste hintet jeg kan gi deg er at det laveste tallet på oversikten deres er – 6000 og det høyeste er 4000.

Fint! Det var de scenariene vi har forberedt, nå vil du få muligheten til å se gjennom opptaket sammen med Paul/KM og meg og samtidig snakke litt mer om hva du tenkte underveis.

Spørsmål? Vil du ha mer å drikke osv?
User-Centred Development of Simulator-based Training
—an exploratory case study

Kjell-Morten Bratsberg Thorsen
Department of Psychology, University of Oslo, Norway

Abstract

Development of training simulators poses new requirements for User-Centred Design methods, as the simulator will support a different context of use than the one analysed to inform its design. These requirements were explored in a case study by applying existing user-centred methods to the design of a simulator for negotiation training, leading to a suggestion for a possible approach to the design of simulator-based training, founded mainly on Contextual Design and Cognitive Work Analysis, and a formative approach to User-Centred Design.

Many attempts have been made at using technology to facilitate learning—with various degree of success (Koschmann, 1996). One of the perhaps more successful and promising attempts is the use of simulators to provide training in fields where real training is too expensive, dangerous, or simply not practical. The military settings (Farmer, Rooij, Riemersma, Jorna, & Moraal, 1999) and aviation (Salas, Bowers, & Rhodenizer, 1998) are typical examples. Traditionally, the skills learned through simulation have mostly been based on physical or procedural operations, but now we see the advent of simulators for training in more social or “soft” skills, such as leadership (Aldrich, 2004). This poses a special challenge to the development of simulators, as human behaviour and social interaction have to be part of the simulations in addition to the rules of physics.

A natural choice for the development of any training simulator, and especially one for training in social skills, would be the User-Centred Design (UCD) approach, with its main tenet to keep the users, not the technology, at the centre of development (Faulkner, 2000; ISO 13407, 1999; Nielsen, 1993). In principle, UCD methods may be applied to the development of any system with human users. However, in most cases, UCD approaches have the development of tools to support work as their focus (Beyer & Holtzblatt, 1998; Vicente, 1999; Woods & Hollnagel, 2006). There is an underlying premise that a system designed on
the basis of data of how users perform relevant tasks in a specific context, will be fed back to that context of use to support and transform these tasks (Carroll & Campbell, 1989), and the development of training simulators does not fulfil this premise. The purpose of a training simulator is not to support work, but to simulate it as an environment for training and exploration (Gredler, 2004). Hence, the development of a training simulator relates to two distinct contexts of use—the one that will be simulated and offered training in, and the one in which the actual training will occur. The design of a simulator will be based on data from the former context with the purpose of supporting the activity in the latter. In other words, the analysed context and the context in which the simulator will be used are not the same, and the development process has to relate to both.

In order to explore this gap between traditional UCD methods and the situation of designing a training simulator, an exploratory study was conducted within a project aimed at developing a simulator for negotiation training. The development project served as a testbed where user-centred methods and techniques were applied, and the activities of the design team were recorded, reflected on, and later analysed to generate ideas for a User-Centred Design method for training simulators. The Human-Centred design processes for interactive systems (ISO 13407, 1999) provided an overarching framework for the design process, within which conventional user-centred techniques from the Usability Engineering approach and the more specialised method Contextual Design (Beyer & Holtzblatt, 1998), were applied.

This article presents the methodological background from User-Centred Design and training simulator development, and describes and discusses the relevant activities and results from the exploratory case study. Finally, based on tendencies and requirements discovered during the study, a possible approach to a design method for the development of simulator-based training is suggested. The emphasis will be on design methods and techniques, and pedagogical issues will only be mentioned briefly.

Background

User-Centred Design

The term ‘User-Centred Design’ refers to a general approach to artefact and system development, where two of the most central principles are to involve users directly or
indirectly in the design process, and to design, test, and redesign the system or artefact incrementally through an iterative process (Faulkner, 2000; Gould & Lewis, 1985; ISO 13407, 1999; Karat, 1996; Mayhew, 1999; Nielsen, 1993). The approach has its origins within Human Factors, also known as Ergonomics, a multidisciplinary field spanning disciplines such as psychology, informatics, and sociology, to name some; with the design of artefacts compatible with human properties as its main focus (Vicente, 2004).

The International Organization for Standardization (ISO) has formulated the Human-Centred design processes for interactive systems (ISO 13407, 1999) as a guiding framework for User-Centred Design, and a similar process is presented in the Usability literature as the Usability Engineering Lifecycle (Faulkner, 2000; Mayhew, 1999; Nielsen, 1993). ISO 13407 (1999) is only intended to complement existing methods and techniques, while Usability Engineering as a field includes a multitude of possible techniques for all phases (Faulkner, 2000; Kuniavsky, 2003; Mayhew, 1999; Nielsen, 1993), based on the definition of Usability as the extent to which a system is easy to learn, easy to remember, efficient and pleasant to use, and whether it has a low error rate (Nielsen, 1993).

Both processes start by analysing the users, the tasks they perform, and the context in which this occurs, summarised by ISO as a phase for understanding and specifying the context of use. This analysis leads to the specification of requirements and goals for the system. In the next phase, design solutions are produced by iterating through a design–test cycle where prototypes or mock-ups are continuously evaluated and tested with actual or potential users. Finally, the designs are evaluated against the requirements to assess whether these have been fulfilled. If they have, the design is ready for production, if not, another iteration through the cycle is needed. The iterative nature of the process implies that not only the design, but also the requirements, may be changed and refined throughout the development process. This is in contrast to the more traditional development processes, where the requirements are formulated once, at the beginning of the process, and only the finalised product is tested and evaluated against them (Sommerville, 2004).

While the User-Centred Design process may offer solutions to many of the challenges of traditional development processes, challenges still remain. Such a challenge lies in the
inherent assumption that the developed artefact is intended to support tasks in the context of use that was initially analysed, frequently referred to as the task–artefact cycle (Carroll & Campbell, 1989). The introduction of a new artefact inevitably transforms the original task, as it both enables and compels new ways of working, and in effect, the artefact will be used to support a different task than it was initially designed for. Further iterations may refine the artefact accordingly, but the redesigned artefact will again transform the task, and so the artefact will always be one step behind. Vicente (1999) has ascribed this problem to a descriptive approach to work analysis, where the way a system does behave is studied. Instead, Vicente proposes a formative approach for analysing the way a system could behave, by focusing on the boundaries or constraints for work independent of current work practice and tools. The descriptive techniques may still be used as a basis, but data from these analyses are further generalised into models of the underlying constraints of work, rather than descriptions of the task at the time of analysis. While the techniques of Usability Engineering are examples of the descriptive approach, examples of the formative approach may be found within Cognitive Engineering (Norman, 1986). The two fields are highly related and partly overlapping, but while the former is mostly concerned with the design of artefacts that are usable for a single human user, the latter focuses its analysis and design on sociotechnical systems comprising both humans and artefacts, as well as their interaction (Hollnagel, 1998; Vicente, 1998; Vicente, 1999; Woods & Hollnagel, 2006).

Cognitive Work Analysis (Vicente, 1999) is an example of a formative approach, concerned with the analysis of complex sociotechnical systems. In the tradition of Cognitive Engineering, the focus of Cognitive Work Analysis (CWA) is not on the design of an artefact only, but a new sociotechnical system that will induce and support future work practice. The analysis is based on five conceptual distinctions with direct implications for design; the Work Domain, Control Tasks, Strategies, Social-Organisational, and Worker Competencies. Instead of describing the current way of working, modelling tools are provided to find the intrinsic work constraints for each distinction, both technological and organisational. The resulting models, starting with the Work Domain, puts further constraints on the degrees of freedom for action in the studied system. This leads to a definition of the boundaries for an end-user’s actions in the system, without specifying the details of these actions. Furthermore, the analysis builds on an ecological, as opposed to cognitive, approach to Human Factors. Rather
than starting with the constraints following from user characteristics, as is often done in other user-centred methods, the ecological approach starts with the constraints imposed on the users by the environment. Instead of supporting a user’s potentially faulty model, the system is designed to give the users a more realistic mental model (see Norman (2002) for an introduction to mental models in design).

Another formative method is Contextual Design (Beyer & Holtzblatt, 1998; Vicente, 1999), consisting of multiple user-centred techniques collected as an integrated process and tailored to the challenges of working in design teams. Actually, Contextual Design (CD) uses the term ‘customer’ rather than ‘user’, to make a point of the fact that not only direct users of a system are affected by it, but other than that the terms are interchangeable. CD proposes five work models as a basis for the analysis and design process; a Flow Model, a Sequence Model, an Artefact Model, a Cultural Model, and a Physical Model. What makes this a formative approach is mainly the consolidation of sequential, story-based accounts of users’ work practice into the structural work models and a hierarchical organisation of key statements from the accounts into an Affinity Diagram. Similar to CWA, the method is based on the principle of designing a new way of working based on technology. Several successive techniques lead to the design of a new work practice as a response to the user data, including drawing a sketch of the design as an overall picture of the new system, in CD referred to as a ‘vision’. From there, the system is designed through an iterative process with rapid evaluation of prototypes with users, much like common user-centred prototyping techniques.

The Development of a Training Simulator

The term ‘simulator’ in this article is to be understood as a system that is able to present a controlled representation of the appearance and/or behaviour of certain aspects of a real system and possibly also its environment (Farmer et al., 1999). Furthermore, the term ‘system’ is used in a broad sense, potentially including physical, technical, and social aspects, compliant with the term’s use within General Systems Theory (Bertalanffy, 1972). However, in the understanding of this article, a simulator will most likely be implemented as a computer system.
In the case of a training simulator, the simulated aspects are chosen on the basis of intended learning outcomes and the user will be able to manipulate the simulation in a way that promotes practice and learning (Gredler, 2004). This is based on a constructionist view of learning, where one learns through an active and social process of constructing meaning (Kafai & Resnick, 1996; Koschmann, 1996; Squires, 1999). The simulator will present a context that the learner may actively engage in, to build understanding of the real context. Also, there should be a certain degree of correspondence between the simulation and the real system, an attribute referred to as fidelity, in order to support transfer of the acquired skills—meaning that the skills may be applied to a real life situation (Alessi, 1988; Farmer et al., 1999).

As already mentioned, the development of a training simulator will involve two systems or contexts of use. There is the field of practice to offer training in, which will be referred to as the system to be simulated, and the system in which the simulator-supported activity of training will occur, referred to as the system to be supported. In the tradition of Activity Theory (Kuutti, 1996), the two systems may be represented as two different, but related activities, according to the basic structure of an activity depicted in Figure 1. In the system to be simulated, which in the study presented in this article is the practice of negotiation, a negotiator—the subject of the activity—is using language, rhetoric, different strategies, etc., as tools to reach an agreement with the opponent; this agreement being the object of the

![Figure 1. Basic structure of an activity. Reproduced from Kuutti (1996).](image-url)
activity. A negotiation happens within a *community*, possibly involving several team members from each party as well as other influenced persons and parties. Their interaction is controlled by *rules*, both formal and informal, and they have a *division of labour* in relation to the agreement to be achieved. In a similar vein, the training activity consists of a learner—the subject—within a community of other learners, instructors, and moderators, where the simulator is the tool mediating the subject’s training in negotiation, with the expansion of his or her negotiation skills as the object. Again there are rules for the training, and with their different roles in the activity, learners, instructors, and moderators may be said to have a division of labour between them. While the details of these two activities are not important to this study, their existence is.

There are several relations between these systems or activities. First, the activity of negotiation—the system to be simulated, is represented in the training activity through the simulator, as part of the tool. Second, the intended outcome of the training is that the subject’s negotiation skills may be transferred to the activity of negotiation. Third, the two activities are overlapping, as the learner will be involved in the activity of negotiation within the training activity, although in a simulated way. As an illustration of the last point, a learner will simultaneously act with the intention of reaching an agreement with the simulated opponent and the intention of learning to negotiate, he or she will have to relate to both the rules of negotiation and the rules of the training situation, and so forth.

From this, it should be clear that the underlying premiss of User-Centred Design that the artefact is intended to support the analysed activity does not hold in the case of developing a training simulator. Although the User-Centred Design processes presented in this article are open frameworks and different techniques may be applied within them depending on the details and demands of each development situation, they do not give any guidance on how to include both the system to be simulated and the system to be supported in the process. Given these systems’ different relations to the simulator to be designed, special clarification of their roles in the development is needed.

While no user-centred approaches to the development of training simulators has been formulated, a methodology for specifying the requirements for training simulators has been
developed as part of a large European, military programme, the MASTER project (*Military Application of Simulation and Training concepts based on Empirical Research*), to enhance the effectiveness and efficiency of military training (Farmer et al., 1999). The research group of the MASTER project observed that the requirements used to develop systems were also used to simulate them for training purposes, but instead the group proposed a methodology based on the principle that the requirements should be derived from training considerations. The methodology starts with a *Training Needs Analysis*, where the activity of the real system, the tasks performed by actors within this activity, the skills required for these tasks, and the skills available in the trainees are analysed. The discrepancies between the required and the available skills are formulated as a set of training objectives, and provides a starting point for the next phase, the *Training Programme Design*, where the overall training program, the specific training activities, training scenarios, and instructions are worked out. Finally, the detailed requirements for the training simulator are specified in the *Training Media Specification* phase. The MASTER approach is not built on the principles of User-Centred Design, but it is the only approach to acknowledge the two systems involved in training simulator development. In the first phase, the system to be simulated is analysed, and in the second phase, the system to be supported is designed. The third phase is mainly concerned with the simulator itself.

Furthermore, an account of the development of a simulator for leadership training has been given by Aldrich (2004). This is not a description of a development approach, user-centred or otherwise, but a case study of the trial and error process of designing and deploying this simulator. They started with a thorough analysis of leadership through literature reviews and interviews with leaders, resulting in their own model and theory of leadership. The aim of this analysis was to discover content that could be both cyclic and open-ended, meaning that it could be practised over and over and without a predefined outcome. They then decided on an interface for the simulator, the interaction it would provide, and the simulated settings in which to practice leadership. With this in place, the turn came to specify the rules for the inner workings of the simulator; the dialogue system, the artificial intelligence of the virtual characters, and the physical simulations and animations. Finally, the simulator was programmed and put to use. An important principle through this process was that every part of the simulator would reflect their leadership model, so that whatever part the user engaged
with, an understanding of this particular view on leadership would be the learning outcome. Even learning to operate the user interface of the simulator would give a better understanding of leadership.

But although there are examples of the development of training simulators, and although methodologies for specifying training simulator requirements have been formulated, there is a void between these and the user-centred methods. An approach to User-Centred Design for training simulators is needed, where the particularities of simulator development are accounted for.

Methods
Motivated by this need for a User-Centred Design approach to the development of training simulators, an exploratory study was conducted within a project for developing a simulator for negotiation training. The project was initiated by an associate professor at the University of Oslo, and carried out without the involvement of any external stakeholders. The design team was composed of five master’s students in psychology, all dedicating one year to this project while writing their master’s thesis on its different aspects. Some of the members had prior experience with development processes in general and the User-Centred Design process in particular, while others had little or no such experience. A lab at the Department of Psychology in Oslo had been assigned to the project, in which the development activities took place, with the exception of one activity that were carried out in a Usability lab located in the centre of Oslo. All five members of the design team were present at all times and collaborated on the majority of the development tasks.

The aim of this exploratory study was mainly to generate ideas for the application of User-Centred Design methods to the development of training simulators, and the project served as a testbed where relevant user-centred methods were applied and their use and effects continuously logged and evaluated. As this study was conducted by one of the five members on the design team, in the role of a participating observer, methods and techniques could be chosen with the criterion that they should be suited for the design process as well as have a potential for generating inputs to the ongoing research, and first-hand experience of their application could be collected as data and form the basis for generating new ideas (Meyer,
Throughout the project all relevant activities were logged, with descriptions of what was done, the group’s reasoning around the process and techniques, observations from the work, and online reflections on behalf of the observer. The theoretical structuring was postponed until the final analysis, as suggested by Flick (2002).

**Results**

The results presented here are based on observations and reflections recorded during the design process. The presentation is structured according to three of the main activities in User-Centred Design: analysis, design, and user testing. Only the parts relevant to this study are presented. For a full description of the project, see Biørnstad, Furnes, Lundeby, Rambøl, and Thorsen (this thesis).

*Analysing a field of practice as a context of use*

Two investigations of negotiation as a context of use were conducted during the project period. At the beginning of the first iteration, professionals with negotiation experience were interviewed to get an overview of the area and to get details about the task of negotiating. In addition to general questions, the interviewees were asked to describe the sequence of events in a (preferably) recent negotiation. In the second iteration, professionals were observed while they negotiated in sessions arranged by the design team. Afterwards the participants were shown a videotape of the negotiation, and were asked to comment on their actions and explain, as much as possible, what they did and why.

The data from the first iteration were analysed with techniques from Contextual Design (Beyer & Holtzblatt, 1998), through several sessions where the design team first interpreted the data from each interview, resulting in a list of key statements and models of how the interviewees perceive and practice negotiation. The models were then consolidated as generalised models spanning the individual cases, and the statements were organised hierarchically in an Affinity Diagram (Figure 2; for a more detailed description, see Beyer & Holtzblatt, 1998). Only two of CD’s work models were considered relevant for the collected data. The Sequence Model (Figure 3) presented a generalised description of a negotiation in phases, steps and intentions, displaying the common structure across interviews. The Cultural Model (not included here) gave an overview of the groups and people involved in a
negotiation, and their influences on and attitudes toward each other. Due to diverging configurations of people, groups, and roles from negotiation to negotiation, the common structure across interviews was not as apparent for this model as for the Sequence Model. Data from the second iteration were analysed in a similar manner, extending and refining the Affinity Diagram. Together with the two models, the Affinity Diagram gave the design team a broad impression of how negotiation is practised, and pointed to central aspects. It was the design team’s experience that this gave a more intimate understanding of the interviews, as the data was evaluated several times, both individually and as a group. This was especially true with the Affinity Diagram, as each statement was glued to a Post-it, placed on the wall, and then grouped and regrouped several times until an overall structure emerged. The physical presentation and the size of the diagram made it possible to analyse the data together as a team. Individual members also claimed to have had their first impressions of the tendencies in the data altered and expanded through the interpretation and consolidation, resulting in a different presentation of the interviews than the group’s initial, more intuition-based experience of commonalities across the interviews.

Furthermore, the models, especially the Sequence Model, and the Affinity Diagram were important inputs to the creative process, both as a common point of reference for the design team and as aids for getting into the right mindset—the team members would revisit the models and the diagram at the beginning of design sessions. Qualitative differences were
observed between discussions on topics included in the models or the Affinity Diagram and on those that were not. As an example, an idea regarding the use of a mediator in the simulated negotiation came up during the design process. There was actually a lot of data on mediation, but this had not been included in the first round of analysis due to time constraints and a decision to narrow the focus of the analysis. While evaluating this idea, the team members made arguments like “but he said in the interview...” and “she always used to...,” referring to the negotiators that had been interviewed. For other ideas, references were made to the diagram and the models, and not to specific interviews. Thus the models and the diagram seemed to have made the design team less focused on the specifics of individual cases, and instead induced a focus on the general tendencies in the data.

However, the design team voiced a concern that the original meaning of the interviewees might not be preserved through all stages of the analysis process, from the interview, through the interpretation into the individual models and statements, and finally to the consolidated models and the Affinity Diagram. The diagram also seemed to hide many specifics, especially on topics mentioned by only one or two of the interviewees. For example some specific negotiation strategies that could have been important to include in the simulator, did not show up on the labels in the final diagram. They were present below more general labels, grouped with other related statements, but the specific strategies were lost in the hierarchy.

*Designing a simulator-based training program from user data*

Inspired by Contextual Design (Beyer & Holtzblatt, 1998) and Cognitive Work Analysis (Vicente, 1999) the aim of the development process was to design a training program in negotiation, supported and facilitated by the simulator, as opposed to designing a simulator only. With the Sequence Model, the Culture Model, and the Affinity Diagram as input, the design team started the creative process by brainstorming several different visions of how a training course with the simulator would look like. Based on considerations of positive and negative aspects of each, two common visions were created from the most promising ideas, one for the training program (Figure 4) and one for the simulator (not included here). Usually in CD, only one common vision is created for the entire design of a new way of working. While the simulator vision were really a part of the training program vision in this case, a split was made to render the design decisions clearer.
In the spirit of Contextual Design, the visions were then explored in more detail by drawing storyboards of the interaction between a user and the simulator in an imagined scenario, as a series of cartoon-like images (Figure 5). This allowed an explication of parts of the design without having to make a prototype of it, and to make decisions on a more detailed level than is possible in a vision. Storyboards are intentionally kept on a conceptual level, though, not going into technical details, so the design discussions initialised by this technique were mainly concerned with the user’s interaction with the system and the virtual opponent in the simulation, and not with the inner workings of the simulator would be. These sessions were focused on what parts of the simulation the user would need to control in order to have the necessary degrees of freedom to practice negotiation in a way that would seem sufficiently realistic and involve issues relevant to learning this skill. This was a constructive process that both generated new ideas and uncovered issues that had to be solved for the design to work.

As an example of an issue uncovered through storyboards, the vision for the simulator included an idea motivated by data on the importance of taking the opponent’s perspective in a negotiation, were the user would get the opportunity to actually have a look at the opponent’s “cards”, so to speak, by switching view either during the negotiation or immediately afterwards. In this way the user could compare his or her impression of the opponents position and priorities with the actual situation in the simulation, and reflect on any discrepancies. However, when this came up in the storyboard, some team members began to question whether this feature would really teach a user to consider the opponent’s
perspective. Instead it could make him or her more focused on getting a good deal, by allowing a comparison of the end-result of a negotiation with how much further the opponent would have been willing to go. This could lead to a view of negotiation as an effort to get as much as possible from the other party—a view the design team would not necessarily advocate. The conclusion of the discussion there and then was that the initial idea of switching view had come up because it was possible rather than being a good way of facilitating the desired learning objective. Through the focus of the storyboard technique the design team were able to discover this issue and find alternative and more suited ways of focusing on perspective taking.

Testing simulator-based training with users

Based on the design from the first storyboard session, a prototype of the simulator was created and tested with users, in accordance with User-Centred Design approaches in general (Beyer & Holtzblatt, 1998; Faulkner, 2000; ISO 13407, 1999; Kuniavsky, 2003; Mayhew, 1999; Nielsen, 1993). However, the task of recruiting participants for this test raised the question of who would be relevant users for the training simulator. On the one hand, the end-users of the simulator would be persons seeking training in negotiation, but as a consequence of this characterisation, they would not be able to evaluate whether the training is relevant to the task of learning to negotiate and whether the simulation is a satisfying representation of negotiation. On the other hand, testing on experts of negotiation could provide inputs on the realism and accuracy of the simulation, but this would not by itself provide any indication that the simulator will actually facilitate learning (Alessi, 1988; Farmer et al., 1999).

At this stage in the development, the main focus was to test the general interaction between the user and the simulator and whether it was experienced as a conversation with the virtual character presented in the prototype. Thus, for this first Usability test the participants’ level of experience with negotiation was not crucial, and available students at the University were recruited. The test provided valuable inputs on the design and the general design concept, but the question of who would be relevant users for future tests remained unanswered.

Also, at this point, it became clear that this user-centred process had not really provided any training objectives for the evaluation of the design. A lot of analysed data on negotiation had
been gathered to drive the creative design process, and this data were in itself a set of requirements for the design, but from a Usability perspective only—not from a pedagogical perspective. In other words, the user-centred analysis had resulted in input on what to include in the simulator in order to design an interface for a negotiation between a human user and simulated characters, but not for the purpose of providing training in the skills involved in negotiation. Hence, the user test provided the design team with inputs on the Usability of the simulator, but not on training aspects.

**Discussion**

This study has been concerned with the application of User-Centred Design methods to the development of a training simulator. Most of the techniques in the study were adopted from Contextual Design (Beyer & Holtzblatt, 1998) or User-Centred Design in general. While the results are inconclusive in the sense that they do not span a complete development process from first analysis to finished product, the aim of the study was to generate ideas for User-Centred Design of a training simulator, and several tendencies have been discovered.

The development project has served as a demonstration of how a field of practice, in this case negotiation, could be analysed through user-centred methods for the purpose of designing a simulation of it. In this regard, the conclusion of the study is that the Sequence Model, the Cultural Model, and the Affinity Diagram from Contextual Design, including the techniques for generating them, may provide the design team with a broad understanding of the field and a point of reference for the creative process of designing the training program as well as the interaction with the simulator. These techniques directed the focus in the creative process to the commonalities across cases, rather than personal opinions and specific and possibly contradictory cases.

That said, the experiences from this study suggest that the Affinity Diagram and the models will not provide the necessary level of detail and accuracy to inform the design of rules for the inner workings of the simulator, such as the artificial intelligence needed to control the behaviour of the virtual characters (Aldrich, 2004). The many steps of interpretation from data collection to the final, consolidated models and diagram may transform the original meaning of the data and, in the worst case, lead to skewed or faulty models of the field of
practice. Any loss of meaning in the presented case study may be due to the design team’s way of applying the techniques, but on the other hand, the data gathering and analysis techniques in CD are based on building understanding in the members of the design team, and in several of the steps this understanding is the main carrier of data to the next step. Thus a loss of meaning or a bias may be expected by any design team using these techniques. Moreover, the hierarchical structure of the Affinity Diagram in this case revealed little specifics and was mostly general in nature. The generality in the diagram may stem from a lack of specificity in the original data, as the first round of analysis in this case was based on interviews and not on observations of negotiation. People’s own accounts of what they do are generally less detailed than their actions in a real situation (Suchman, 1987). It may also be that a topic and a field as large and complex as negotiation would need more than three levels of categories in an Affinity Diagram to reveal any details. A third possibility is that generality may in fact be a necessary property of a diagram generated through a consolidation process. Regardless of the source of this generality, the study indicates that the specifics needed for the rules of the simulator may not be provided through the Contextual Design techniques. Note that this is not intended as a critique of CD per se, as its techniques was never developed to meet the criteria set by this discussion; the intention is rather to clarify its possibilities for application in the design of a training simulator.

The principle of Contextual Design and the formative approaches in general, to redesign work rather than just design a tool to support it, may not at first seem to apply to the development of a training simulator. Instead of redesigning the analysed task, it should be simulated with a certain level of fidelity to allow the skills acquired to be transferred to a real situation (Alessi, 1988; Farmer et al., 1999). To exemplify, a redesign of the negotiation activity could involve a computer application that would take both parties’ interests and priorities as input and calculate the most advantageous outcome, but as this is not how negotiations are conducted, this is not what should be designed into the simulation either. However, while the field of practice should be simulated as it is analysed, the training activity could be designed or redesigned—supported by the simulator. This was demonstrated in the presented study, and gave the design team a different perspective on the design process and the issues related to the actual simulator. An example of this, taken from the results, is the idea of letting the user switch focus and see the negotiation from the opponent’s perspective.
The idea had come up because it was a possible feature, without an evaluation against the intended training outcome, but through a design process with focus on the entire training program and not just the supporting artefact, the design team was able to discover this confusion. The idea may also be attributed to a more conventional User-Centred Design thinking, as it could have been a plausible feature had the goal been to redesign negotiation, rather than simulating it. This supports the claim that a clarification of the involved systems and their differing roles, is needed.

Even though the design team had a focus on designing the training activity, they presented their overall design as two distinct, but related parts—that of the training program and that of the simulator system. One can only speculate whether this specific division was triggered by a real need of the process or by an a priori distinction on behalf of the team members, but the distinction was nevertheless experienced as both meaningful and necessary by the design team. Thus, while the process gained from the emphasis on designing the entire training activity through a Training Vision, a separate focus on the simulator system, with a separate Simulator Vision, was also valuable in this process.

A final challenge stemming from the User-Centred Design approach, was discovered by the question of whom to test the simulator and the training design with—experts that can verify a correct simulation of negotiation or end-users with little negotiation experience, that must be able to use the simulator in order to learn from it? A first intuition on this dilemma would be to simply test the simulator on both of these groups, but a usable simulator with high fidelity does not necessarily ensure that novices will actually learn the skills relevant for negotiation in a real setting (Alessi, 1988; Farmer et al., 1999; Squires & Preece, 1996). Furthermore, as the user testing technique is based on the definition of Usability (Faulkner, 2000; Nielsen, 1993), its application will inevitably focus on whether the user is able to operate and understand the simulator instead of on the training outcomes, and again the effect may be that the team designs a simulator to support negotiation between the user and virtual characters rather than to support training. It is essential to make sure that the user will be able to operate the simulator and to ensure a certain degree of fidelity, but these should not be the only aspects of the design–test iterations. The evaluation of the training activity and the simulator should focus on training objectives and pedagogical issues as well. In the extension of this, a
method for developing training simulators should also include techniques for specifying a set of learning objectives to evaluate the design against, as the User-Centred Design methods obviously do not.

As a summary of this discussion, techniques from Contextual Design may be used for designing the training program and the interface of the simulator, but more detailed and accurate techniques are needed to inform the design of the inner workings of the simulator; a perspective where one designs the entire training program should be adopted in order to give the design team a focus on supporting training, not only simulating an activity, although it may be useful to approach the overall design as a Training Vision and a Simulator Vision; and while Usability tests are necessary to ensure that the users are able to operate and understand the simulator, and fidelity checks with domain experts may be important to promote transferability of the acquired skills, techniques for defining and assessing the training objectives with users are needed as well.

General discussion

This article has so far pointed to some requirements for User-Centred Design methods for training simulators. First of all, guidance on the different roles of the systems involved in the development is needed. Second, techniques must be included for providing data for the creative design of the training program and the simulator interface, as well as for the rules and details of the inner workings of the simulation, based on the principle of designing a simulator-supported training activity, not only a simulator. Third, the method must support the design team in defining training objectives for the simulator and overall training activity, and supply techniques for assessing whether the design is capable of fulfilling these, as well as evaluating the Usability of the simulator with learners and the fidelity of the simulation with domain experts. In the following, a possible approach for such a method is suggested.

The different roles of the involved systems

To start with the first requirement, a clear depiction of the systems involved in the development process is needed. Two systems have been recognised from the start; the system to be supported—the training activity, and the system to be simulated—the field of practice to provide training in. In addition, a third system was mentioned in the previous discussion—the
simulator system itself—given its natural and distinct role in the studied design process. These systems are also found in the three main phases of requirements specification in the MASTER project (Farmer et al., 1999), which give separate focus to the field of practice, the training activity, and the simulator. The relationships between these systems are given in the earlier description of the system to be supported and the system to be simulated as activities, namely that (a) the field of practice is represented in the training activity through the simulator, (b) the skills acquired in the training activity should be transferable to the field of practice, and (c) the user will simultaneously be engaged in the activity of training and the simulated activity from the field of practice. To elaborate on the role of the simulator system, Kuutti (1996) mentions the possibility of technology to provide a “window” (p. 34) into an activity, and this is how technology is used in the case of a training simulator, although possibly in a more direct sense than intended by Kuutti. The role of the simulator system is thus to provide the user with a window through which he or she may engage with the field of practice as a part of the training activity. Figure 6 displays a model of the three systems, with their three types of relations represented as arrows.

From this, it follows that the purpose of the design process is to enable the relations between the three involved systems. Through an analysis of the field of practice, a representation is designed into the simulator system allowing the user to engage in the field of practice as a
part of the training activity, in a way that lead to the acquisition of skills that may be transferred back to the field of practice. The training activity and the simulator system are the ones to be developed through the design process, indicated by the thicker lines around these systems in Figure 6, where the simulator will have status as a tool for the training activity.

**Informing the design of training activity, simulator interface, and simulation**

As for the second requirement, the techniques of Contextual Design (Beyer & Holtzblatt, 1998) may very well be used for the design of the overall training program and the simulator interface, as demonstrated in this case study. The field of practice would be analysed and presented in an Affinity Diagram and any of the five models relevant to the particular field of practice. Based on this the design team may lay the foundation for the training activity and the simulator interface by creating a vision for each, and elaborating through storyboards. The emphasis of this process should be on the training activity and the acquiring of skills that can be transferred to the field of practice, and this should dictate the design choices for the simulator, and not the other way around. Also, user-centred analysis of an existing training activity could be useful to inform the design of both the training activity and the simulator, in addition to their continuous evaluation through Usability tests and other relevant techniques.

When choosing techniques to provide input to the inner workings of the simulator, Cognitive Work Analysis (Vicente, 1999) seems to be a strong candidate for several reasons. First, the method’s heritage from Cognitive Engineering, with a focus on sociotechnical systems rather than artefacts, complies with the requirement for designing the training activity and not only the simulator. Second, its modelling tools for finding the intrinsic constraints of the different layers of analysis are more detailed and scientifically based than the creative techniques of CD, giving reason to expect that CWA may provide the level of details necessary for specifying the rules governing the simulation. Third, and most interesting, learning is at the centre of CWA, as its analysis starts with the constraints of the environment rather than the cognition of the user, in order to provide the user with a more realistic mental model. This forming of a mental model in the user is in essence learning. The intrinsic constraints of the activity in the field of practice may be analysed and represented as the space of action possibilities in the simulation, and by exploring these constraints, the user could get a mental model of the field of practice that may be applicable in a real situation. Furthermore, the idea
of defining a constrained space for possible actions, as opposed to designing a set sequence of events through the field of practice, is compatible with Aldrich’s (2004) principle of providing the user with cyclic and open-ended content. Instead of following a predefined trajectory through the content, the user will be free to explore, apply different strategies, and test the boundaries of the simulation in order to build an understanding of the field of practice in a constructionist way of learning.

That said, CWA and its modelling tools are developed in the setting of more tangible and established sociotechnical systems, such as process control systems (Vicente, 1999), and not as a tool for modelling social activities like negotiation. However, its techniques have been used to analyse activities as different as design processes (Rasmussen, 1990), the game of chess (Vicente & Wang, 1998), interdisciplinary interactions (Burns & Vicente, 1995), and medical examinations (Hajdukiewicz, Vicente, Doyle, Milgram, & Burns, 2001). Vicente (1999) also claims that CWA is not limited to “domains where workers are controlling a physical system whose behavior is governed by laws of physics that can be described by equations” (p. 304). Based on this, it may very well be possible to analyse negotiation as a Work Domain in CWA, with the goals of the activity as Control Tasks, and with several Strategies for reaching each goal; though a further explication of this is beyond the scope of this article. The Social-Organisational task allocation and co-operation has already been mentioned in the description of the field of practice in terms of Activity Theory (Kuutti, 1996), as the division of labour, and the fifth conceptual distinction, Worker Competencies, will be returned to later in this discussion.

With the techniques from Contextual Design to inform the design of the training program and the simulator interface, and the models from Cognitive Work Analysis as specifications for the simulator, a link between the two is still missing. Both will provide an analysis of the field of practice, but they represent two distinct approaches to this analysis with different models and diagrams. A solution may be found in Vicente’s (1999) description of the formative approach as based on conceptual distinctions with “direct and obvious implications for design” (p. 110). The five models of Cognitive Work Analysis will inform the design of the simulation in much the same way as described by Vicente, although with emphasis on simulating rather than redesigning the analysed context, and on giving realistic possibilities
for action to both virtual characters and human users rather than distributing responsibilities between workers and automation. Contextual Design, on the other hand, will be applied with implications for the training program and the simulator interface, through the two conceptual distinctions presented by the Training Vision and the Simulator Vision. The former poses constraints through overall decisions on which parts of the field to supply training in, while the latter represents the boundaries of the simulator as a window into the field of practice.

In Figure 7, the Training Vision and the Simulator Vision are depicted as two layers of analysis above the layers from Cognitive Work Analysis, representing a transition from pedagogical considerations to the ecological considerations of CWA. This order is in accordance with one of the main tenets of the MASTER approach, that requirements for the simulator should come from training considerations rather than the details of the system to be simulated (Farmer et al., 1999). Also, the notion of the simulator as a window into the field of practice, would imply that the boundaries of the window need to be defined before the analysis of what the user will see through it. Vicente (1999) recommends “defining the scope of the analysis by drawing a boundary to delimit the work domain of interest” (p. 171) before

![Figure 7. The layers of analysis for a training simulator. Adapted from Vicente (1999).](image)
conducting a Work Domain Analysis, which is precisely what is done through the visioning process for the training program and the simulator.

An objection to the approach described here may be that a vision in Contextual Design is not a model of intrinsic constraints from the field of practice, as are the models in CWA. While this is correct, there is no direct link from the intrinsic work constraints in a field of practice to a set of useful constraints for a training program, meaning that the definition of these constraints will necessarily have to be based on decisions made by the design team. Furthermore, similar decisions are made through the analysis in CWA. For example, an analysis may include decisions on the distribution of tasks and responsibilities between human workers and automation in the new sociotechnical system to be designed. It should therefore be equally legitimate to constrain the analysis of the field of practice based on the overall decisions for the training program and the simulator interface, especially since these are grounded in data from the field of practice as well.

Defining and evaluating training objectives

As for the requirement of a technique for defining training objectives, the MASTER approach (Farmer et al., 1999) may provide some insight. In MASTER, the discrepancies between required and available skills form the basis for defining training objectives. This is the end result of the Training Needs Analysis, which progresses from an analysis of the overall activity and the tasks performed within this activity, to an analysis of the skills required and the skills currently possessed by the people to be trained. This progress bears resemblance to the transition from environment to cognition in CWA’s analysis, and the modelling tool for Worker Competencies, the last level of analysis for intrinsic work constraints in CWA, is not only intended for analysing the constraints of the users’ cognitive capacities and the skills needed for satisfactory performance, but may also provide an analysis of the current competencies of users as well (Vicente, 1999). Thus, by analysing the required and available worker competencies, CWA is not only promising as a technique for informing the design of the inner workings of the simulator, but may also be used as a technique for defining training objectives for the simulator and the overall training activity.
Then the only remaining requirement is techniques for evaluating the training outcomes and their relation with Usability testing of the interface and fidelity checks with domain experts. The description of specific techniques for evaluation of training outcomes is outside the scope of this article, but it may be argued that Usability and educational aspects should be seen as interacting issues rather than two distinct dimensions (Squires & Preece, 1996). Attempts have been made at integrating the principles of Usability with modern learning principles in order to perform expert evaluations on both aspects (Squires & Preece, 1999). Also, participants may be observed and interviewed as part of the test with the training objectives in mind, to find indications of learning or the lack thereof, as input to the design process (Rappin, Guzdial, Realf, & Ludovice, 1997). On the other hand, it has been argued that usability issues should be addressed first, since the ability to use a system is a prerequisite for learning from it (Quinn, 2005), but what parts of the simulator to make usable should nevertheless be seen in relation to the task of learning, as struggling with a task may actually be necessary for learning (Mayes & Fowler, 1999). This discussion is in line with an ongoing discussion in the educational computing literature (Squires, 1999), and no clear solution to the dilemma exists at present time (Ardito et al., 2006).

When it comes to conducting fidelity checks with domain experts, applying a Usability approach to test whether the experts are able to negotiate with the virtual characters in the simulation, may actually be valuable. If experienced negotiators consider the simulated negotiations to be realistic, the chances are higher that the correct constraints on the space of possible actions have been identified, and skills acquired through training with the simulator may be transferable to real situations. This testing should be done with some care, though, as this perspective of supporting negotiation should not be adopted for any other part of the design process. Also, a faithful simulation is not necessarily related to learning, and deciding to what extent and in which way fidelity is a goal for the design process is essential (Alessi, 1988; Farmer et al., 1999). While tests with learners may integrate the Usability and educational perspectives, tests with domain experts from a fidelity perspective have to be carried out separately, as different participants are involved. Nevertheless, these latter tests should be seen in close relation with the former, to ensure that they serve the overall goal of training and not that of supporting negotiation.
Conclusion

Based on the experiences from a User-Centred Design process for developing a simulator for negotiation training, a user-centred approach to the development of simulator-based training has been proposed, founded primarily on Contextual Design (CD) for the design of the overall training activity and the simulator interface, and Cognitive Work Analysis (CWA) for the rules and details of the inner workings of the simulator. Through a formative approach where the field of practice is analysed in order to define constraints for the user’s actions in the system, a Training Vision and a Simulator Vision are created through techniques from CD, to represent the constraints of the training activity and the simulator system respectively. Within these constraints, the field of practice is analysed through the five conceptual distinctions from CWA in order to inform the design of the simulation. This leads to a space of possible actions in which the user may explore the simulated field of practice to build an understanding and a mental model that may be transferred to real situations. The last conceptual distinction of CWA, Worker Competencies, may also provide training objectives for the simulator by analysing the discrepancies between the required skills for the field of practice and the skills available in the potential users. Based on these training objectives, the design of both the training activity and the simulator may be tested on potential users and domain experts, with an integrated perspective on training, Usability, and simulation fidelity.

Research is still needed to evaluate whether Cognitive Work Analysis may be applied to the analysis of a social reality like negotiation, and whether the Cognitive Design visions may serve as constraints on top of CWA’s layers of analysis in an actual design process. Also, more work is needed in the pursuit of integrated techniques for evaluating the Usability, fidelity, and pedagogical issues of simulator designs. But hopefully, the approach suggested in this article will provide designers with better methods for developing training simulators that will facilitate learning of useful and transferable skills.
References


