Talking to a geni

or
How to communicate expert information

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ABSTRACT

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Communication within our society is an element that is considered as most vital and important. Without good communication problems arise, disputes are taking place and a lack of clarity about information will be evident.

Within IT systems, and the development around them, there is not much deviation from the effects of improper communication than what happens within society. If the communication is not correct or incomplete, wrong expectations can be evoked, incorrect information is exchanged and thus wrong decisions might be taken.

One might say that incorrect or incomplete communication within and around the development of knowledge systems is even more disastrous or is at least heavily influencing the reliability of these knowledge systems.

Based on the above-mentioned logic, the conclusions of the dissertation project, which can be found in the last chapter of this dissertation, might therefore be a surprise to the reader. It must be said that neglecting the communication, within the development of knowledge systems, or taking it light hearted, will have a big influence on the efficiency of the development of the knowledge systems. However it is not a major obstacle that will result in the total failure of the system. It appears that users are quite capable of adapting themselves to the illogic or unnatural behavior of the systems. They find ways to use the system to their optimal use. The unfortunate downside to this compensating behavior is that each user will find its own way to handle the system. It will be obvious that this can have a negative effect on the efficiency of the system.

In order to give the knowledge system's project initiator and developer a good starting point with regard to communication protocols, the deliverable of this project will be a checklist that will have a positive effect on the efficiency of the development.

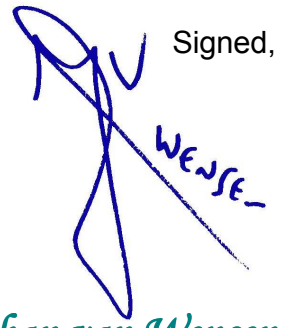
This checklist should not be considered to be complete. It is a starting point and might be extended with other communication elements that are specific for the situation of that moment.

DECLARATION

I hereby certify that this dissertation constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions or writings of another.

I declare that the dissertation describes original work that has not previously been presented for the award of any other degree of any institution.

Signed,



Johan van Wensen

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I would like to thank my sponsor, Dr. E.S.G. Stroes, of the Academic Medical Center of Amsterdam. Dr. Stroes is a staff member of the Vascular Medicine department within the AMC hospital. However he is also a very good friend and I would like to thank him for his support, input, friendship and motivating enthusiasm during my project.

The dissertation project was started at the Vascular Medicine department where an expert system is being used. With this expert system as starting point I focused on the subject of communication in and around this system.
It quickly appeared that a lot of communication elements could be found not only within the system, but also in the organization around the package.

The project quickly expanded outside the AMC hospital. Specifically also participants of the Erasmus Medical Center of Rotterdam have been very helpful and informative. Having the possibility to compare two different, but equal in their basics, hospitals was a welcome advantage. I especially would like to thank Professor J. van der Lei, who I found to be very approachable, skillful and knowledgeable, for his valuable input. It was a motivating experience to have met him.

I also would like to thank two project leaders of the IT departments of both, above-mentioned, hospitals; Mr. O. Labots of the AMC and Mr. C. Ouwens of the EMC. It is always good to hear the experience of fellow colleagues of other organizations. I am always pleasantly surprised about the great similarities one can find regardless of the different businesses we are in.

Warm thanks are also for my Dissertation Advisor, Kathleen Kelm. Without you I might have been lost in the dissertation project activities. You guided me, with a few necessary words and answers, at the right moment in the right direction.

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Last but not least I would like to thank my wife, Ariëlle, for her patience and support during my entire study. It certainly was not always easy and we had to make some sacrifices with regard to time for each other, especially when we take into account that you also had to study hard for your profession.
We will have to kick the habit, but I know that we now shall be enjoying the time we have together to the fullest.

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GLOSSARY

AMC	Academic Medical Center. Academic hospital liaised with the medical University in Amsterdam, The Netherlands.
Data dictionary	Overview of all fields, data, used in a system.
EMC	Erasmus Medical Center. Academic hospital liaised with the medical University in Rotterdam, The Netherlands.
EPD	Electronic Patient Dossier. This term indicates the system that stores all information of patients electronically. The system should be deployed hospital wide or even outside the hospital via a secured environment.
Expert system	A system can be considered an 'expert system' if it incorporates a specific amount of intelligence. It is being said that the better term for these systems should be 'knowledge system' since it should not only be designed for or by experts.
FAQ	Frequently Asked Questions. Questions that are asked to the helpdesk of a system, and their answers, are registered and stored for future users as a reference work.
HCI	Human Computer Interaction. This is the way that the software is communicating to the users of the system. The other side of this term is the way that users can control the system.
He	Where it says 'he' in the general sense, please read '(s)he'. Where it says 'him', please read 'him/her'.
Knowledge system	System that, apart from containing information, also is able to reason based on the information. See also 'expert system'.
ODBMS	Object Data Base Management System. Methodology to store information not based on relationships between databases, but between objects and classes. Object Oriented approach.
PDA	Personal Digital Assistant. Small device with the size of a hand. Control is mainly done by using a small pen. Interface of the device is limited.
PET	Positron Emission Tomography. Research method to scan the activity of the brain.
Protocol	rules that make it possible to determine a diagnose on a patients illness. These are the basis of the knowledge system.
RDBMS	Relational Data Base Management System. Methodology that is based on the relations between databases. Each database identifies an entity of the designed system.
User interfacing	The way that the software is presented on the screen and how the user of the system can communicate with the software.
Web-log	Internet oriented software where a registration is done of questions or remarks of users. The structure is such that the follow up of each item is easily identified. Thus the discussion can be easily followed or caught up.

1 INTRODUCTION

1.1 History of the Problem

Treatment of patients with vascular diseases is changing rapidly. New data have emerged to show that it is of crucial importance to make a full inventory of risk factors in all patients at increased risk for vascular diseases. Thus, a patient who presents himself with high blood pressure should also be evaluated for all other vascular risk factors, including lipids, homocysteine, lipoprotein (a), etc. Unfortunately, this full screening is not common practice yet. This will require additional efforts to allow successful implementation into clinical practice.

Subsequently, abnormal risk factors have to be treated towards target levels. This requires doctors to know the target values for all risk factors, which themselves are dependent upon the absolute cardiovascular risk for the individual patients. Unfortunately, doctors poorly adhere to treating towards target levels. In addition, only few doctors actually assess the absolute cardiovascular risk at baseline. The latter in spite of the fact that it has been convincingly demonstrated that the gut feeling of doctors with respect to risk inventory is often quite wrong! So, both implementations of target level based treatment, as well as absolute risk based treatment will require some kind of assistance and/or tool for doctors to guarantee full compliance.

Third, the options to treat patients are expanding rapidly. This requires an enormous amount of research. Thus, all patients at the ward should ideally be selected to participate in clinical research in order to advance clinical practice. However, in real life it has proven to be most difficult to select patients from the outpatient clinic. Identification of patients, fulfilling all in- and exclusion criteria, is a most time consuming effort, which translates into loss of many eligible candidates.

Fourth, pressure is rising to see more patients in less time. Simultaneously, support from secretaries is declining due to fewer personnel available in view of limited budgets. So, paperwork will also need to be optimized within the next few years.

Collectively, these new demands call for action. Thus, the specialists at the outpatient clinic of the AMC decided to find potential answers by implementing an electronic patient file, able to address all these issues. Since this proved to be a major effort, a system was chosen which also offered the opportunity to support clinical decisions by adding protocols and clinical decision rules into the system. Additional effects of such an electronic patient dossier are: increasing insight into the quality of care of patients, facilitated workflow monitoring and simplified administration.

Whereas the basic procedures of the expert systems are up and running on the sponsor's site, it is becoming clear that the major hurdle is actually to feed the expert system with the correct decisions on diagnoses and

treatments. Also, the logics of the program are not always immediately apparent to the medical doctors, which results in incorrect use and feeding information on ´wrong´ locations (which results in quality loss of the database). Finally, the system is experienced as time consuming, which is seen as an obstacle for medical professionals without IT background to feed the system with information. Without the unconditional support of the doctors, from various disciplines, the final deliverable of the expert project might be jeopardized.

Experts, medical doctors, are bound by time. By applying a good communication interface with the expert system, they can save time. This is firstly due to the fact that new expert rules are easily, automatically, applied in the expert system; deducted from the doctors manual diagnoses.

Secondly; future diagnostic decisions will be more accurately, automatically, 'predicted' by the expert system.

When we read all this, several questions might arise which are screaming for an answer:

- Is the interaction of the knowledge system on the sponsor's site incorrect?
- Who decides whether the knowledge system is time consuming?
- Can a better interface contribute to the success of the system? Make the system less time consuming?
- Does the IT background of the experts really have an effect on how the system is used?
- Is training necessary on the use of the system?
- Does one need to monitor on a regular basis the use of the system?
- Is there a genuine need for feedback from the system?
- Is it useful to work with a local knowledge system? Or is this asking for problems when working with a knowledge system?

Hopefully you will be able to find the answers to the above-mentioned questions, and others, in the rest of this dissertation document. All the questions and their answers in this document all relate in one way or another to the subject of communication.

1.2 Literature review

A recent dissertation from Adrian Japp, made in 2002 [Japp, A. (2002)], deals with the general issues of user interfacing, its drawbacks, possible improvements and future.

'Talking to a geni' is focusing more on a specific user interfacing area, that of expert systems. It can be seen as an extension on Japp's dissertation document.

In this specific area, communication and interfacing within expert systems, literature is scarce. Various documents, information, is available that deals with the design of interfaces and Human Computer Interaction, however only aged information is found that specifically focuses on expert systems. Some examples:

- Interface design issues for advice-giving expert systems, by John M. Carroll and Jean McKendree [Carroll/McKendree, 1987]. Although that this document is now 18 years old, some findings are still relevant today. This is probably the case due to the fact that these statements are based on human psychology and this is not something that will change in a few decades.
- An architecture for expert user interface and design management, by J. Lowgren [Lowgren, 1989]. In his paper Lowgren proposes to separate the user interface from the decision process.

1.3 Expert or Knowledge system?

The dissertation subject is concerning the communication of expert information in expert systems. During the interview with professor van der Lei, the term 'expert system' was shortly discussed. According to him, and the reasoning of this statement is quite logic, the term 'expert system' is actually incorrect.

The term 'expert system' could call upon either of the following ideas:

- The system can only be used by experts
- The system is build and filled by experts

However a system that incorporates intelligence should be able to be used by all users irrespective of their intellect. This problem has also been identified by J. Lowgren in his paper.

> "Another commonly mentioned problem is the locus of control. Expert systems often tend to be system oriented in that the system initiates all interactions and the user is reduced to a mere gatherer of data. As Baroff et al [2] point out, while a system-oriented dialogue is helpful for novices, it is certainly not satisfactory for more skilled users." [Lowgren,1989, p 43]

At the other hand is it to be expected that a genuine expert will not use the system since he might be concentrating on matters so specific that these will not be able to be dealt with via an expert system.

Another reason that the system should not be called an expert system is that it likewise should not be filled by, a select group of, experts. The idea is that information is gathered and that the rules which incorporate the intelligence are entered into the system by mutual consent of an entire scientific field. Within the medical field this 'mutual consent' is based on the standard protocols of a discipline. The information with which the rules are triggered should be retrieved from the integration with other systems.

Therefore the better term might be 'knowledge system' as this is focusing more on the system itself. The system supplies knowledge based on proven protocols, the user of the system can determine for themselves whether to apply the knowledge supplied by the system or not.

Having said this, we must also acknowledge that new protocols, which are not yet approved, must be 'invented', created. The knowledge system should give the user the possibility to test his new protocols whether or not they can be founded by 'evidence based medicine' experience.

1.4 Focus of the dissertation project

Due to the scarce number of expert systems, the focus of this dissertation project is in the end not only limited to expert systems.

The project has started off by investigating the expert system on the sponsor's site. Shortly after the kick-off and after some interviews it was apparent that the investigation area needed to be broadened. Therefore it was decided to also investigate the communication within a related project in the medical world, that of the electronic patient dossier (EPD).

The relation between the EPD and the knowledge system is quite evident. Electronic Patient Dossier systems gather information than can be very valuable for knowledge systems. From that perspective, adding these systems to the research area of this dissertation is not unusual.

2 PROBLEM AREA

2.1 Problem definition

Performing incorrect or incomplete communication can jeopardize the success and reliability of a system. Is this true?

When the document speaks of 'communication' then this term is considered as communication in the broadest sense of the word. Systems tend to communicate by the screens they present to the user. Users also communicate amongst each other and to suppliers of systems.

The problem definition in this dissertation is based on two phrases which are not mutually exclusive:

- Does improper communication cause the failure of a system
- When we improve the communication, is the system then also getting better

In this dissertation document it is tried to demonstrate that both sentences can be considered correct.

2.2 Scientific findings on communication

During the interview with Professor van der Lei, the fact was discussed whether communication within knowledge systems was of vital importance for the success of these systems.

Professor van der Lei stated that from his years of experience with knowledge systems in particular, he could not conclude that the way that information was communicated to the users was an obstruction to using the systems. The definition of communication is in this case explained as the way that the screens present the information or that the necessary knowledge rules are entered in the system. The human computer interaction (HCI) or layout of the systems has, in his opinion, never been a reason for the failure of a system.

This however does not exclude the fact that HCI can be improved in the majority of the available systems.

Carrol and McKendree in their paper have done some interesting statements which are good finds, but also good discussion points. The ones that relate to communication issues are:

- Due to the fact that in the past there has not been interest in analyzing the usability, expert systems have had limited impact with their technology [Carrol/McKendree, 1987, p 15].
- You have to analyze the human cognitive processes in order to match them with the user interface of the system you are building [Carrol/McKendree, 1987, p 17].

2.3 Project goals

The 'Talking to a geni' project must result in recommendations with which project leaders and developers of knowledge systems can improve the efficiency within their project or knowledge system. This part of the goal of the project is more focused to a macro level.

The project should also give the project sponsor tools in order to review the project organization on his department. By applying these tools, increase of the satisfaction level of the project sponsor with regard to the communication between him and his suppliers should be noticed.

When applying the project deliverable to the development of knowledge systems it is expected that the quality of the systems will increase.

3 BUILDING THE GUIDELINE

3.1 Approach

The approach to building the guideline, or checklist as it is also called, is one of gathering as much information as possible. This information gathering is based on three different aspects:

- Interviewing method
- Own experience
- Literature

By interviewing as many persons as possible that have experience, or have been involved, in the development of medical IT systems, it is tried to identify similarities in the approach towards the communication subject within knowledge systems.

These similarities can either be issues that have been deployed in the development projects that had a positive influence on the communication within or around knowledge systems. However it can also be that different projects contain the same errors, or approaches, with respect to communication issues.

At the other hand the author has 19 years of experience in the development of software and the management of software projects. During these years it is experienced that particular communication issues are of positive influence towards the implementation of software.

Although that the author's field of business expertise is not related to the medical area, generic elements can be deducted that can be of benefit for other project leaders or developers.

Combining these two aspects results in the deliverable as can be found in the appendix.

3.2 Analysis of findings

In the following paragraphs, one can find the specifics of the communication elements that can be contributing to a proper communication structure.

The findings elements can be divided into three major 'wishes':

- Project coordination
- Communication
- Interfacing

Although that project coordination can be considered as a separate subject, it even is a whole separate knowledge area, it was discovered that some project managing issues heavily influence the communication within knowledge system projects. Thus the reason why it was decided to mention some project management tasks as particularly relevant within this dissertation subject.

3.2.1 Project coordination issues

During the creation of software systems, and thus also knowledge systems, it is important to maintain structure in the development process. This is done by adhering to the general project management principles.

Not all project management issues will be discussed elaboratively in this paper, since this is going beyond the scope of this dissertation project. However with respect to the communication around project development, some basics from the project management methodology are necessary to be executed in order to improve communication.

Without these elementary activities it is bound that vagueness and lack of clarity will occur during the development of the system.

3.2.2 Communication issues

With respect to the exchange of the information in, knowledge, systems some basic principles should be adhered to. This all in order to present the user with the correct information and thereby avoiding any possibility for confusion about, or misperception of, the information.

Therefore one will find several recommendations with which above-mentioned should be able to be achieved.

3.2.3 Interfacing issues

Also when looking at the actual layout of the information to the user, several elements should be taken into account. These elements seem quite basic and straightforward, but during the author's years of experience with several systems it has become obvious that not all developers are paying close attention to these basic issues.

Will systems fail without these interfacing issues? Maybe not, but it will influence the efficiency of the users working with the system.

3.2.4 Survey analysis

From the survey held amongst the participants of the Dissertation Project we can determine that communication is considered as very important. With proper and good communication, there is a higher chance of making optimal use of the developed system and of more reliable input of equally reliable information.

It is worthwhile to inform the users of a developed knowledge system about the reasons why certain decisions are taken or certain structures are used.

One of the participants commented that in past projects there was an overestimation of the enthusiasm and knowledge of the participants. This caused projects to fail or at least not finish with the proposed results. When there would have been more focus on the communication, this would have had a positive influence on the project. Projects would have a better chance on success.

3.3 Database design

The investigated, knowledge, systems in this dissertation project are using a 'form-based' architecture approach. This structure can be caught under the more generally known methodology: Object Data Base Management System (ODBMS).

The Object Oriented approach towards database design avoids the limitations of a relational database. This is very nicely explained in the introduction in the paper, Hitting the relational wall, made by Dr. A.E. Wade.Ph.D.

> "Relational Database Management Systems (RDBMS) have been very successful, but their success is limited to certain types of applications. As business users expand to newer types of applications, and grow older ones, their attempts to use RDBMS encounter the "Relational Wall," where RDBMS technology no longer provides the performance and functionality needed.
> …..
> Attempts to scale the wall with relational technology lead to an explosion of tables, many joins, poor performance, poor scalability, and loss of integrity. ODBMSs offer a path beyond the wall." [Wade, 2002]

This architecture deviates from the more widely used Relational Data Base Management System (RDBMS) due to the fact that the forms, or data on the forms, are not necessarily related to each other. That is; the relation is not stored in a particular database.

With the ODBMS structure it is possible to create a pool of single data elements and construct from all the available elements a separate form. This form, or object, contains the information for a particular instance of the knowledge system.

Visually this could be presented as shown in *figure 4; form based database design*.

What we see in the above figure is that the forms can be created either from single data elements, or we can select a group of elements to be added to the form.

The thus created structure results in a many-to-many relation between the form and either the data item group, or the data items. In an object oriented database management system, the relationship can be avoided by creating association classes. Relations between the different forms are maintained through the attributes of the objects (forms). In the above figure this is presented as a one-to-one relationship between the data items.

The creation of the forms should be done preferably by, a selected group of, users. By doing so, the knowledge system would become more flexible in its setup.

Adding new data items, or question elements, can again be decided upon and entered by an even more selected group of users.

Finally, the above-mentioned database design results in a form-based database containing a wealth of information. The following step is to make this information available for research and decision systems, the genuine knowledge systems.

In this step the protocols as mentioned in paragraph 1.3 will need to be matched up with the data items from figure 4. If these protocols are in a layout that corresponds with the single data items than they can be entered in the knowledge system, in the other case a conversion will need to be performed to match them with the structure of the information acquisition system.

The visual presentation of this system could be as shown in *figure 5; knowledge acquisition*.

The protocols, or knowledge rules, should be marked with a timestamp in order to reconstruct the situation of the past. It would also be evident that adjustment or addition of protocols is authorized by the proper staff of the user organization. Thus it can also be reconstructed who authorized a protocol and it will be easier to determine where this decision was based upon.

3.4 Interface design structure

In order to have flexible control over the interface issues, one of the participants suggested the use of a layered structure in which the majority of the layout and interface elements, but even a number of database elements, could be controlled in a local way.

The idea behind this is that as soon as a change request for the system is determined to be an individual, organizational, issue and not a generally accepted, or considered, request, this could be incorporated into the structure of the knowledge system on a higher level.

Visually this was presented as can be viewed in *figure 6; knowledge design architecture*.

All changes in a lower level will be, due to the hierarchical structure of the model, available in a higher level.

The ‘General database’ can be used to exchange information to other systems, i.e. for export functions or other integrated research systems.

3.5 Creating the guideline

In the following paragraphs each item, summarized on the checklist as mentioned in the appendix, will be studied more in depth. The checklist is the brief overview that can be used as guide when designing the interface and interaction in the project – and software structure.

The ‘P’ issues are actually matters that need to be monitored or controlled by the project leaders. As already said earlier in this document, this is part

of a more extensive project management function, but the issues mentioned are specifically related to the communication subject within developing or exploiting knowledge systems.

'C' issues are related to information communicating matters. 'I' issues are focusing on interface elements.

3.5.1 P1- Close the gap between expert and developer

It is rare that a specialist operates on multiple fields, this specifically is valid if the fields are quite opposite of each other. With regard to the medical field it is not often found that medical specialists, experts, are also skilled in IT.

In the recent years IT has become more open and easily available for medical experts to use it to their likings. This can be seen as a result of the high acceptance of Microsoft products within the personal computer world. It is easily possible with Excel or Access to build databases and small analyses systems.

However for the majority of the experts it will still be necessary to close the gap between the medical area and IT. This can be done by pursuing the following activities:

- Extensive training sessions
- Arrange that a frequently asked questions ('FAQ') system is available.
- Setup an online helpdesk, where questions can be asked

3.5.2 P2- Perform regular software upgrades

In the starting phase of a knowledge system development project it is of utmost importance that the users detect progress in the development of the system. This is mainly the case when the project uses the evolutionary development method.

As soon as users do not register improvements, but they have detected flaws in the system in an earlier stage, the system jeopardizes that they will lose interest in the system.

When the system is implemented for a longer period and there is reasonable satisfaction about the system, the period of deploying software upgrades can be widened.

3.5.3 P3- Observe users before and after deploying the software

When analyzing the workflow in a user organization, it is sometimes difficult to gather information from the user what activities are exactly carried out. Functions are forgotten to be mentioned.

Another aspect is that users are very creative to adjust their way of working with existing systems, but also to find ways to use the system of which the developers of the system have never thought of.

Therefore it is wise to have regular 'observation' sessions in which the user is observed how he uses the particular system. With the findings from the observations, the knowledge system can be improved and adjusted.

3.5.4 P4- Register and monitor change requests

There is nothing as annoying and discouraging as when your requests for system adjustment are ignored or forgotten. The project leader, in combination with the developer of the expert system, should maintain a conscientious registration of the change requests.

All change requests need to be categorized and prioritized. Feedback should be given to the users on the progress of, or other decisions taken about, the queries.

The best alternative for maintaining a registration of change requests is a transparent online system where users can apply for changes and monitor the progress of their applications.

Implementing such a change request registration system improves the communication within the knowledge system project. It prevents extensive elaborate communication to participants who might not all be interested in the particular change request.
As soon as the users of the knowledge system under construction can be found on geographically separated locations, a system deployed via the Internet would be considered the best option.

Especially with the current web-logging software it might be easily possible to setup such a registration and communication system, that is: as long as the change requests can be freely accessible.

3.5.5 P5- Stick to a market segment

Different market segments require different functionalities. It is extremely difficult, and probably commercially not worth the investment, to develop a knowledge system that is able to adhere to all requirements of the various markets.

The more different markets or organizations incorporated into one single knowledge system, the more concessions will need to be made to individual, organizational, requirements. The lesser organizations are involved in the knowledge system, the higher satisfaction level of the system can be reached.

3.5.6 P6- Integrate the system on an organization wide level

Depending on the problem area, it is recommended to identify all the participants supplying information for the problem area. Deploying the system for just a part of these participants will not contribute to the success of the system.

If the system is implemented for only a part of the information supplying participants, there needs to be performed a lot of additional work in order to supply the integration of, and with that the addition of the remaining information from, other systems.

3.5.7 C1- Give, when requested, insight in reasoning

Knowledge systems should give the user insight in the reasoning for a certain outcome. If this is not done, this can have two effects:

- The user's intelligence is ignored, which may make him lazy and thus less intelligent.
- When the user has no insight in the reasoning of the system, he might lose trust in it. The system might very well be right, but people tend to want to stay in control.

This insight in reasoning however should be done on a voluntary basis. Users who are familiar with the system can than ignore the details of the reasoning and continue with the outcome of the knowledge rules.

Carrol and McKendree in their paper even suggest for a system where the information need is based upon a user classification. Depending on the classification, the user is given more or less information. The classification of the user is done by analyzing his actions and responses to the system [Carrol/McKendree, 1987, p 19].

If a unique outcome in knowledge systems cannot be obtained, it is recommended to order the different alternative answers to their relevance. Thus the most likely outcome will be at the top of the list of answers.

3.5.8 C2- Supply selection of values

When in the knowledge system the entry or selection of values is required this can be best arranged not by letting the users enter the value themselves, but by giving them selection possibilities for alternative values.

The disadvantage of this system is that there has to be a member of the construction team present who can add new values. This preferably is organized by giving a 'super user' the possibility to add new valid values for a specific kind of information.

When these 'super users' are strategically distributed amongst the participants of the project, there is no degrade of flexibility which will have a positive effect on the implementation of the system.

3.5.9 C3- Build rule base flexibly by using I1

The most optimal knowledge system is one in which the infrastructure allows for a flexible rule base. If rules are fixed in the basics of the system, this blocks the flexible deployment of the system.

The difficulty here is that apart from the fact that the system should be able to recognize all the different knowledge elements in the system, it also needs to be able to reconfigure 'older' rules in order to give reason to historical outcomes and the deviations it causes in current rules.

The first issue is covered by interface item 'I1', categorize all information. If each piece of information can be uniquely identified by the user, it is even possible to build a flexible rule base that can be changed at will.

If this is desirable then these types of requirements need to be determined from the scope of the implementation in the corresponding organization. As already mentioned in one of the previous chapters; for the medical world,

the protocols are set by a committee experienced in the specific discipline this in order to prevent a subjective view on a certain medical subject.

However when it is possible to identify each single piece of information, it is easier to construct protocols that can be reviewed by the committee and understood by the knowledge system administrator. This positively contributes to the closure of the gap between expert and developer.

The second issue in the above-mentioned difficulties is that the rule base needs to be situational. For alternative answers to a query that are given in the past, it is necessary that the historical reasoning can be determined. This in order to explain why, in for example a medical environment, a certain treatment has been chosen.

This issue is more complex since this result in a rule base system where rules, protocols, are also marked with a timestamp.

See the previous database chapter for a more detailed example on how this can be achieved.

3.5.10 C4- Create clear logic, flow, in software

Clear logic should be adhered to when confronting the user with screens. This logic should follow closely the workflow structure that would be followed if there would not have been an automated system.

If it is possible to automate the process of information gathering, then this should be implemented according to the followed work methods. If this is not possible, the software should give the user the possibility to flexibly select the next step of the process. It is in this case important that the navigation buttons are immediately accessible by means of a single mouse click or key.

It has been noted in one of the observed systems that calculated information based on entered information in screen 2 was not shown before the user arrived in screen 4. This was noted as awkward by the user as the calculated information gave the user a better insight in the situation.

This guideline should be seen in close connection with the interface guidelines ‘I2’, ‘reduce number of click- or enter points’ and ‘I3’, ‘observe the current environment to create a natural way of interfacing’.

3.5.11 C5- Arrange flexible access to data

The knowledge system, if used correctly, will contain a wealth of invaluable information. This information should be accessible for research purposes.

The danger here is that subjective visions on protocols could be followed. In a medical environment, as already mentioned earlier, this might not be advisable. However in other environments, this would not be an obstruction.

For research purposes the information should be accessible, if only because via research new protocols can be developed.

The implementation of the accessibility can of course be arranged via different ways. Since that the IT gap with experts is closed due to the availability of very accessible software, the most flexible way to create the accessibility of the data would be to have a possibility to select and export data. The selection of the data should give the user the possibility to use complex selection options.

When the format of the exported data conforms itself to the generally known data formats, the data can be used by the user in those analyzing software packages that he is familiar with.

3.5.12 C6- Determine procedures on the use of the system

A knowledge system is generally categorized as a complex piece of software. The information is opposite to small; an abundance of information will be available at one's fingertips.

All the information one way or another has to be filled in for the majority of the data. The way to perform this can either be automated from integrated systems, or manually by the users of the system.

Clear and strict protocols need to be communicated to the users in order to avoid the incomplete or improper filling of data in the knowledge system. This is a vital issue that can lead to the decline of the knowledge system. Without reliable information, no rules can be applied to the data, thus resulting in a degradation of the use of the system.

By performing user trainings and monitoring the user in the way they handle the different issues in the system, it need to be checked whether the correct procedures are in place for feeding the knowledge system with information.

3.5.13 C7- Deal with errors in an accurate and timely manner

Creating a system 100% error free is considered as a utopia. This will certainly be valid for complex systems as knowledge systems. Therefore it can be expected that users will run into problems or flaws which need to be dealt with in an accurate and timely manner.

Depending of course on the situation the user is in, it could be necessary that the problem is solved without delay.

Setting up a skilled helpdesk that can assist users in solving these urgent issues is an absolute necessity for the success of the system.

The problem with this issue is that it needs to be determined how urgent the particular problem is. A complex number of factors are at the bases of this:

- Is the user performing time critical activities?
- Is it a skilled user, or is there another underlying problem of lack of training?
- What other problems are currently worked upon?
- Was the user cooperative and adding value to previous flaws of the system or in the construction of the system?

3.5.14 C8- Create a 'history in a glance' functionality

For skilled professionals, experts, it is not always necessary to elaborate on the details of a certain situation. With one 'glance' they know how to value a certain situation. It is therefore a good thing if a glance can be given on the current and historical situation.

Within the medical environment a doctor for example would like to see previous visits and action points that have been agreed upon with the patient. This information should be easily accessible and visible.

3.5.15 I1- Categorize all information

As already mentioned when explaining the guideline 'C3', 'Build rule base flexibly', each piece of information, data, should be made assignable. This does not only need to be done hidden in the database or software, but also in the interface to the user. In this way the user can use the identifier of the field in new or change requests for an update of the rules.

By using a data dictionary, which is accessible for the user, a trace can be made to where the corresponding piece of information is used in the knowledge system. This provides the possibility to identify the value of the corresponding data.

Thus the system also shows that it accepts the intelligence of the user as the user can determine the importance of information for other rules in the knowledge system.

3.5.16 I2- Reduce number of click- or enter points

Experts, or coming experts, are in the majority of time very bound by time. In the medical field, retrieved from the interviews with the doctors, it appears that for a standard consult, a maximum of 15 minutes is calculated. This indicates that there is very limited time to enter information in the system during the consult. As the system should be considered as an important source of information for the doctor, it is vital that the system is used and works smoothly during the visit.

In detail the working of the system should be observed and the number of click – and enter points should be decreased to an absolute minimum.

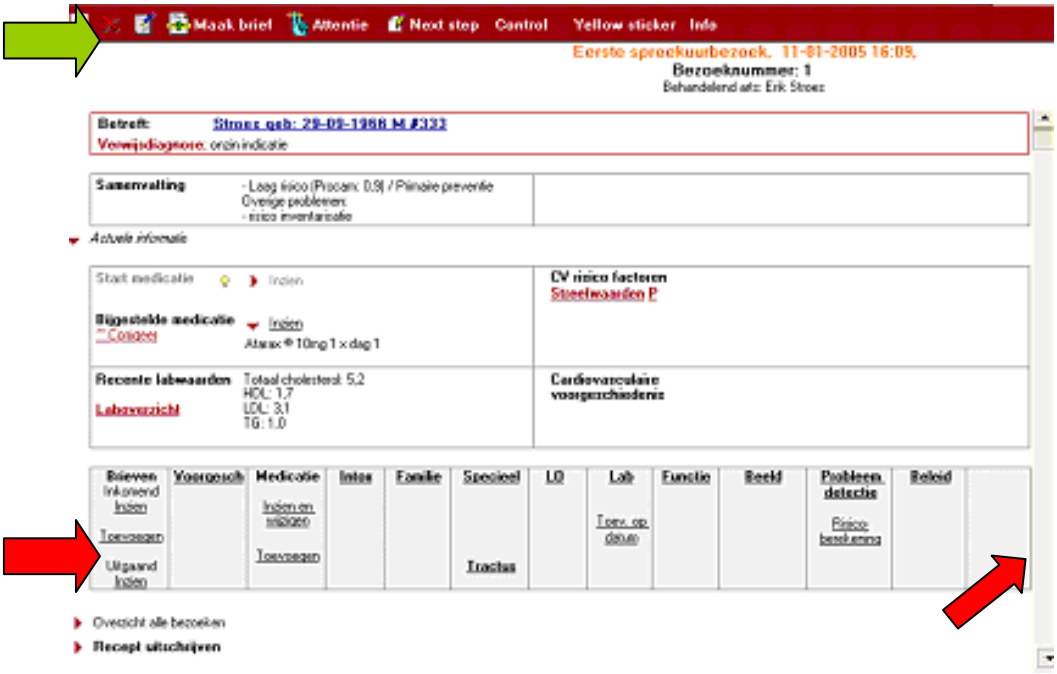

Figure 1; toolbar example

One of the first benefits here is to mention the navigation buttons at a fixed toolbar at the top (green arrow in figure 1), bottom or side of the screen. Via this way you prevent that a user need to scroll down to find the button which navigates him to another part of the system. This seems an easy example but is one of many small timesavers.

In figure 1, as shown above, other navigation hyperlinks are mentioned at the bottom of the screen, however not fixed. So as soon as the screen contains too much information, the navigation hyperlinks disappear to the next screen. The user will need to scroll down before being able to use the navigation hyperlinks. This slows down navigation.

3.5.17 I3- Observe and create natural way of interfacing

Knowledge systems can be used in different environments. It is important to investigate and analyze the environment where the system is used.

In the medical world for example the relationship between the doctor, expert, and patient is very sensitive and personal. Using a standard personal computer breaches this delicate relationship. Patients should be able to feel at ease with the doctor, a normal personal computer could arouse a feeling that the doctor has become too impersonal.

So analyzing the systems used in any particular environment is important and should be adjusted accordingly. At this moment there are quite a lot of technological possibilities to avoid the awkward situation as sketched above.

One could think of interfacing by using:

- A laptop; is significantly smaller than a pc

- A pc of which the screen sunken into the desk of the doctor, but in line with the positions of the participants during a patients visit (doctor → patient).
- A tablet pc; looks like a notebook and has handwriting recognition software. However it very much resembles a normal paper notebook and will therefore be less violating the sensitivity of the situation. For the knowledge system specific design measures should be implemented in order to work seamless with the tablet pc.

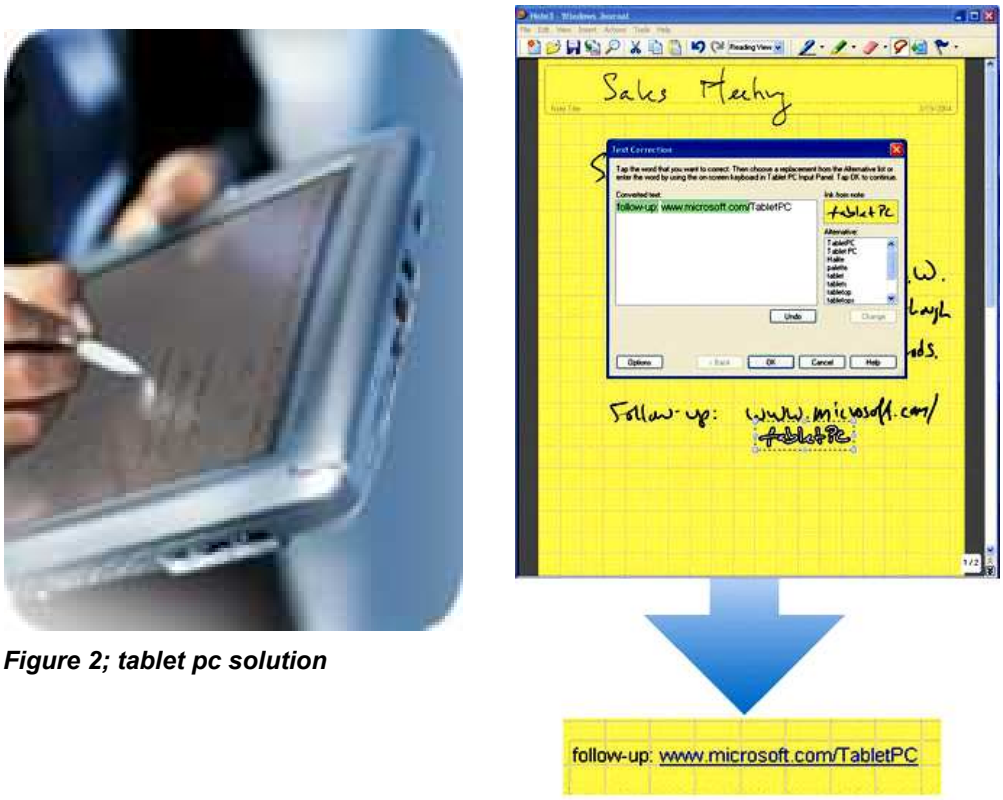

Figure 2; tablet pc solution

- A personal digital assistant (PDA); the disadvantage of this device is that it takes time to get used to the pen-based interaction with the system. Also the knowledge system should be able to cope with pen-based interaction. The PDA is not particular useful if large amounts of text need to be entered.

However it must be said that current office furniture does not necessarily need to be unpleasant, as the picture below shows.

Figure 3; Office furniture

By using a wireless keyboard and mouse, the doctor can still face the patient and only need to look aside every now and than to note something, actually just as he need to look at his notebook or patient status in order to write down observations.

3.5.18 I4- Fixed text need to correspond to entered data

The interface of the knowledge system should be very accurate. If the fixed text and values of a piece of information in the system does not match with each other, the user might be confused and fill the knowledge system in that instance with incorrect information.

Also the information should be categorized and the same categories of questions should have the same corresponding answer alternatives.

3.5.19 I5- Align the information

Information that is scattered across the screen is a nuisance. The alignment of screens is important as this guarantee for relaxed and ease of reading of the information.

When the screens are not properly aligned, the eyes of the user need constant focusing and repositioning to other areas of the screen. It is also more difficult for users to remember where certain information is located on the screen.

The IT department of the School for Oriental and African Studies, let by Mr. Raggett, has placed a review on design elements on the Internet [Raggett, 2005]. These clearly indicate the importance of a simple structure of screen design. Research has been done especially towards informational reading in web-browsing situations, however elements of their guideline are also relevant to other software screens.

The impact is heavier when the knowledge system has multiple screens that are all aligned differently.

Also data that is related to each other should be logically grouped and aligned on the screen.

3.5.20 I6- Use coloring in a logic sense

Colors used in the screens of the knowledge system can have its effect on the understanding and the speed of identifying parts of information.

Using an abundance of information will be tiring for the user, also when important information need to be identified, this could get lost in the abundance of the colors already on the screen. It is therefore recommended to use colors only for indicating certain pieces of information or of deviations from a normal situation.

When colors are used, it should be analyzed which colors are used for which piece of information.

For example if an abnormal value is found, the color red would be the most appropriate. Throughout the rest of the system, the color red should then also be used for abnormal or blocked situations. So for example if a departmental agenda is used to register the availability of the experts, indicating that an expert is unavailable should also be done by a red color.

Creating such a correlation between colors and their meaning makes it easier for the user to identify abnormalities, blockings, or work on negative reporting bases. Carrol and McKendree see this as ‘soft advices’ [Carrol/McKendree, 1987, p 23].

Using visual effects makes the most optimal use of the brain and will be much more effective, if not overdone, than only verbal adjustments. This statement is underpinned by notes of Dr. Dawson, professor at the University of Alberta in the discipline of Psychology. In his notes he mentions the research of John Jonides et al [Jonides, 1998], who researched which part of the brain is involved with verbal and non-verbal stimuli.

> “Visual information interferes with spatial task, but not verbal; the reverse is true for verbal information. PET studies offer support too. For example, PET studies have been done of the "two-back" task, in which subjects have to say "yes" if a letter being presented now is the same as the letter presented two letters ago. PET reveals left hemisphere sites, including Broca's area, the frontal lobe, and the left parietal lobe, light up for this task. A similar task for visual information, though, lights up different areas -- this time in right hemisphere, 2 frontal lobe sites, a parietal lobe site, and an occipital lobe site. "One hypothesis consistent with these activation sites is that subjects create a mental image of the dot locations, using processes of the occipital lobe. They encode the locations of the dots from this image using processes of the parietal lobe, and they then store these encoded locations using frontal mechanisms."
> [Dawson, 2005, par 7.3 alinea 18]

3.5.21 I7- Create a clear, simple, easy, intuitive navigation

For navigating through the knowledge system, it is not of great importance whether buttons or hyperlinks are used. However it should be clearly identified that these buttons or hyperlinks can be used. Especially with hyperlinks it might be unclear that the user can click on those to navigate to another screen.

This is particularly the case because of the fact that users do not tend to read the user manuals, but start working with the system and use their intuition in navigating through the screens.

This phenomenon has also been identified by Carrol and McKendree in their paper, Interface design issues for advice-giving expert systems.

> "The situation can be sketched as follows: People want to use computer equipment because they want to get something accomplished.
> ….
> But this same pragmatism can also make an individual unwilling to spend any time learning about a system on its own terms. After all, to consult on-line tutorials or programmed self-instruction manuals is for a time to effectively cease working. There is then a conflict between learning and working that inclines new users to try to skip training altogether, or to skip around in a training sequence, sometimes with disastrous consequences."
> [Carrol/McKendree, 1987, p 14]

When multiple screens are used to communicate data from the user to the system and vice-versa, the navigation through those screens should be simple to identify. Buttons or hyperlinks should be displayed in a logical, sequential, order corresponding to the normal workflow of the user, so that he knows in which part of the information gathering he has arrived.

3.5.22 I8- The interface need to adjust to the expert

Whenever possible, the knowledge system should be constructed in such a way, that the expert can adjust, tune, the system to his way of working. This can be useful, to a lesser content, for the color setting of the product.

More important is it useful if the expert can create his own forms with which he can update and register all relevant information within his discipline.

In the EMC this principle has been very well thought of, see the database chapter for a more elaborate explanation. The idea is that a 'super user' is able, in mutual consent with the other experts on the department, to construct the forms used in the electronic patient dossier. From a large data dictionary, the necessary fields, and thus questions, can be retrieved and attached to a form. In this way the forms, needed to gather all relevant information, are build up.

4 CONCLUSIONS AND SUMMARY

4.1 Conclusions

Poor communication of information does not necessarily need to result in a complete failure of the knowledge system development project. However it can influence the smooth and timely manner of the course of the project.

So as a general conclusion at the end of this dissertation project it can be said that communication should not be neglected during knowledge system development projects. Nor should it be considered finished as soon as the system is implemented.

Although that we can see that users are very well capable to adjust their selves to changed and different interactions with computer systems, this can be accompanied with a lot of negative feelings and thus decreased productivity and efficiency.

It also can take time, sometimes even years, before one is used to, or has a different attitude towards, a different interface or system.

In an organization where the staff members do not need to worry about efficiency and finances the decrease of productivity might not be a major issue, however in the academic medical field finance is a big issue.

The checklist guidelines mentioned in this document can contribute to an efficiency improvement in the development of new or changing systems.
By following these guidelines discontentment of the participants can be avoided, or at least be decreased. This was also acknowledged in the survey by one of the participants in this project; human reactions on developed systems can have a negative impact on the added value of it. This effect can be cancelled out by having good communication structures.

An analogy of the conclusions of this dissertation document can also be found in the approach to this particular ‘Talking to a geni’ project. It appeared that success and setbacks are going hand-in-hand in this project.
Successes contributed to a better quality of the deliverable, while setbacks sometimes jeopardized the entire project.

Success and setbacks both have their own particular influence on the project deliverables.

Going along the path of the dissertation project it was discovered that ‘genies’ have their own agenda’s, interpretations and ideas. Some ‘genies’ just ignore requests, others have no time or do not want to cooperate the way that was needed. All these matters are from one perspective frustrating situations, but at the other hand they are also challenges that need to be faced with and solved.

During the course of the project one needs to be flexible to adjust the plan of approach to changed situations. For the dissertation project to be

successful, apart of the change of approach, it was also necessary to find other sources of information.

This will not always be possible as also can be determined from the technical underpinning of the guideline. Due to the changed attitude of a participant, the technical research on the pilot site was unsatisfactory which had its effect on the corresponding parts of this dissertation document.

Due to the scarce number of suppliers it was also difficult to find an alternative on short notice. For future work other knowledge system suppliers should be found to better base the deliverable of this paper.

These experiences in the 'Talking to a geni' project are nothing different then in a development project of a knowledge system. The advantage of the later is that if the project management issues of the checklist are properly incorporated and the right hierarchical support and authorization is acquired, participants can be motivated, in the worst case 'forced', to deliver the necessary input.

4.2 Summary

There are mentioned a number of guidelines in the above document that can have a positive effect on the information communication issues within, knowledge, systems. All of the participants of this project mentioned in the survey that this dissertation document can contribute to a better communication structure between users and developers. It will improve the quality aspects of knowledge systems. The document in its final form will be used as a handle in future talks with developers.

Without executing these issues, the development might not fail since users are capable to adapt their selves to a new and changed environment. However the development will face a far less then perfect project course.

More communication issues might be able to be determined. It is therefore important that before a project is started, the subject of communicating is discussed extensively and all elements are identified. Each element of communication should have an equivalent solution or approach towards how the participants should deal with it.

Therefore the checklist, as mentioned in the appendix, might be growing in due time.

4.3 Recommendations

It is recommended that anyone involved in the development of knowledge systems will take thorough notice of the guidelines from the 'Talking to a geni' project. Not because that it claims that these are the sole truth to perfect communication structures, but to start a change of attitude towards the communication within development projects to our customers, the users.

Taking the communication of information seriously and plan a professional approach towards it can contribute to the success of the development of a knowledge system.

Before starting the development of a knowledge system it is to be advised that the participant makes an inventory on the communication issues involved in the new or changed system. A mutual consensus about this subject will improve the whole course of the project.

One should be careful that not one participant in this project can start dominating the others. It has to be a smooth team play. In order to facilitate this, a person with the proper authorization, preferably of the user organization, should be in charge of the project team. In case of dilemmas or matters in dispute, this person should take appropriate decisions, which should then be followed by the other participants.

Why someone from the user organization? This is because of the fact that they are the closest to the day-to-day business. Others can have a refreshing view on the work, but will not be able to decide in the end what is necessary as they will not have the required expertise. This particularly is relevant in the area of expert knowledge.

Related to identifying the communication issues per project, is setting the right responsibilities. Each item must have a responsible person who closely monitors progress.

Based on the experience acquired during this dissertation project it can also be recommended to prepare yourself and be ready for setbacks. Try to find alternative sources of information just in case if the proposed, crucial, participants seem to fail to attend.

To alleviate the risk elements the following can be executed:

- Request the full cooperation of the vital participants in advance of the project. Preferably this should be done in writing so that no vagueness can rise about the level and character of input,
- Find alternative resources that can supply the same information that is necessary for the project.

4.4 Future work

With this dissertation document not everything that can be said with regard to communication within knowledge systems has been said.

Four months is far from enough to research the consequences of the explicit guideline elements.

More thorough research should be done to identify the reasons why systems in first instance are badly, or with low enthusiasm, received by the user organization and with lots of negative comments and remarks that it need to be improved.

In due years it than seems as if the ‘defects’ of the system become less important and users seem to be able to work properly with the systems. In order to find the reason for this phenomenon extensive research of years would need to be performed in order to find the underlying issues.

REFERENCES CITED

Carrol, J.M./McKendree, J (1987), 'Interface design issues for advice-giving expert systems', *Communications of the ACM*, 30 (1), pp 14 – 31, *ACM digital library* [Online]. DOI: 10.1145/7885.7886 (Accessed: 20-04-2005)

Dawson, Dr. M.R.W. (2005), *Working memory and thinking.* [Internet] Canada, Edmonton: University of Alberta. Available from: http://www.bcp.psych.ualberta.ca/~mike/Pearl_Street/Margin/OSHERSON/index.html (Accessed: 26 August 2005)

Japp, A. (2002), *The Human Computer Interface: appropriate graphical components for an intuitive and proximal interface,* dissertation document for the Master of Science in IT study at the University of Liverpool.

Jonides, J. et al (1998), 'The Role of Parietal Cortex in Verbal Working Memory', *The Journal of Neuroscience,* 18 (13) [Internet]. Available from: http://www.jneurosci.org/cgi/content/full/18/13/5026 (Accessed: 26-08-2005)

Lowgren, J. (1989), 'An architecture for expert user interface and design management', *Proceedings of the 2nd annual ACM SIGGRAPH symposium on User interface software and technology,* pp 43 – 52, *ACM digital library* [Online]. DOI: 10.1145/73660.73666 (Accessed: 20-04-2005)

Raggett, Malcolm (2005), *Design Guide for Authoring Intranet Pages.* [Internet] United Kingdom, London: School for Oriental and African Studies. Available from: **http://mercury.soas.ac.uk/it/docs/guides/intranetdesignguide.htm** (Accessed: 2 September 2005)

Wade Ph.D., Dr. A.E. (2002), *Hitting the relational wall.* [Internet] California, Sunnyvale: Objectivity, Inc. Available from: **http://www.objectivity.com/WhitePapers/WallPprIntro.shtml** (Accessed: 24 August 2005)

INDEX

APPENDIX

A. Checklist

On the next page you will find the summarized guidelines from the above document. This summary can be used as checklist for project leaders and developers of knowledge systems.

Project Coordination

- P1. Close the gap between expert and developer. ☐
- P2. Perform regular software upgrades. ☐
- P3. Observe users before and after deploying the software. ☐
- P4. Register and monitor the change requests. ☐
- P5. Stick to a market segment. ☐
- P6. Integrate the system on an organization wide level. ☐

Communication

- C1. Give, when requested, insight in reasoning. ☐
- C2. Supply selection of values. ☐
- C3. Build rule base flexibly by using I1. ☐
- C4. Create clear logic in software. ☐
- C5. Arrange flexible access to data. ☐
- C6. Determine and communicate procedures on usage of the system. ☐
- C8. Deal with errors in an accurate and timely manner. ☐
- C9. Create a ‘history in a glance’ functionality. ☐

Interface layout

- I1. Categorize all information. ☐
- I2. Reduce number of click- or enter points to an absolute minimum ☐
- I3. Observe the current environment to create a natural way of interfacing. ☐
- I4. Fixed text should correspond to entered data. ☐
- I5. Align the data for clear and relaxed reading. ☐
- I6. Use coloring in a logic sense. ☐
- I7. Create a clear, simple and easy navigation. ☐
- I8. Interface need to adjust to expert. ☐

B. Diagrams

On the next pages you will find the diagrams as used in the above document.

Form based database design

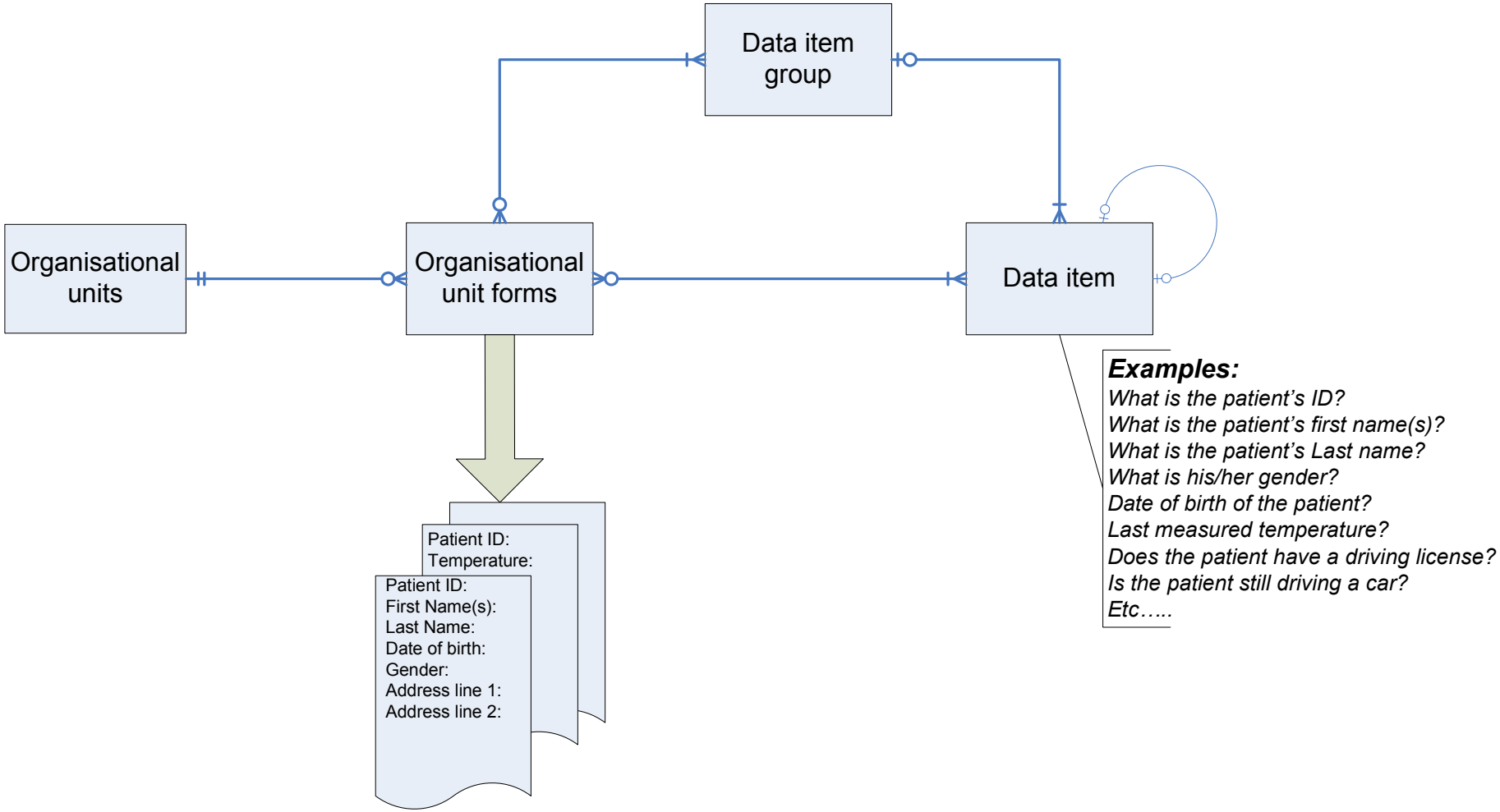

Figure 4; form based database design

Knowledge acquisition

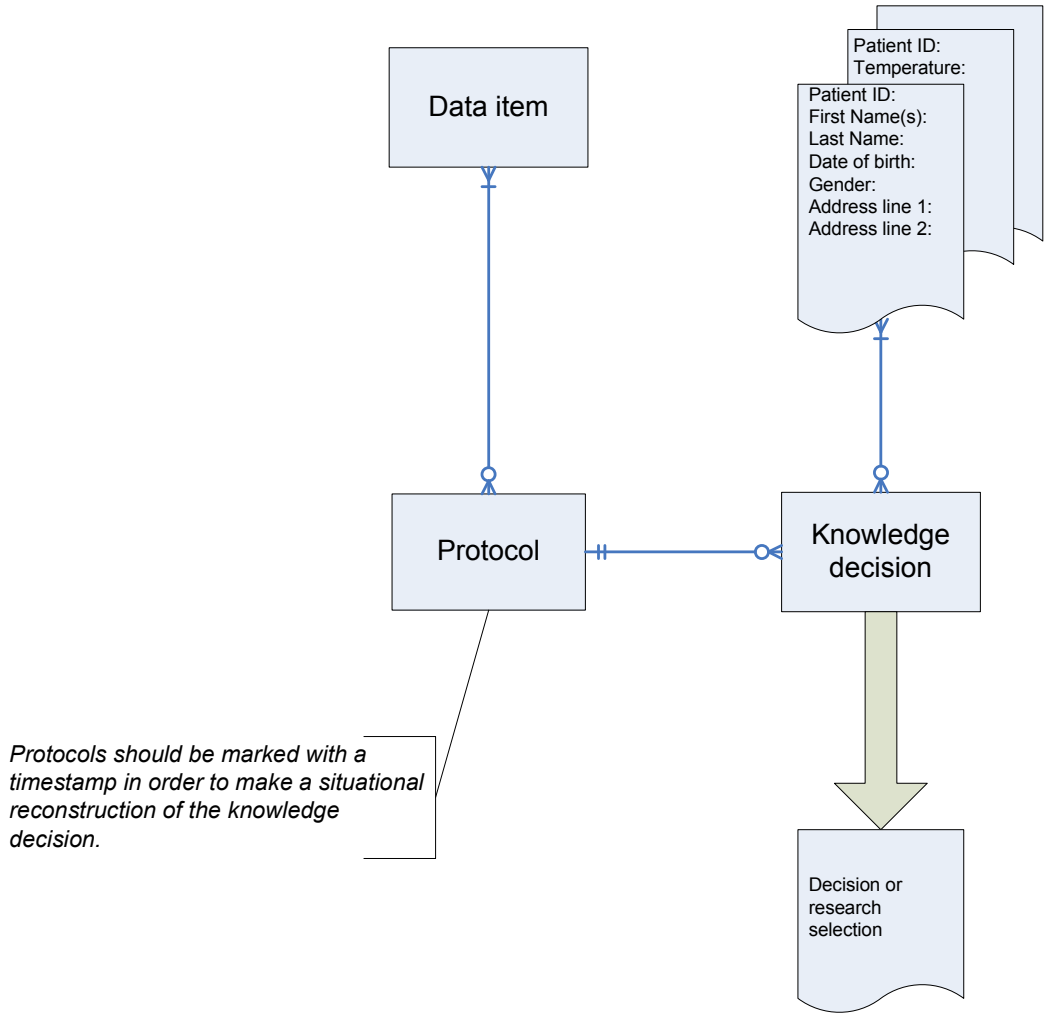

Figure 5; knowledge acquisition

Knowledge design architecture

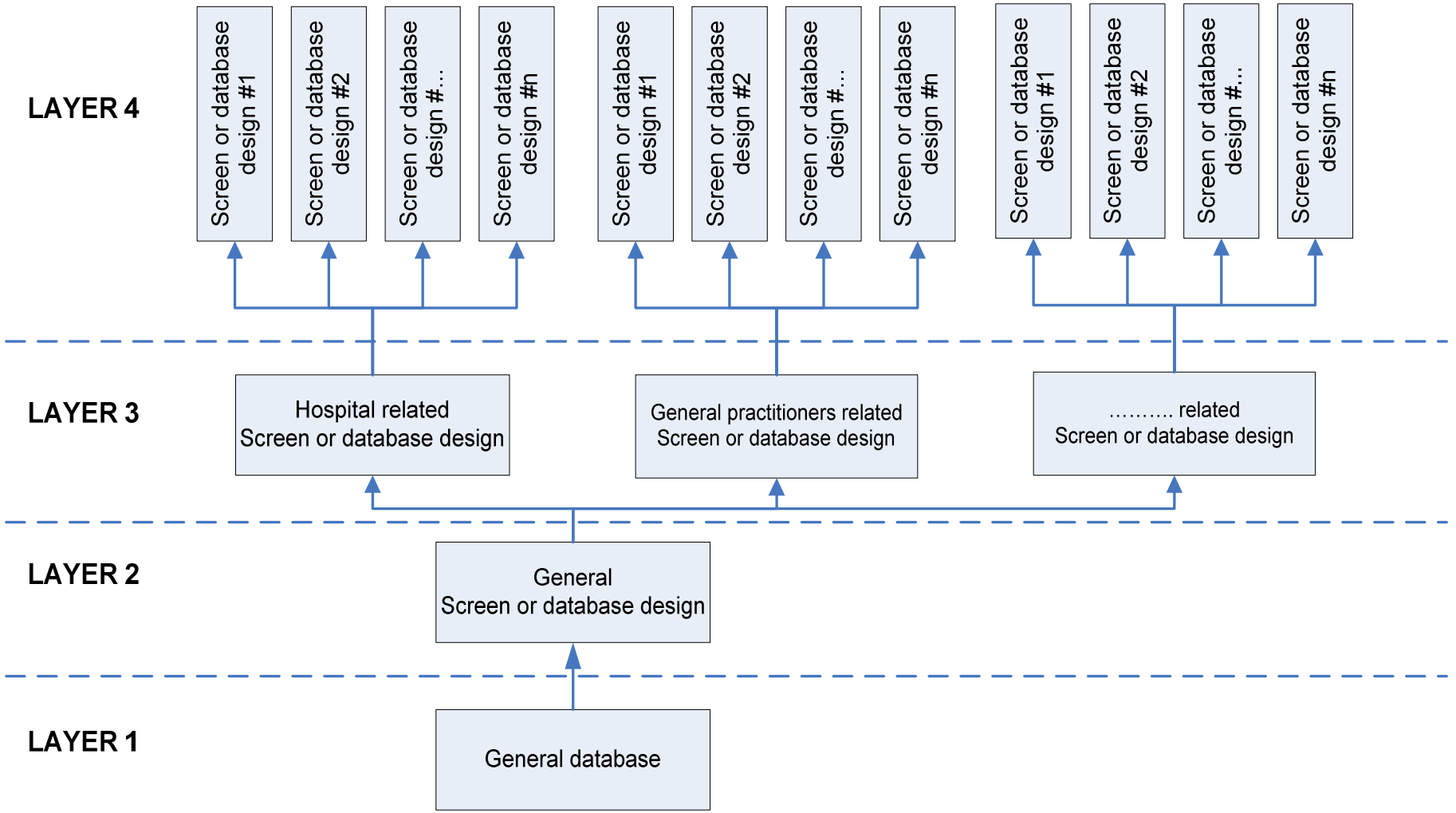

Figure 6; knowledge design architecture

C. Literature list

On the next page you will find a registration of all documents in the author's possession that have been gathered the last two years and which are one way or another linked to the subject of the dissertation project.

Not all of these articles or documents however have been used for referencing in the above-mentioned document.

Dissertation Literature Research

Subject: Communication within expert systems between experts and system administrators

#	Date	Title	Writer/ background	Source	Type of information	Value	Lang.	Xtra info
1	31-12-2002	HCI-Appropriate intuitive interfacing	Adrian Japp MSc Student	Dissertation document	Document	H	English	Document deals with the general user interfacing of current software. Some general recommendations are made
2	10-3-2005	Electronic medication dossier	Jelle Wijkstra Journalist Automation guide	IT newspaper	Article	L	Dutch	researchers of university of Pennsylvania have found out that an Electronic medication dossier will not ban errors in the prescription of medication. Errors in medication are due to specific interfacing. Is an electronic system, expert system(!), beneficiary to the patient?
3	23-2-2005	Human Computer Interaction	Debra Farrior Instructor Laureate	Advanced Topics - HCI	Lecture	M	English	
4	1-1-2003	e-Tools: the use of Assistive Technologies to enhance disabled and senior citizens' autonomy	U. Cortes et al	research paper	Document	L	English	How embedded tools (e-tools) can assist disabled people to stay autonomous.
5	1-12-2004	Mini KADS: a method for small knowledgesystems projects	J.D.B. Stemerdink et al	IT academic newspaper	Article	L	Dutch	Out-dated (1993) article about Knowledge Acquisition and Documentation System method to develop knowledge systems. System is MS-DOS based.
6	2-2-2005	iSoft Hospital Information System	iSoft	Seminar e-health	Leaflet	M	Dutch	Article about a Hospital Information System. It can be interesting information to see how the cover the element of user interfacing
7	2-2-2005	Your partner in healthcare	Logica CMG	Seminar e-health	Leaflet	L	Dutch	Very general, not usefull, information
8	2-2-2005	Primary knowledge system for professional training	Furore	Seminar e-health	Leaflet	L	Dutch	Not really interesting information. Only an interview with a doctor is interesting. His major focus the coming time is the integration of the EPD with multiple systems.
9	2-2-2005	The world in 2014	EPN platform for the information society	Seminar e-health	Leaflet	L	Dutch	Not interesting information.

#	Date	Title	Writer/ background	Source	Type of information	Value	Lang.	Xtra info
10	28-1-2005	Crucial steps in eHealth	ECP platform for eNetherlands	IT newspaper	Article	L	Dutch	National EPD not a question of 'are we going to', but 'how'
11	6-1-2005	Natural language generation via schema	Floriana Grasso/ Aiman Badri	Advanced Topics - NLG	Lecture	M	English	The NLG scheme could be used to build a diagnose ruling system.
12	17-12-2004	EU needs standard for ICT in healthcare	Ester Schop	IT newspaper	Article	M	Dutch	e-Healthcare should be normalized and standardized according to a focus group of the European Normalisation Institute.
13	21-8-2004	Piece by piece building an EPD	Michael Brocaar	Hospital newsletter	Article	H	Dutch	The academic hospital Erasmus MC in Rotterdam, The Netherlands, has setup an Electronic Patient Dossier. Maybe the originator can be interviewed to discuss the issue of communication and interfacing to the users of the system.
14	5-11-2004	Fragile software screams for creative approach	Gert Florijn	IT newspaper	Article	M	Dutch	Systems are becoming more complex and thus more fragile. Integration and configurability of the software makes the software interdependent.
15	12-11-2004	Complexity without fragility	Mark Hoogenboom	IT newspaper	Article	L	Dutch	Autonomous and adaptive software components should relieve complex software and make it more easy to keep insight and overview on projects
16	19-11-2004	Controlling the complexity explosion	Rini van Solingen	IT newspaper	Article	L	Dutch	Complex software requires more effort and thus more finance. It takes a longer time to integrate the new, complex, software systems into daily work.
17	26-11-2004	Component technology reduces complexity	Kees van Hee	IT newspaper	Article	M	Dutch	The coordination of components in complex software systems is a difficult task.
18	3-12-2004	Complexity can be handled	Marcel Claessens	IT newspaper	Article	L	Dutch	Not the technology is the source of complex or fragile software, but the lack of specification, explicitation or control of the development. It has to be cheap and fast.
19	17-12-2004	Good enough' is not good enough	Doaitse Swierstra	IT newspaper	Article	L	Dutch	Components, i.e. a content management system, sometimes create products that are almost perfect, but still not 100%. The defective % can cause sometimes unpredictable results. We accept this, but shouldn't.

#	Date	Title	Writer/ background	Source	Type of information	Value	Lang.	Xtra info
20		Pay attention or how to make sure the user gets the message in multimedia	Alistair Sutcliffe	Academic presentation	Lecture	M	Dutch	On slide 3 Alistair claims that the track record of HCI guidelines (ISO9241) is poor. This ISO standard is not publicly available, but need to be purchased for $ 2000,=. His presentation connects cognitive, psychological, issues to hci.
21	5-11-2004	The new company is a sequence of projects	Jelle Wijkstra Journalist Automation guide	IT newspaper	Article	L	Dutch	Developing software according to a project approach requires a change in the attitude of the developer towards his former way of working.
22	29-4-2005	You've got to feel a computer	Gerrit van der Veer/ Bert Bongers	IT newspaper	Article	L	Dutch	Working with IT should be a positive experience for users. The software/hardware should be intuitive. Not longer only scientist are using IT, but also the regular man, 'John Doe'.
23	1-10-2004	Family doctor find EPD time consuming	Ester Schop	IT newspaper	Article	M	Dutch	Family doctors communicate patient information to specialist, however this is done by coding. They fear that unquantifiable information is lost and not taken into account for a diagnose.
24	1-6-2005	Real-time patient information for mobile doctor	Mile Buurmeijer	IBM update, newspaper	Article	M	Dutch	Gives a description about a mobile solution for doctors in the Academic Medical Center (AMC) in Amsterdam to access patient information. The joined forces of the companies: Pfizer, Nokia, IBM and Capgemini are working on this solution
25	1-1-2000	Supporting Special-Purpose Health Care Models via Web Interfaces	James R. Warren et al	research paper	Document	H	English	Found in: First Australian User Interface Conference By James R. Warren, Heath K. Frankel, Joseph T. Noone, Berend J. Van der Zwaag Publication Date: January 2000 pp. 118
26	1-1-1987	Interface design issues for advice-giving expert systems	John M. Carroll / Jean McKendree	Communications of the ACM	Article	H	English	Older article, 1987, of which need to be investigated how up-to-date the observations still are.
27		Surveys	E.P.W.A. Jansen/Th.H. Joostens	Library	Book	M	Dutch	Book about the various ways of performing a survey.

#	Date	Title	Writer/ background	Source	Type of information	Value	Lang.	Xtra info
28	1-1-1989	An architecture for expert user interface design and management	J. Lowgren	Proceedings of the 2nd annual ACM SIGGRAPH symposium on User interface software and technology	Article	M	English	Older article, 1989, not much information that can be used in the dissertation document.