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Autonomous Analysis for Design Analysis

For a better overview and a greater understanding

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Abstract

Autonomous Analysis for Design Analysis

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This master thesis evaluates autonomous analysis potential to be used for design analysis. Autonomous analysis is a method that helps you to see the broader perspective of the problem you are facing. By using autonomous analysis in the design process, I was hoping to find a way to support the project managers and developers, in their efforts to consider and take into account all relevant advance information and assumptions of the various stakeholders. To test autonomous analysis I used it to analyse GADD, a database that is under development for SKB (Swedish Nuclear Fuel and Waste Management Company). The analysis is made with help of EthXpert that is a tool constructed for autonomous analysis of moral problems. EthXpert most important feature is, that it neither makes nor proposes any decisions, but instead is intended to supplement guidelines and guide those who make the decisions. In the master thesis I also compare autonomous analysis with design rationale and discuss its possibility to be used together with Scrum.

My conclusion in this master thesis is that even if autonomous analysis can be used for design analysis, its better suited for analysing whole projects. When it is used to analyse only a small part of a project, like the design, you waste its greatest potential, that is to give the developer a great overview and understanding of the project as a whole.

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Sammanfattning

Detta examensarbete undersöker autonomianalysens förmåga att användas för att göra designanalyser. Rapporten börjar med att jag jämför autonomianalys med design rationale samt förklarar vad autonomianalys är för något, för att sedan fortsätta i en förstudie. Förstudien följs av att jag redogör hur jag använder mig av autonomianalys för att analysera GADD, en databas som är under utveckling och kommer att användas av SKB (Svensk kärnbränslehantering). Därefter reflekterar jag över mina resultat för att försöka komma fram till hur mycket av mina resultat som beror på autonomianalys samt vad jag tror att jag skulle kommit fram till även med andra metoder. Det slutliga resultatet av mitt examensarbete är att det går att använda sig av autonomianalys när man gör designanalyser, men det är inte optimalt. Autonomianalys är bättre lämpat för att analysera hela projekt där man kan ta till vara på autonomianalysens styrka, att man får en väldigt god överblick över projektet i sin helhet.

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Introduction

The website “This is broken” (Good Experience, 2007) has a lot of examples of different bad designs. I think that a lot of them have the problem that they put in some function only because other similar products have that function, without reflecting over whether it is really needed for their product. An example of this are products that have too many popup windows that ask the user, if they want to continue with the operation that was requested. I think this kind of usability problems come from a heteronomous way of looking at the designs. If the designers just had thought for themselves instead of following their preconceptions they got from heteronomous thinking, that kind of problems would not occur. But this is not only a problem for small-scale web pages and programs. Also bigger projects can have this kind of problems. An example of this is the county council's health care system which has been written about in the newspapers (Uppsala nya tidning: Landstingsanställda dömer ut Cosmic. 2006). The system should help the users in their daily work, but many of the users think it is the other way around, that it makes their daily routine more complicated.

In this thesis will I evaluate the potential in using autonomous analysis for solving this kind of problems. Autonomous analysis is a method that helps you to see the broader perspective of the problem you are facing.

When using autonomous analysis, you will be faced with a lot of stakeholders, and it will take time to identify and evaluate all of them. However, when you have done this, you can be quite sure that you really understand the pros and cons of your design. The great overview you get from this is especially good, if you are creating a novel design or are working with a project that requires you to think outside the box.

An example of the worth of thinking in new ways is Nintendo Wii's game control. When other companies were working to make their consoles as powerful as possible, Nintendo instead tried to find new ways to enhance the gaming experience and improve the ways you play console games. I think that it is one of the factors that lead to a situation where Nintendo's console is selling in greater quantities than their competitors. (Vgchartz, 2011) This kind of thinking is called Blue Ocean Strategy (Kim and Mauborgne, 2004). Blue Ocean

Strategy is when you actively are trying to find uncontested market space and thereby making the competition irrelevant.

This thesis is written by me, Emil Wessely, but some of the work is done in collaboration with Shant Davidian who also is writing a thesis about autonomous analysis. The analysis in EthXpert and the interviews are done in collaboration but most of the conclusions are my own. When I write that *we* did something, I refer to my collaboration with Shant.

Problem description

The goal of this master thesis is to evaluate the potential in using autonomous analysis for design analysis, and exploring the possibility to combine analysis of both moral and design aspects. By using autonomous analysis in the design process, we hope to find a way to support the project managers and developers, in their efforts to consider and take into account all relevant advance information and assumptions of the various stakeholders.

A stakeholder can be many different things. It may refer to a person, group, organization, or system who affects or can be affected by an organization's actions.

An example of a tool used to support autonomous analysis is a matrix, where all different alternatives to handle a problem is systematically compared with all values and aspects that is relevant for everyone that is affected by it.

Different user groups' requirements, but also developers' and organizations' interests, influence design decisions. A survey of these can be made when you in a focused and practical way identify potential conflicts of interests in the design of an interface.

The work of my master thesis begins with a literature study where we read about the methods behind autonomous analysis, different methods that are used today to analyse and work with design projects, and similar projects that have already been discussed.

Next step is to develop a theoretical model and with help of the software EthXpert use autonomous methods to analyse design projects. The purpose is to evaluate which parts of the autonomous analysis can be applied directly in design analysis, and which have to be modified. By using the information gathered during my literature study, I will try to identify problems with the model and find alternative solutions.

Then it is time to test the model on a real project. Together with Shant I will look at SKB's (Swedish Nuclear Fuel and Waste Management Company) new database that is under development.

Finally the results will be used to evaluate the possibilities to use autonomous methods when analysing a design project. I will also investigate the methods compatibleness with

project management methods like Scrum.

Delimitation

I will focus on how the method can be applied in design analyses of computer systems and discuss when and why it could be useful.

Background

Articles that have influenced me

During my work I have read a lot of articles that have influenced my way of thinking without contributing strongly to any single part of my work. Gilbert Cockton has written most of these articles. (Cockton, 2004, 2006, 2008, 2009, 2010) The articles are about how to identify value, and what/how to think when developing artefacts. I have also read some articles where he discusses post hoc rationalization and how to interact with the intended users. Cockton's articles about how to identify value helped me to understand what to look for, when I did my different analyses, and have given me a deeper understanding of what I want to achieve. In one of the articles he mentions the importance of not only looking at the artefact, but also to look at the context it will be used in, to be able to identify the relevant values. These are thoughts I think have a lot in common with what I try to do with autonomous analysis (Cockton, 2006).

The articles where he mentions the dangers of post hoc rationalization is the reason that I added the part where I evaluate autonomous analysis impact on the analysis we did on SKB's database.

Design Rationale

Design rationale (Regli et al., 2000) is an explanation of why an artefact, or some part of an artefact, is designed in a specific way. Its purpose is to support designer's decision making by providing the means to record and communicate their argumentation and reasoning behind different decisions and the design process.

This is done by documenting the reasons behind a design decision, its justification, the alternatives you have considered, the evaluations of the different trade-offs, and the argumentation that led to the final decision.

The design method is considered to give good results and has a lot in common with autonomous analysis, but is not commonly used.

There are different ways of using design rationale methods. Some of the key distinguishing features are:

- How the data is captured,
- How it is represented, and
- How it can be used.

The data capture methods can be divided into two categories, User-Intervention-Based Capture and Automatic Rationale Capture.

In User-Intervention-Based Capture the designers must manually record the design information during the design process. This can be done by using documentation to record the history of design activity and later to assemble it to a report. The information recorded in the report is as follows: what decisions the designer made, when they were made, who made them and why. The creation of the report is most commonly done after the design process, so that the documentation merely records decisions, without influencing the designers thinking process leading to the decisions.

In Automatic Rationale Capture the documentation is performed automatically, i.e. there is a predefined way to capture the communication among the designers and the design team. This is done to extract design rationale and decisions as they evolve during the design process. The tools used for this includes; for example; tape recorders, video cameras, e-mails and other techniques to capture oral discussions as well as writings and drawings exchanged between designers. The goal is that designers do not need to do anything more than work with their usual design activities.

As with most parts of design rationale, there exists different ways to make representation schemes. The goal they all have in common is that they should help designers to re-use design rationales. A good representation scheme can help you save a lot of time if you work with a really big project, and want to know why something was done in a specific way, or if you are working with a project similar to something that has already been done with help of design rationale and want to know the reasons behind their decisions. The results from design rationale can be used in many various ways, some of which are:

- Design verification – When you use design rationale to verify design decisions and the artefact you created.

- Design evaluation – When you use design rationale to evaluate various design alternatives discussed during the design process.
- Design maintenance – The design rationale can be used to help determine changes that are necessary to modify the design of an artefact.

I think the big advantage with design rationale is, that you can always answer how and why something is done in a specific way, and what alternatives have been considered. This is extra important when you want to motivate your decisions for users and clients.

The drawback for design rationale in my opinion, is that it is more of a design philosophy than a design method. You do not have a specific way of doing things and you have to use it in combination with other forms of design support tools. It also implies that a lot of work needs to be done if you change a major part of your design, because then you may have to redo your reasoning for all the different alternatives you have considered.

I think all this extra work and the absence of specific ways motivates a lot of designers not to use it.

Autonomy and heteronomy

Autonomy and heteronomy are two different ways of thinking when facing a problem. These two models of how people think when solving problems are an important part of the method for solving ethical and moral problems that has been advocated by Iordanis Kavathatzopoulos for around 10 years. I will describe the method below, after a short introduction to the two models (Kavathatzopoulos, et al., 2007).

Autonomy

Autonomy is a reflective and systematic psychological process used for solving problems and making decisions. You can say that the mental process for autonomy is pure reasoning without any influences of authorities. By supporting autonomy and blocking heteronomy -you have a better chance to make supported and well-reasoned decisions. An example of when it is important to try and think in an autonomous way could be if you have to develop a product for someone with a disability. Because if you do not have the same disability it is hard to know from your own experience how they want it to work.

Heteronomy

Heteronomy is thinking constrained by previous experiences and knowledge, rules, biases and authorities. It can help us make fast decisions that will help in everyday situations, but can be

a burden when you are faced by a problem from a field that you lack experience in. It can also block us from seeing a problem from different angles and perspectives. An example of when it could be of an advantage to think in a heteronomous way could be if you are an architect and your employer gives you the task to make the plans for a bridge that they want to be similar to the last bridge you made plans for. In this case your experience from your earlier work will speed up the project and be a great asset.

Autonomous analysis

Autonomous analysis is a method that helps you to see the broader perspective of the problem you are facing. By using the methods behind autonomous analysis, it can be expected that you find a lot of stakeholders and different interests that you could otherwise have missed. Hopefully this will help the designer to find the important values for the design, but it also means that you will find a lot of irrelevant stakeholders and relations between stakeholders, which makes it easy to become overwhelmed. Some design methods see this as a problem and propose delimitation of the design project instead. The agile methods like extreme programming use delimitation in the beginning of their iterative process (Ferre et al., 2005).

But how do we know that we do a delimitation of the right parts of the project we are working with? That we are not missing any important parts? Experiences can help here, but you can never be sure that it is enough. When going by experience, we are comparing with similar problems and using personal preferences. But how do we now that those are the best solutions?

I also think that autonomous analysis could be good when you need to motivate why you want to design a product in a different way than the user or customer ordered it. The reason for this is, that you in an easy way can show how the changes you suggest can affect the different stakeholders and their interests.

Examples of information that you may find when using autonomous analysis are:

- If the users know what they really want from the product/design.
- Have they found all the important user values?
- Does the product work well even when the user is under a big cognitive workload?
- Which of these different solutions is most economically feasible?
- How is its compatibility with other similar programs and different hardware?

One of the greatest advantages with autonomy analyses for design decisions is that you get a tool that can both help you with developing designs and handle the ethical aspects of the project at the same time.

Even though I believe that autonomy could work as a good design tool for most kinds of work I think that it is less suited for some. It is probably easier to use other design methods if you are making a new version of an old program, or making a program that has as a goal to be similar to another program, given that the method is common-sense and simple.

The big question that I ask myself when I start looking into autonomous analysis is why, even with all its advantages, autonomous analysis and similar methods aren't commonly used?

Similarities between Autonomous analysis and Design rationale

In my opinion, autonomous analysis and design rationale have some similarities in how they work. In autonomy analyses you look at different stakeholders and their interests and relations to find out reasons, justification and arguments for your decisions.-

In design rationale, you evaluate all your work so you can show what reasons, justification and arguments that were the cause for your design.

There are also similarities in the final outcome; the difference is how you get there. When design rationale is like a design philosophy that tells you how to document your work in a structured way to easily see the reasons, justification and arguments behind your decision, autonomous analysis is a design method that helps you find out the same things by following a specific path while developing your design.

The reason why I think that autonomous analysis could work better than design rationale is because you get clearer instructions on how to work with autonomous analysis and you will get the tools to give good arguments and a way to design in the same method.

I also think that it will be easier to make changes in autonomous analysis than in design rationale if there is a radical change. In design rationale you may have to re-evaluate much of your work because the reasons behind a design could have changed. In autonomous analysis you may need to update and change your stakeholders and after that it's quite easy to see what kind of impact the change has.

Method

In the beginning of my master thesis I had a very experimental approach to autonomous analysis. I copied the procedure for how autonomous analysis is used for ethical problems (Laaksoharju, 2010) and used it with the goal of finding out which part of the method that works and which parts that needed to be altered to work better with the task of finding important values and making design decisions. I was quite sure that it would work well for finding hidden interests and stakeholders but did not really know how to change the interests and stakeholders to actual requirements and design proposals. By testing the method on a requirement specification, I hoped to find out which parts work, and which parts of the method are in need of some changes.

To perform the analysis I used EthXpert, which is a tool constructed for autonomous analysis of moral problems. EthXpert's most important feature is, that it neither makes nor proposes any decisions, but instead is intended to supplement guidelines and guide those who make the decisions in the process to create as clear an idea as possible of the actual problem. By using this tool, the user gets help to organise and structure the problem.

Analysing a requirement specification

The first step in trying to find a theoretical model for using autonomous analysis for design solutions was to look at and evaluate a requirement specification.

Even if analysing a requirement specification is different from analysing a whole project from scratch, we hoped to get some insight into how autonomous analysis could work.

Our goal was to read the objective and the general descriptions of the project and try to do our own analysis by using the methods of autonomous analysis. We used the tool EthXpert to help us structure the work.

We tried the exact same approach as when you use autonomous analysis and EthXpert to solve ethical problems.

The first step was to define as many stakeholders as possible with their respective interests

as possible. We did this by brainstorming together. As second step we defined interests for these stakeholders, based on their respective roles in the organization and in the development of the system. Third, we analyzed the relationships between different stakeholders, based on the identified interests.

As a last step we made a comparison of our analysis with the requirements in the requirement specification by mapping the requirements to the different interests we found for the stakeholder.

Analysing GADD

The analysis of GADD is done in EthXpert. The process of analysing an artefact in EthXpert can be divided into four steps:

1. Finding stakeholders
2. Finding interests
3. Finding relations
4. Looking for conflicts between different interests and relations.

We began by brainstorming for stakeholders on our own after which we merged the results and looked for more stakeholders together. The reason for this was to not influence each other too much in the beginning of the process.

Then we repeated the process for interests and relations. Interests are a generalisation of values, needs, goals and principles. Relations on the other hand can be different things, some examples are:

- How the fulfilment of an interest influences other interests.
- How an interest is influenced by other interests.
- How an interest interacts with other stakeholders' interests.

If it is unclear whether something is an interest or a relation, it can be good to consider if the interest addresses a specific stakeholder. If that is the case then it is probably a relation. After that we read through all information we had about GADD more thoroughly to see if the analysis covered what was written there. The reason for this was to find out if we had missed anything, and if we could conclude information was lacking in some areas, or if we had different opinions about how things should be done.

The final step was to look for conflicting interests and relations and trying to come up with ideas for solutions. We chose two different cases to analyse. This was done by looking at the cases and the conflicts in these and try to come up with solutions that have less drawbacks, creates smaller problems and fewer conflicts in total.

After that, we tried to come up with interview questions about the system based on our analysis, that would help us get a better understanding of the system and the intended users' needs. The reason that we waited so long with interviewing the users was partly because we wanted to see if we could get a good understanding of what they wanted from GADD with only the analysis, and partly because we had limited access to the users.

Interviews

When we prepared for the interviews with the employees at SKB's LOMA department, we divided our questions into four categories:

- *Present*: How the users work now, and how the system they use works.
- *Expectations*: How they hope that the new system will work, what expectations they have and what risks they can foresee.
- *Requirement specification*: Questions about the requirement specification.
- *Missing functionality*: Things we believe should or could be a part of the system.
- We tried to formulate the questions so that you could not answer them with a simple yes or no. We did the interviews by asking two different persons the questions individually. When needed, we asked follow-up questions, some times directly after a question and sometimes after the original questions in the concerned category. The interviews were recorded to allow further analysis.

Results

Results from pilot study

When we looked for relations between different stakeholders we found our first problem: We had used too specific interests for our stakeholders. By adding as many interests as possible we were thinking that we would avoid heteronomy but instead it led to too specific interests that gave us very narrow relations. An example of this could be the stakeholder publisher, his interest to be able to distribute information in a good and efficient way could be split up in a close to unlimited amount of specific interests as for example: font types, size on the text, a good way to search for topics, authors and content, good editing functions and so on. This approach would have forced us to have a close to unmanageable amount of interests so we went back to the previous step and started to merge interests to create more general interests that instead had a lot of different relations. An interest like the one to distribute information in a good and efficient way, can be given a lot of interesting relations to many different stakeholders, but an interest like a nice font type does not open up for any interesting relations or thoughts.

We found also another very interesting thing: The relations between stakeholders could probably work as our requirement on the system. If all the relations for a specific stakeholder were satisfied, the stakeholders' interests would probably be met to. An example of this could be if stakeholder 1 has the interest to distribute data and stakeholder 2 has the interest to get that data, one requirement on the system could be that stakeholder 1 must be able to give the data to stakeholder 2. Another interesting thing was that the interests that we thought of as the most important were the ones with the most relations to other stakeholders.

One problem that remained even after creating more general interests for the stakeholders was that we did not have enough information about some of the stakeholders' roles to be able to map good relations to them.

When we made a comparison between our analysis and the requirements in the requirement specification, by mapping the requirements to the different interests we found for the stakeholder, the result was quite interesting: Most of the requirements were pointing towards the most important interests that we found during our analysis. But an interest that we thought

was important, was almost totally ignored in the requirement specification. On the other hand we did find out that we missed some stakeholders and some interests.

As a conclusion, I think it will work really well to use the methods of autonomous analysis to make a requirement specification. Still, we did make some mistakes during our analysis and got some interesting insights.

The most crucial of these was that we did not take enough time to find stakeholders and define interests in the beginning. The stakeholders and interests that we missed should have been quite easy to find if we just had read the objective and the general descriptions a little more accurately. A good lesson to learn was that stating many interests is not always more accurate than stating a few well-formulated interests.

I think that one way to find the relevant stakeholders in a reasonable amount of time is to start with a brainstorming session, where each member is sitting on her own or in small groups and when everyone feels that they can not come up with more stakeholders, or the time you set for looking at stakeholders on your own is up, you merge every group's stakeholders into one big group to see if you can find any more stakeholders. By working in this way I think that you will reduce the risk that you influence each other with your ideas and miss something that could be important.

The insight that relations probably can be used to check if an interest is fulfilled was for me the most important discovery.

I think we managed to find things that would have improved the requirement specification even though we made some initial mistakes. This shows that our method probably would work for the process of making or analysing requirement specifications.

How the method would work if you were to develop a design from the beginning is hard to tell from this experiment but I think it has some potential.

Results from analysis of GADD

We have learned a lot by reading about autonomy, heteronomy, methods similar to autonomous analysis and testing our theses on a requirement specification, but to learn anything about if the model really could work we need to test it on a real project.

The project we got to look at was the development of GADD, a database system that will be used by SKB (Swedish Nuclear Fuel and Waste Management Company) to keep track and aid the handling of radioactive waste from power plants in Sweden. Before GADD they had a

database called Triumf that they were not fully satisfied with.

GADD is supposed to become a big database system that links together databases from all power plants in Sweden, and all departments of SKB, so we decided to only look at a small part of it.

The part we choose to look at is the functionality that is used by the department for low and intermediate level radioactive waste called LILW (LOMA in Swedish).

Our first step was to have one person from SKB's LOMA department to come and tell us about what they are doing at the LOMA department. Their work is to find out ways to handle the LILW (low and intermediate level radioactive waste) waste that are accepted by Swedish radiation safety authority (SSM) and their ultimate goal is to find a way for final storage of radioactive waste. The department is working a lot with writing reports and making prognoses of how different kinds of LOMA waste will behave over the timescale of 10 000 years.

One interesting thing that came up during his presentation of their work on SKB LOMA department is that they still find out new things about LOMA waste that can be of importance when handling the waste.

So the information we got from the presentation that could be of use when trying to find improvements for GADD was that the database is going to do a lot of computing. It will also need to be easy to update because they will need to be able to alter their equations and the data they save in the database if they find out that more information about the waste is needed. Finally it must also be easy to include information from other databases. We also did some reading about the work of SKB (SKB, 2009; SKB, 2010).

Our next step was to look at the requirement specification for GADD. After reading the requirement specification we saw that the parts handling the graphical interface were written in a vague manner. We decided to make an analysis of GADD before we went and interviewed the users at SKB and afterwards we added the information from the interview to our analysis. The reason for this is that we wanted to figure out good questions for the interview and that we did not want to be too influenced by the future users in the beginning of our analysis. The optimal way of doing the analysis would probably have been to do it together with the users, but they did not have time for that.

We did our analysis with help of EthXpert and we started by brainstorming stakeholders on our own, and when we had gathered as many stakeholders as we could find in a reasonable amount of time we merged our results. After that we had a look at all the stakeholders

together to see if we could find any more, or if we should change or merge the ones that we had already found. The final result can be seen in Figure_1. Then we repeated the same procedure, but this time to add interests and their relations. Our next step was to check our interests and relations against the requirements of the requirement specification, to see if they covered what was written there. The reason for this is to find out, if we had missed anything, and if we could conclude the requirement specification was lacking in some areas, or if we had different opinions about how things should be done.

The only stakeholder we found that was not in the requirement specification was the general public. We thought that they were important stakeholders because they are the ones that SKB tries to keep safe with their work and they are the ones who pay for the energy from the power plants.

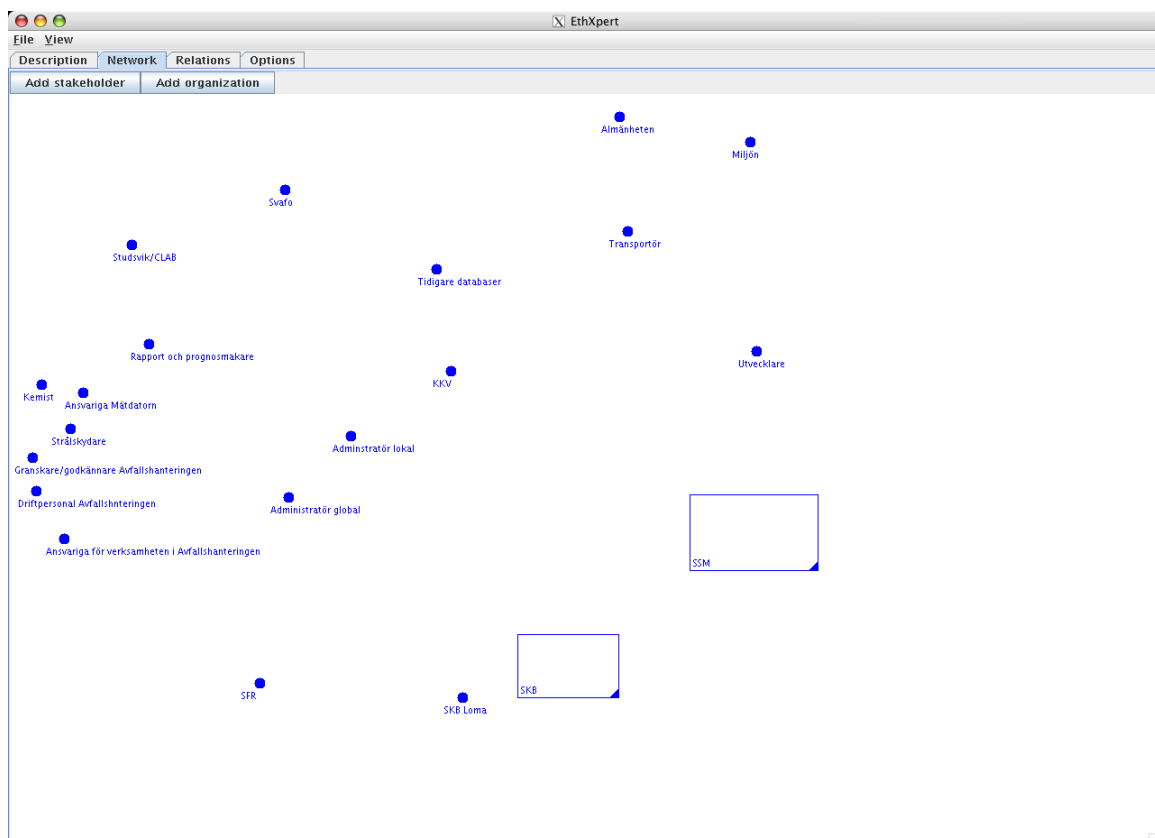


Figure 1: *This is a picture of the stakeholder tab in EthXpert. From here you can add more stakeholders and give them interests and relations.*

A lot of interesting things came up while working with finding interests and relations. In Figure 2 can you see how the interests and relations are presented in EthXpert. The first thing is, that it is very important that the database handles data in a correct way and that it is easy to update the system. The safety systems for the database must also be very good because it will include a lot of important data. It also becomes quite obvious that it is very important to be

able to navigate the system in an efficient way. The database will need both a good search system, for finding data and locations of the waste package, and efficient functions to show a lot of important information at the same time. SSM is monitoring all the work of SKB and when the database is as big and important as GADD probably will become, then it also becomes important that SSM will be able to easily find and check information in order to make decisions regarding the work of SKB.

| _GADD will also include the information from a lot of other databases, so it is also of importance that it has good functions for merging data from old databases.

As mentioned earlier we thought that information regarding how the interface should look was a little bit vague after we read the requirement specification. While working with the interests and their relations, that feeling just grew stronger.

We could also see that the nuclear power plants had a lot of involvement with the other stakeholders that we thought was of importance.

While working with interests and relations with the autonomy analysis one also sees some of the ethical aspects of what one is doing. Even if we concentrated on technical and design issues some ethical aspects are interesting to mention. I think that the general public is interested in knowing what happens with the radioactive waste from nuclear plants and that they should be entitled to some data on what's happening on SKB and the nuclear power plants in Sweden. The information needs to be presented in such a way that it is easy to get hold of and understand._

Description	Network	Relations	Options	SSM	Almänhet	Miljön	Utvecklar	Administr	Ansvariga	Driftpers	Granskare	Strålskyd	Kamist	Ansvariga	Rapport	Stadsstyr	KKV	Tidigare	Svarof	Administr	SKB	Loma	SFR	
Transport	Utföra	Vill ha korekta och tydliga instruktioner i																						
SKB	Känna sig	Vill vara säkra på att det inte är farligt att																						
	Gott	Allt avskalat																						
	Säkert	Allt baka																						
	Häntera	Allt																						
	Bygga i	Så att det är																						
	Bra	Allt																						
	Klara	Skulle det bli																						
	Smidigt	Utbildning																						
	Prestanda																							
	Upppfylla																							
	Lät att																							
	Bra	Så man kan																						
	Komma																							
	Utföra	Allt fram																						
SSM	Ha insyn	Så att man kan kontrollera uppgifterna man																						
	Kunna	Man vill kunna litte på att databasen gör rätt																						
	Ha ett	Man vill vara säkra på att obehöriga inte																						
	Översikt																							
	Lät att																							
	Säker	Att SKB kommer fram till en säker metod för																						
	Ekonomi	Att genom SKB få in pengar från KKV ägare.																						
	Gott rykte																							
Almänhet	Känna sig	Vill kunna få tag på information om SKB:s																						
	Säker	Vill vara säkra på att försaren verkligen																						
	Miljön	Ta så																						
	Utvecklar	Veta																						
	Vidare																							
	Gott																							
	Tjena																							
Administr	Utbildning																							
	Kunna	Underhålla systemet och ha koll på																						
Rapport	Få in och																							
	Kunna																							
	Bra	Kunna litte på att beräkningarna som görs i																						
	Utbildning																							
Stadsstyr	Säkra på																							
	Veta vad	Skall kunna medela SKB om hur mycket																						
	Förvara																							
	Få																							
	Häntera	Veta när och hur kollin kommer att komma,																						
	Lämma	Ha ett bra och säkert sätt att lämna ifrån sig																						
	Gott																							
	Säkert	Vill vara säkra på att databasen inte blir																						
	Utbildning																							
	Häntera																							
	Känna	Vill att slutföraren ska vara så billiga som																						
	Lät att																							
	Administr																							
	Kunna																							
SKB Loma	Kunna																							
	Säkert	Fällgode SKB: mål																						
	Möjligheter																							
	Smidigt																							
	Häntera																							

Figure 2: This is the relations tab. From here you can see a diagram of all the relations and their interests. It is used to get a general idea of how different interests and their relations interact with each other.

One function that we thought was important and was not even mentioned in the requirement specification was the ability for SSM to check the database without going through people at SKB.

When looking at the requirement specification for the interface with our relations and interests in regard we came to the conclusion that they were written in a vague way because SKB does not really know how they want the interface to be designed.

The requirement specification emphasized the importance of a good search function but also there we thought they were a little bit vague about how it should work. I think that this is a side effect from having a vague interface design. If you do not now how the search function will look, I think it is hard to know how it should work (Torgny, 1997).

Two requirements that we thought were strange when we analysed the requirement specification was that SKB wants 3D_maps of their radioactive waste disposal sites, and a history state of the database where you can go back in time to whatever date you choose and navigate the database as it looked at that specific time. We decided to evaluate those two requirements a little bit closer to try to find out if they were really needed and if we could find

any alternatives, Figure 3.

The reasons that we thought that the 3D_map sounded like a strange idea is that we believe it could be expensive to develop 3D_maps of all the radioactive waste disposal sites, and the fact that they do not know for sure how they will look like. This in combination with that we could not see why they needed the 3D_maps made us check this requirement. For the history state, we thought that it sounded strange to be able to rewind the system to any optional time and then navigate the system as it looked during the selected period. Why do they need something like that?

When trying to find alternatives for those requirements, we looked at the interests of the stakeholders that we thought was affected of the specific requirement and tried to come up with an alternative that we believe would fulfil their interests. Then we checked which of the alternatives we thought best fulfilled the different interests and relations and at the same time had the least amount of contradictions to other interests. We did this by using EthXpert's options function.

It works like following: you add the different options that you want to analyse and then you go through the list of interests and check which interests are fulfilled by a proposal, and which interests are in conflict with the proposal. The goal of this process is to get a good overview of the pros and cons of different designs, and to discover conflicts, so that you can make justifications for your decisions.

Add option	Fork option	Description	Network	Relations	Options
		3D-karta			<p>3D-karta</p> <p>Detaljerad märkning av kollin</p> <p>Historikläge</p> <p>Loggbok</p>
Transportör	Utföra TRAM				
SKB	Känna sig säkra				
	Gott rykte sammit säkerställa				
	Säkert system för hantering av	Eventuellt kan det höja säkerheten att operatörer har tillgång till en			Kanske kan ge bra översikt över hela databasen
	Hantera allt avfall från KKV på ett	Om avfallet behöver flyttas så kan det vara bra att ha en exakt			Enkelt att kunna se och ändringar som gjorts
	Insyn i KKV värksamhet				
	Bra verktyg för att ta imot och	Kanske allmänheten förstår bättre med en visuell representation.			
	Klara ekonomin	En lösning med 3D-kartor torde vara dyrare att ta fram än en enklare			Borde vara billigare lösning
	Smidigt att föra över data från	Hur överlätt man gör att man får information till 3D-modellen?			Har ska gammal data från tidigare databaser
	Prestanda krav	Beisstår antagligen systemet mer.			Borde vara lägre prestandakrav
	Uppfylla SSMs krav				
	Låt att uppdatera och underhålla	Hur underhålls detta?			Borde vara lättare att underhålla
	Bra funktioner för att kunna se	Verkar vara svårare att få historisk överblick i en 3D-karta.			Lättare att se hur databasen har utvecklats
	Komma på ett sätt att förvara avfall	Svårt med 3D-karta om man inte vet hur förvarat ska fungera.			
	Utföra TRAM				
SSM	Ha insyn i SKB:s värksamhet				Kan vara bra om dom vill göra ospecifika
	Kunna lita på rapporter				Bli gå snabbare att söka om man vet vad man
	Ha ett säkert system				
	Översikt över vad som finns förvarat				
	Låt att kunna kontrollera rapporter*				
	Säkert förvaring av avfall				
	Ekonomiska intressen	Borde vara dyrare			Borde vara dyrare
	Gott rykte				
Allmänheten	Känna sig trygga				
	Säker framtid				
Miljön	Ta så lite skada som möjligt				
Utvecklare	Veta exakt vad databasen skall klara	Detta kan garantera vidare samarbete eftersom det antagligen inte är			
	vidare samarbete	Det ser säkert modernt och avancerat ut med 3D-modeller. Därför kan			Men avseendet med historikläge. Därför kan det
	Gott rykte	Mer arbete ger mer inkomst.			Men arbete ger mer inkomst.
	Tjäna pengar				
Administratör global	Utbildning				
	Kunna utföra sina uppgifter på ett				
Rapport och prognosmakare	Få in och hantera information om				Kan vara bra om man behöver en massa olika
	Kunna lita på mätdata				Borde underlätta sökning i gammal data
	Bra system för att hantera rapporter	Gör det kanske enklare att generera snygga rapporter.			Borde underlätta sökning av gamla rapporter
Studsvik/CLAB	Utbildning i systemet	?			Kanske kräver mer detaljerskaper än
	Säkra på att framtida förvaringar				
	Veta vad som finns kvar	Det kan vara lättare och smidigare att hitta exakt rätt kollin med stöd av			Kan ge en bättre överblick över vad alla kollin
	Förvara och hantera idagligt lag-				Borde vara lättare att kolla upp information om
	Få relevant information från KKV				
	Hantera TRAM-info från SKB				Kan ge en bra överblick över alla transporter
	Lämma från sig avfall				Kan ge en bra överblick över alla transporter
	Gott rykte				
	Säkert skydd för värksamheten				
	Utbildning				
	Hantering av kärnbränsle				
	Känna pengar				
Tidigare databaser	Låt att föra över information till				Lättare att läsa över gammal information
Administratör lokal	Utbildning				Borde gå lättare till en logg bok
	Kunna utföra sina uppgifter på ett				
SKB Loma	Kunna hantera information om lag	Hur får man överblick? Hur visar 3D-modellen mängd? Hur visar			
	Säkert förvaring av avfall				
	Möjliggöra tillgång till olika data				
	Smidigt sätt att sammanställa och				
SFR	Hantera avfall i framtida slutförvar	Hur ska man göra 3D-karta om man inte vet hur framtida slutförvar ska			

Figure 3: This is the options tab. From here you can make different proposals for designs and make comparisons between them.

The alternative we had for the 3D map was to have a detailed tagging of the waste packages. This can be achieved by having a list of all the packages in the disposal site where they have exact position parameters and their most important features as a header. The reason for this proposal is that we believe that it will give enough information about the packages and it would still be easy and cheap to develop.

We started by looking at all the pros and cons with a 3D map. The pros we could find were:

- May be easier to see where in a disposal site a specific waste package is located.
- May be easier and faster, and thereby safer, to find the waste package if you need to enter the disposal site for any reason.
- Could make it easier to generate good-looking reports.

The cons we could find were:

- In need of a good update function so that it always shows correct positions. (Could be very confusing if it did not update correctly if a package was moved.)
- A lot of graphical information should be shown at the same time, which can result in

a hard to read interface that can encumber the system.

- How would it handle the history mode?
- How to start working with a 3D_map of final disposal sites if it is not decided how they would be constructed.
- Probably expensive and time consuming to develop.
- Is it really easier and faster to find a package by looking at a 3D map than searching in a list?
- Then we checked out the pros and cons in a detailed tagging of waste packages. The pros we could find were:
 - Cheaper and easier to develop. (May already exist in some form.)
 - Lower load on the system.
 - Easier to add old data.
 - Easier to update.
 - Easier to get a historical view.

The con we could find was:

- May need more detailed knowledge about waste packages.

Next up was looking at the historical mode, and evaluate it against one other alternative we thought would work. The alternative we came up with was a kind of record where all the changes were saved and where you could look up information as it was prior to changes, for prognoses, reports, waste packages and so on. We thought this would give enough information without needing to rewind the whole system.

As with the 3D map, we started with looking for pros and cons for the different suggestions. We started with evaluating the historical mode. The pros we could find were:

- Will give a good overview of how the database has expanded.
- May be good if you do not know exactly what you are looking for.
- May be good if you need a lot of different information from a specific time.
- May be good if you need to know where a lot of different waste packages were located at a specific time.

The cons we could find were:

- How will data that earlier was located in other databases, from before GADD, be handled?
- May be expensive to develop.
- May take unnecessarily long time to check old data if you know what you are looking for.

Then we did the same with the historical record. The pros we could find were:

- Easy to see where and when changes has been done.
- Fast and easy to search for changes.
- Easy to implement old data from other databases.
- Less restraining on the system.
- We believe it is cheaper to develop.

The con we could find was:

- May take longer time to search if you do not know what changes you are looking for.

After the analysis it was time to motivate why we thought that one of the options was better then the other.

First out is 3D map vs. detailed tagging, and we decided that we believed detailed tagging was the better alternative. The reason is that we thought that it is cheaper to develop, easier to update, has lesser strains on the hardware, gives a better overview of the package that is in the disposal site and it gives a sufficient information regarding the physical location of different packages and the free space of the disposal site. It may give a little less accurate view of how it looks like on the disposal site but this does not make such a great difference that we think it motivates a 3D map.

Then it was time for historical mode vs. historical record, and even in this case did we believe our own alternative was better.

We thought that the historical mode would require a lot of hard drive space, be hard and expensive to develop in an efficient way and we could not really see any benefits of rewinding the whole system. A historical record on the other hand would probably be quite

easy to develop, and be easy to use. You could easily see what changes that have been made for different data types and when and how many times the data has been changed. The only downside we could think of was that if you do not know exactly what kind of change you are looking for but have a hunch about when it was made, then it may be easier to find the change with the historical mode.

For both the overview of waste disposal sites and how to browse in old data, we choose our own alternatives. Maybe we had the opinion that our own solutions were better even before the analysis, so it became a little bit of a self-fulfilling prediction but I think we found some arguments that emphasises our own proposals.

Meeting the users

After coming this far in our analysis we thought that it was time to go and talk with the intended users of GADD at SKB LOMA to see how accurate our analysis was, and to see if the problems we thought existed were real or not. We also wanted to see what we had missed regarding how they work, and what their expectations on GADD are. To get the most out of the appointment it was important that we were as prepared as possible.

The best scenario would have been if we were able to meet the people at SKB LOMA as much as we would need to, but we had to do with only one appointment.

To be able to get as much information from the meeting as possible, we looked through our analysis, to see what kind of picture it gave us of the organization. Our goal was to try and identify the parts that the analysis pointed out as important, and to find as many relevant questions as possible about those parts. We also tried to identify what parts of our analysis that we thought were lacking so we could make further inquiries. We also tried to find questions that would help us to compliment our picture of how SKB LOMA would work with the database.

Our picture of the system before we met with the employees on SKB LOMA was, that they wanted a more effective system than before with a better interface and more efficient search functions, that they wanted to have a good overview of all the waste packages, both composition and location of them, that they wanted to be able to track information back in history and that the reports and the forecasts will be easy to modify if new kinds of data turns out to be of importance. We also believed it would be good if it was easy to generate different kinds of reports depending on who it was meant for and we thought the security of the system has to be high since it will include important information.

An effective way for SSM to inspect the work of SKB could also be of use.

So far so good but from reading the requirement specification and the talk we had with one of the employees at SKB, we had a feeling that they were not sure how all this could and would be achieved.

The questions that we came up with was divided in four categories:

- *Present*: How they work now and how the system they use works.
- *Expectations*: How they hope that the new system will work, what expectations they have and what risks they foresee.
- *Requirement specification*: Questions about the requirement specification.
- *Missing functionality*: Things we believe should or could be a part of the system.
- The questions can be found in Appendix 1 (in Swedish).

At SKB

While in the office of SKB LOMA, we got to interview two persons. Both interviews were really informative and we had the luck of interviewing two different kinds of users.

One of them was not really interested in how the system would work as long as it did work and wanted things simple, the other one on the other hand wanted to be able to double-check things and wanted to feel that he was the one in control.

We felt that our analysis of what they wanted from the system was quite accurate but a lot of interesting things came up during the interview.

Both of them agreed on some parts and had different opinions about other parts of the system. Our interpretation of what they both wanted from the new database is as follows:

For the structure of the database interface, they wanted to be able to show more information at the same time and wanted to have better access to different functions (less clicks with the mouse) than they have in the current database. This was not stated in the requirement specification, but when they described and showed pictures of their current interface (Figure 4) this became quite obvious. And when we asked them if this was what they wanted, they answered yes.

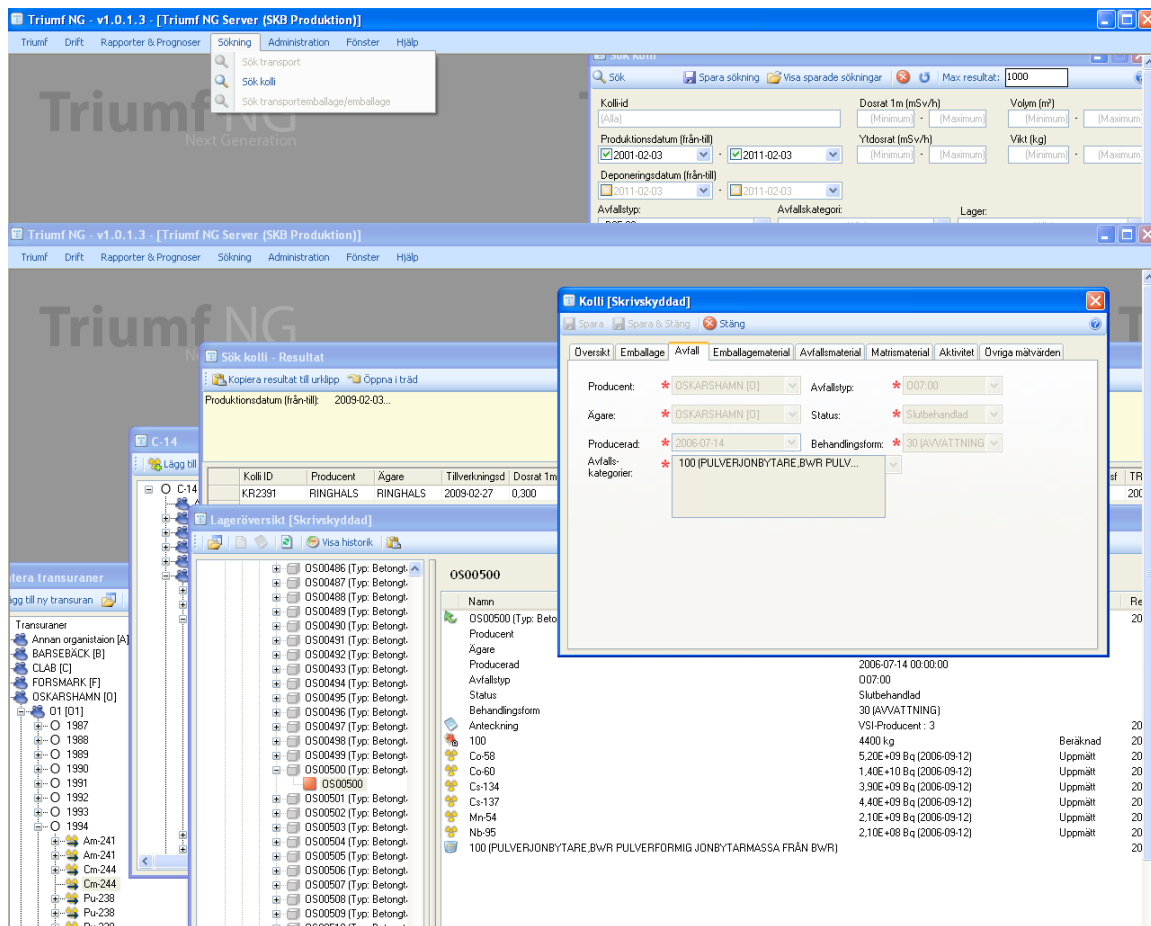


Figure 4: This is a picture of what it can look like when they work with their current system. All windows may include information that they need.

They wanted the new search functions to be very detailed and accurate and at the same time provide a good overview. As well they wanted better functions for generating reports and forecasts, including having more well-reasoned predefined reports and forecasts, better assurance that you can rely on the computing the database will do when you make your own adaptable reports or forecasts, in combination with better traceability of what settings that was used in predefined reports.

Another function they both wanted that came up during the interviews was the ability to check on but not be able to alter what other parts of SKB and the KKV's (nuclear power plants) were working on. This revelation came after both of the employees were given the question "How is a normal day at work?" The answer from both of them was that the first thing we do when we start our workday is to answer questions from the KKV's where they ask why we need different kind of information. When we asked them why they believed it was this way, they answered that they believed the people working on different KKV's did not have any understanding of why people on SKB needed some information, and people on

SKB do not know the workload behind finding some information. The amount of questions, and thereby the time that is needed to answer questions and ask for information would be shorter if both parts would have a greater understanding of each other's work. Later in the interview other cases of communication problems between different parts of the organisation came up that further emphasise the use of an observation function, but more about that later.

The functions they disagreed on was about the database's computing functions, one of them did not want to be able to alter the different equations and functions in any way, because she was afraid something would go wrong. The other one was worried of the opposite, he was afraid that if he couldn't alter the different equations and functions, then something might go wrong. In the end, I think, it comes down to two different perspectives on the same problem, they do not trust the way the current database handle data.

To give SSM the ability to login to the database was something that both of them thought is a good idea. A function like this does not exist in their current database and it once happened that SSM wanted SKB to print out the whole database on paper, I think this is a sign that a function like this is needed. They also mentioned that the people on SSM could use the function to see how the different functions in the database worked so that they got a better understanding of the work they do at SKB.

We also asked them if they wanted the possibility for people that work with GADD to login remotely, and after some discussion the answer was that it would be useful to be able to login from a distance and browse the database, but when you login in this way you will not be able to change anything because of the safety risks.

On the questions regarding how long the learning period should be, both answered that for the basic functions, the learning period should be just some days, maximum a week for learning all basic and everyday functions. For the more complicated functions they answered that it was okay if it took longer time but maximum a month.

When we asked them why they needed a 3D map, they couldn't give us any good answers, the greatest reason for this was that the people working at the disposal sites wanted an easy way of showing people working at the office in Stockholm the amount of free space in a specific storage room. But they thought that this was mostly a communication problem between different departments and that the problem probably could have cheaper solutions.

One thing that we noticed was that they again mentioned communication between different parts of the organisation as a problem. I think that this is a sign that the new database should

be developed with facilitating of communication between departments in regard.

For the historical mode on the other hand, they had a very good reason to have it. Because safekeeping of nuclear waste includes new technology and science, all relations between different readings regarding radiation are not known yet. This results in that they do not really know what parts of the database they need to rewind if they want for example to recreate a calculation in order to look at some readings again. To be able to guarantee that the result is based on the same premises as when you did the calculations the first time, they need to rewind the whole system.

I think the history mode is a strange solution, but I cannot come up with anything better that can guarantee the same results, so until there is more knowledge of how the decomposition process works, it may be the best solution.

To our questions about reports to the general public, they answered that they do not make any reports that are addressed to the public, but all reports that they hand in to SSM are accessible for the public. So reports already exist that everyone has access to although they are written in a technical language.

Aggregation of results

	Initial analysis	Observations and interviews	Conditional comments
User interface	The employees were not sure what they wanted from the new interface, and did not know what it should look like.	Their main problem with the current interface is that their monitors get too clustered with information, and that they have to do too many operations to use different functions.	The information problem, but not the access problems, could be solved by bigger monitors. In the requirement specification they want a Windows standard on the interface, but I believe having a Windows standard right now is causing the problems.
Communication	There are a lot of relations between the nuclear power plants and SKB.	A lot of time is spent on solving/discussing problems that arise because of poor understanding of different departments' tasks.	An observation mode where you could look at what other departments are working on could help here.

Supervision by SSM	SSM wants to be able to check the work of SKB in a discreet but effective manner.	SKB did not have any functions to help SSM observe what they are doing.	An observation mode for SSM similar to what I suggested for different departments could be good.
Login remotely	The users could be interested in logging in remotely, to be able to work from home or other places.	It might not be a good idea from a safety perspective.	Maybe an observation mode to just check on data, not alter anything could help.
Detailed tagging	Instead of the 3D map - a cheaper and simpler solution.	SKB were not sure why they needed a 3D map. A reason could be poor understanding of how it looks like at the disposal sites.	I think detailed tagging is a better solution than a 3D map. There are better ways to get a greater understanding of the disposal sites than a 3D map.
Historical record	Instead of the history mode, it would probably be faster to check what you want. Cheaper and simpler.	The problem is, that nobody knows exactly how different types of nuclear waste interact. So to be sure everything goes right, all data must be possible to rewind.	The history mode is required right now, but I think it will not be the best solution in the future.

Discussion

The interviews went really well and most of our questions gave some kind of interesting information. Some of the questions may have been too specific, and for some of the questions we may have drifted away a little bit from the purpose of the database.

When we looked through our answers after the interviews, I reckoned that it was one question that we missed that I think would have been interesting to ask, and it was to which degree they felt that they needed a new database. They had a lot of complaints on the previous one but that does not necessarily imply that all of it is bad.

I think that the picture we had of GADD was quite accurate, the only thing that I felt we really missed was that we did not understand the problems that came from the fact that the handling of nuclear waste is still a field that is under development. No one knows exactly how different materials can interact and what data about nuclear waste that is of importance.

An example of that we did not understand how this can affect the system is the fact that we missed the greatest reason for why they wanted the history mode.

Some of the problems they have with their current database may also have cheaper solutions than developing a new database. One example of this is that using bigger monitors could solve some of their interface problems.

In the requirement specification they wrote that the new interface should follow Windows standard, but one of the problems they have with the current interface is that they have too many steps for computing different commands and I think that its to some regards because the database they have right now follows the classical Windows architecture. A good thing may be to let the interface move away from the classic Windows architecture, if it helps to solve their interface problems.

The impact of autonomous analysis

So I think that we could make up a fairly good understanding of how they want GADD to work, especially after the interview, but the interesting question is if this is due to our autonomous analysis or not. I think that we could give a lot of the credit to autonomous

analysis and I am going to try and motivate why.

First up is the way the search for stakeholders and interests helped us find some interesting insights. It was during this phase that we discovered that SSM probably could have use of accessing the database, something we may otherwise have missed. Our suspicions about the 3D map and that they might need help to formulate and find out how they want their graphical interface to work also came up during this phase.

The way that it helped us was by making us go through data more carefully and thereby seeing these things that I believe we otherwise might have missed.

We also found some interesting things when looking for relations between stakeholders. We could see that the nuclear power plants were involved in a lot of relations. We could not exactly see in what kind of way this could influence the design of the database but it gave us enough information to be alert for information about power plants when we interviewed the users. During the interview, information about the power plants came up and after some attendant questions we came up with the idea of the observer mode.

To actually look through all relations and consider what kind of impact it can have, even if you do not see anything special with a relation at a quick glance, made us aware of this.

The options part of the analysis also helped us to formulate questions that gave us a better understanding of how GADD could or should work.

Looking for relations helped us to come up with an alternative to the 3D map that I think is good, and it made us look at the history mode. Even if we may have missed the purpose of the history mode, the analysis of it made us ask the questions that gave us a lot of information on one of the big problems they have at SKB LOMA. Even if we did not have any answers to how you could find a better function to handle the history for the data in GADD, I think that it is important to have in mind that the history mode probably is not the best solution.

By doing all the steps that are included in this part of the analysis, I think we found out more than we would have done if we just would had started to ask questions about the different functions.

So even if we probably could have come up with a lot of the questions and some understanding of how the system worked without the analysis, I think our understanding of what they expected, wanted and needed from GADD would have been much poorer.

Thoughts about autonomous analysis

After working with autonomous analysis and reading about similar methods I think that my understanding of the advantages and disadvantages of autonomous analysis is much greater. In our studies we have only been able to look at a small part of a project, with limited access to the stakeholders, and I know that it is not enough to make any conclusions, but I will come with some assumptions for and against autonomous analysis.

Making an autonomous analysis will probably help you get a good understanding of how to design an artefact and how it shall work, but it can also be quite time consuming and if the designers have some understanding of what they are working with from the beginning, then it may feel like a waste of time.

When we tried to use autonomous analysis to evaluate the designs and functions of an artefact, one problem that came up was that when we tried to analyse it in a autonomous way, it felt like we always more or less drifted away to start looking at other aspects of the artefact. One of the points of autonomous analysis is to look at other aspects to see how they can influence the aspect you are analysing, in our case its design and functions. But I think it was hard to look at the different aspects with only the design in regards. It felt like the other parts always got more or less mixed in so that it never really was an analysis of only the design and functions of the artefact. This made the analysis a little bit messy and it felt like we always had things included that did not have anything to do with our original goal. It does not need to be a bad thing but if the goal is to look at the design and use of different functions it feels like a lot of energy and time is placed on other things.

Maybe autonomous analysis is best suited for analysing and getting an understanding of a whole design project and not as a tool to design after. The problem here is that the designers then must use autonomous analysis in conjunction with another design methods and that was one of the things I wanted to see if it could be avoided.

I think that autonomous analysis is best suited for big, hard to grasp projects with a lot of different interests and stakeholders that may be in conflict with each other. It is in that kind of projects that I believe that the risk to miss important data is the greatest, and therefore the need for some kind of analysis most important.

One of the greatest features in autonomous analysis is that you easily can include the ethical aspects of the project you analyse, and I think it would be easy to include even more aspects as for instance economical aspects. This is an additional reason why it can be good to use autonomous analysis for analysing a whole project and not just some parts of it.

A problem can be that you start looking at too many aspects when you do an autonomous analysis, so that you end up with a shallow analysis of many different parts but without a deeper understanding of any part.

The fact that you also still may need to have limitations on the amount of stakeholders you include in your analysis is a problem. The limitations can only be set by intuition and experience, both of which are limited by heteronomous thinking and thereby to some extent goes against one of the primary goals of autonomous analysis. I think that it is important to always have that in mind when using autonomous analysis, otherwise you may succumb to heteronomous thinking without realizing it. But I do not think that this is a problem for autonomous analysis only. All design models and techniques have their risks if you are not aware of their flaws. If you think that the artefact you are designing will turn out in a good way only because you use a specific model or design technique I think it is doomed to failure.

Autonomous analysis and agile methods

Agile methods are very popular when designing artefacts today. There are many types of agile methods but they all have some parts in common. They are all based on iterative and incremental development. An agile manifesto exists, that defines the approach of agile software development (Manifesto for Agile Software Development, 2001. Wikipedia: Agile software development, 2011).

The 12 principles that forms the basis for the Agile Manifesto includes

- Customer satisfaction by rapid delivery of useful software.
- Welcome changing requirements, even late in development.
- Working software is delivered frequently (weeks rather than months).
- Working software is the principal measure of progress.
- Sustainable development, able to maintain a constant pace.
- Close, daily co-operation between business people and developers.

- Face-to-face conversation is the best form of communication (co-location).
- Projects are built around motivated individuals, who should be trusted.
- Continuous attention to technical excellence and good design.
- Simplicity.
- Self-organizing teams.
- Regular adaptation to changing circumstances.

When using agile methods one of the goals is to deliver executable prototypes as fast as possible, and as I said in the beginning of my thesis, this can be a source to heteronomous thinking if you are not careful. Most agile methods have ways of avoiding this, but I think that autonomous analysis would be a good compliment for many agile methods.

I am going to use Scrum as an example (Schwaber and Sutherland, 2010).

Scrum is an agile framework that was originally invented to complete software development project. When using Scrum, people should work in small groups of around seven people where everyone has defined roles. The teams work in so-called sprints that are 2-4 weeks long with meetings before and after each sprint. There is also a Scrum Master and a Project Owner. The Scrum Master's goal is to keep the team focused on its goal, and the Project Owner's work is to ensure the value of the teams' work.

In Scrum, autonomous analysis could be a good tool for the Project Owner when he sets the priority of different items and searches for values. It could even be a good idea if he starts with the analysis before the first sprint. It could also be used during the Sprint Review when the Scrum Team together with the stakeholders discuss the next step in the development process. By using autonomous analysis in both steps, the risk of getting caught in one way of thinking is less than if the project owner is the only one to work with the analysis.

Conclusion

In this thesis I have tried to use the method Autonomous analysis for evaluating software design decisions. It was used to analyse two different requirement specifications with a focus on the design of the intended systems. My conclusion is that even if I found interesting results and learned a lot when making the analyses, I think that autonomous analysis does not really come to its full right and uses its full potential when used for analysing requirement specifications in this way. The reason for this is, according to me, that a method that is intended to look at and analyse a problem in its entirety wastes a lot of its potential if you only look at a part of a project, in this case a design analysis. I think that autonomous analysis is best suited for analysing whole projects and not just parts of them. I do not mean that you can not use the autonomous analysis method for analysing design decisions, only that if the scope is limited to that, the full strength of the method is not used.

An example of a problem where you can have full use of autonomous analysis is a big complex project with a lot of different stakeholders with complicated interests and relations. A project like this can have hidden stakeholders, with important interests, values and goals. Under those circumstances I think that autonomous analysis will be an excellent tool to use for getting a greater understanding that will help to develop a great product.

Future work

I think that there still exists a lot of interesting work before autonomous analysis is ready for use in bigger projects.

Here are some ideas about what to do to continue my work.

I think the most profitable thing is to test it on a small-scale project where it is possible for one person to analyse the whole project, maybe as a project-owner in a small project where they are using Scrum. This could give a great insight in how effective and useful autonomous analysis can be when evaluating a whole project and not just a part.

It would also be interesting to further try to use autonomous analysis to identify relevant questions for user interviews in bigger project. The reason for this is, that some problems may only be discoverable by asking “the right questions”, and autonomous analysis may be able to identify those questions. By checking the stakeholders that are deeply involved with other parts of the system, and thereby finding relations and conflicts that are vague and hard to find, perhaps this is possible.

Another thing to attempt would be to use autonomous analysis to identify goals/value for a project, product or industry. Some goals may be hard to formulate in an effective way and some can be hidden and hard to see when you start with a project. The goal can be to make something more efficient, but you do not know what to change.

This strategy could be useful for finding Blue Oceans. By using autonomous analysis to find new values for products and industries uncontested market space could be found, new demands could be captured, or the value/cost trade-off could be optimized. (Kim and Mauborgne, 2004).

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Appendix

Intervjufrågor

Nuläge:

1. Hur ser en vanlig arbetsdag ut?
2. Vilka delar av det nuvarande systemet använder du mest? (t.ex. sök i så fall på vad)
3. a) Vad är bra/dåligt med ert nuvarande system?

b) Används den nuvarande databasen för att göra olika beräkningar?

4. Hur navigerar du mellan olika funktioner?
5. Är det nuvarande systemet plattformsbaserat? OBSERVERA
6. Vilka sorters rapporter och prognoser gör du?
7. Hur kontrolleras, godkänns och kompletteras rapporter och prognoser?
8. Rapporten till allmänheten?
9. Vilka andra användargrupper jobbar SKB LOMA med förutom rapport - och prognosmakare?
10. Hur mycket insyn har SSM i er avdelning? (Hur har de insyn?)
11. Hur lämnas förslag in till SSM?

Förväntningar:

12. Vad förväntar du dig av den nya databasen? (Är det några ändringar ni är oroliga över?)
13. Vad vill du kunna lägga till? Vad saknas i dagens system?)
14. Hur vill du att gränssnittet är strukturerat.
15. Hur hårda är interfacekraven? Är dessa måste krav eller förslag på implementation? Vad är viktigast av att följa interfacekraven eller att försöka följa Microsoft standardhantering

16. Hur vill du att historikläget ska fungera för data som fanns innan GADD?
17. Hur vill du kunna söka i systemet? (intervall?)
18. Hur mycket tror du att databasen kommer att behöva uppdateras med nya funktioner framöver? Kommer ni att behöva de externa utvecklarna för att göra uppdateringarna?
19. Hur vill du att utbildningen i det nya systemet ska skötas?
20. Hur lång inlärningsstid kan ni acceptera?
21. Hur mycket beräkningar kommer databasen att göra?
22. Vill du att databasen gör beräkningar? Vilka? Hur?

Kravspecifikation:

23. Hur vill du att funktionen för anpassade rapporter och prognoser ska fungera? Måste anpassade prognoser godkännas?
24. Under sökning i 3.4.5 till vilken format vill du kunna exportera till?
25. Vart i databasen vill du att funktionen för att ska skapa/öppna formulär, rapporter och prognoser ska finnas?
26. Varför 3-D-kartor av förvarsplatsen? (Hur mycket vet ni om framtida slutförvaret?)
27. Historikfunktionen? Vad har du för nytta av att kunna navigera i systemet så som det såg ut vid valfri tidpunkt bakåt i historien? Är det tänkt att man ska kunna välja valfritt datum eller bara visa.

Borde finnas?:

28. Login_system. Bör det vara möjligt att komma in i systemet från distans? Hur gör leverantörer för att komma åt data/bidra med data?
29. Skulle det inte vara bra ifall SSM kunde logga in och se all information i databasen.
30. Sparas ekonomiska uppgifter också i databasen?

Avsiktsförklaring.

För vårt examensarbete är vi intresserade av att se ett konkret exempel på hur det kan gå till på företag när man förbereder utvecklingen av datorsystem. Vi vill titta på kravställandeprocessen som ni använt för den pågående utvecklingen av SKBs nya databas och hur ni har kommit fram till de krav ni har i er kravspecifikation. Detta skulle vara ett utmärkt tillfälle för oss att testa de teorier som vi utgår från i praktiken. Vi vill, med *autonoma metoder* (se nedan), analysera de behov som databasen behöver uppfylla, hur det är tänkt att ni ska arbeta med den, samt vad ni förväntar er av den slutgiltiga produkten. Mer konkret innebär detta att vi kommer att titta på behoven som databasen måste uppfylla ur ett så brett perspektiv som möjligt för att försöka identifiera de mest relevanta kraven på databasen. Genom denna analys så hoppas vi kunna hitta kompletterande krav till dem som ni redan har.

Vårt examensarbete går ut på att utvärdera möjligheterna, fördelarna samt riskerna med att använda sig av autonoma metoder när man skall göra en designanalys och vilken nytta man kan ha av resultatet. Autonomi är en reflekterande och systematisk psykologisk process vid problemlösning och beslutsfattande. Genom att stödja autonomi och blockera heteronomi (dvs. ett begränsat, partiskt och dogmatiskt tänkande) kan man skapa mer genomtänkta och bättre understödda beslut. Ett exempel på verktyg för att stödja autonomi är en matris där alla alternativa sätt att behandla ett problem systematiskt jämförs med alla värden och aspekter som är relevanta för alla dem som berörs av det.

Vi undersöker om en autonom analys i designprocessen kan stödja projektledare och utvecklare att ta hänsyn till och få överblick över all relevant förhandsinformation och alla antaganden som görs om olika intressenter. Olika användargrupperns krav, men också utvecklarens och organisationens intressen, påverkar designbeslut och en kartläggning av dessa kan användas för att på ett fokuserat och konkret sätt identifiera möjliga intressekonflikter i utformningen av ett gränssnitt.

För att kunna hitta relevant information och genomföra en givande analys så behöver vi ha tillgång till kravspecifikationen för databasen samt möjlighet att intervjua några av dem som kommer att arbeta med databasen. Vi kan inte garantera att vi kommer att nå resultat som utgör direkt nytta för SKB även om vi arbetar utifrån hypotesen att analysen ger en bättre överblick över systemutvecklingen. Däremot erbjuder vi gärna SKB att ta del av alla eventuella resultat och fynd.