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COMPUTER-SUPPORTED DIAGNOSIS IN PSYCHIATRY

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The perceptions brought in by the five senses are first treated or worked upon by the faculty of imagination, and it is the images so formed which became the material of the intellectual faculty. Imagination is the intermediary between perception and thought. Thus while all knowledge is ultimately derived from sense impressions it is not on these in the raw that thought works but after they have been treated by, or absorbed into, the imaginative faculty.
It is the image-making part of the soul which makes the work of the higher processes of thought possible. Hence the soul never thinks without a mental picture.

Aristotle in De anima

[From Yates FA: *The Art of Memory*, Pimlico, London, 1966]

ABSTRACT

The aim of this thesis was to analyze possibilities and restraints, from a cognitive perspective, of a CDSS for diagnostics in Psychiatry. To benefit from a CDSS for diagnostics, individual variations in cognitive functioning has to be considered. These individual variations in use are analysed in this thesis with the concepts of learning styles, learning skills and adaptive styles. Four studies were performed in this thesis. Study I investigated the acceptance of the system from a learning style perspective. Study II assessed necessary skills for a successful use of the system. Study III tried to identify adaptability measures to the system by various ways of reasoning connected to diagnostic aspects and situations from an evidence-based medicine perspective. Study IV evaluated the computerized decision support system by a comparison with manual diagnosis. To get a complementary perspective on diagnostics, which might generate knowledge for system development, a narrative analysis of the two cases were also performed.
The results supported a number of conclusions:

- those with preferences for abstract conceptualization mode in information management perceived future use of the system positively
- computer skill was low for most psychiatrists under study
- a high skill in initiative and sense making seemed to be important for successful use of the system
- preferences for concrete adaptive learning mode was connected to faster procedures in the system and that this might indicate low support from the system
- flexibility for abstract adaptive learning mode was connected to longer time system use
- pattern recognition was applied in the deciding situation where hypothetico-deductive reasoning was expected from an evidence-based medicine perspective
- no major difference in terms of correctness of the proposed diagnosis was found between the computerized method and the manual method for diagnosis and where a difference was noted it was in favour of the manual method
- the use of decision support systems for diagnosis in Psychiatry has to be developed before they can be used on a routine basis

The narrative analysis show the need/importance of physician-patient-interaction in the making/creation of diagnosis and using “prognosis” as positive future scenarios in the patients´ life.

LIST OF PUBLICATIONS

This thesis is based on the following papers, which will be referred in the text by their Roman numerals:

I. **Bergman LG**, Fors UGH: Computer-aided DSM-IV-diagnostics – acceptance, use and perceived usefulness in relation to users´ learning styles. *BMC Medical Informatics and Decision Making.* 2005; 5:1 http://www.biomedcentral.com/1472-6947/5/1

II. **Bergman LG**, Fors UGH: Professional skills in psychiatry and their relation to the use of Computerized Decision Support Systems. *Submitted to International Journal of Technology Assessment in Health Care*

III. **Bergman LG**, Fors UGH: Adaptability and Computer-aided Diagnostics in Psychiatry- mind-machine collaboration in various aspects of the diagnostic procedure. *Manuscript*

IV. **Bergman LG**, Fors UGH: Decision support in psychiatry – a comparison between the diagnostic outcomes using a computerized decision support system versus manual diagnosis.
BMC Medical Informatics and Decision Making. 2008; 8:9
http://www.biomedcentral.com/1472-6947/8/9

CONTENTS

LIST OF ABBREVIATIONS AND DEFINITIONS

ABBREVIATIONS

AI	Artificial Intelligence
AIM	Artificial Intelligence in Medicine
ANOVA	Analysis of Variance
ASI	Adaptive Style Inventory
CDSS	Computerized Decision Support System
CB-SCID1	Computer-based Structured Clinical Interview for DSM IV – Axis 1 Disorders
CB-SCID1_Log	Computer-based Structured Clinical Interview for DSM IV – Axis 1 Disorders with log functions
CIDI-Auto	Computerized Composite International Diagnostic Interview
CTA	Cognitive task analysis
DSM	Diagnostic and Statistical Manual of Mental Disorders
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
EBM	Evidence-based Medicine
KI	Karolinska Institutet
LIME	Department of Learning, Informatics, Management and Ethics
LS	Learning Style
LSI	Learning Style Inventory
LSP	Learning Skills Profile
MeSH	Medical Subject Headings
NHIMAC	Australian National Health Information Management Advisory Council
NICS	National Institute of Clinical Studies (Australia)
SCAN	Schedules for Clinical Assessment in Neuropsychiatry
SCID1	Structured Clinical Interview for DSM IV – Axis 1 Disorders
TKS	Task Knowledge Structures

DEFINITIONS

Abduction = A form of logical inference, commonly applied in the process of medical diagnosis. Given an observation, abduction generates all known causes.

Algorithm = A set of step-by-step instructions that, when completed, solves a problem (from Beekman- Quinn Computer Confluence, 2006).

Clinical Informatics = A subspecialty if medical informatics focusing on use of information in support of patient care.

Cognitive science = Confluence of cognitive psychology and computer science. A tendency to create theory around computational rather than biological mechanisms is a characteristic of the discipline (from Winn, 2004).

Computational cognition = Models of cognitive science taking information that a learner encounters, perform logical or mathematical operations on it and describing the outcomes of those operations (from Arbib & Hanson, 1987). Based on the assumption that there is a direct relationship, or "mapping" between internal representations and the world outside (from Kosslyn, 1985).

Computer scripting languages = User-oriented languages that enable users to create programs (macros) that automate repetitive tasks; also known as macro languages (from Beekman and Quinn, 2006).

Computer scripts = Short programs that can add interactivity, animation, and other dynamic features to a Web page or multimedia document (from Beekman and Quinn, 2006).

Deduction = A method of logical inference. Given a cause, deduction infers all logical effects that might arise as a consequence.

Induction = A method of logical inference used to suggest relationships from observations. This is the process of generalization we use to create models of the world.

Inference = A logical conclusion drawn using one of several methods of reasoning, knowledge and data.

Knowledge base = A structured repository for knowledge, consisting of a collection of knowledge elements such as rules and their associated data model, or ontology. A knowledge base is a core component of an expert system.

Learning style = stable and enduring patterns (not fixed traits) that arise from consistent patterns of transaction, called possibility processing structures, between the individual and his or her environment. The way we process the possibilities of each new emerging event determines the range of choices and decisions we see (from Kolb, 1984).

Machine learning = Sub-specialty of artificial intelligence concerned with developing methods for software to learn from experience, or to extract knowledge from examples in a database.

Medical Informatics = The field of information science concerned with the analysis and dissemination of medical data through the application of computers to various aspects of health care and medicine (from MeSH).

Medical scripts = Pre-stored knowledge as a memory structure adapted to goals of clinical tasks, for instance diagnostic tasks. This concept is a variant of the more general concept of schema (from Charlin, 2000).

Public Health Informatics = The systematic application of information and computer sciences to public health practice, research, and learning. It is the discipline that integrates public health with information technology. The development of this field and dissemination of informatics knowledge and expertise to public health professionals is the key to unlocking the potential of information systems to improve the health of the nation. (www.nlm.nih.gov/pubs/cbm/phi2001.html)
Year introduced: 2003 (from MeSH).

Reasoning = A method of thinking.

Schema = Organized structure that exits in memory containing the sum of our knowledge of the world, more abstract than our immediate experience of the world, amenable to change by general experience or through instruction and provides a context for interpreting new knowledge as well as a structure to hold on to (from Paivio 1974).

Scripts = structures proposed for processing stereotypical situations and plans and goals individuals pursue (from Schank & Abelson, 1977).

1 INTRODUCTION

Computerized decision support systems for diagnostics in medicine and healthcare are believed to have a potential for more accurate diagnosis and in shorter time. To find out if this promise is true user characteristics, software solutions as well as mind-machine collaboration have to be scrutinized. But at first we need a definition what we mean by diagnosis-making. The concept is not crystal clear. Some view diagnosis as an ill-defined problem [Gilhooly, 1990].

Historically the first real ordering and organisation of the concept of medicine might be attributed to schools of the isles of Cos and Cnidos (facing each other in the Aegian sea in ancient Greece).From a diagnostic point of view Coan writings contain discussion of the organism, the suffering, the illness and the disease where the Cnidian focus on the description of organs, diseases and disease classification. Today physicians still argue whether medicine must focus on the unique case of the patients´ illness or must restrict its task to the scientific approach of the adequate diagnosing of pre-established (taxonomic) disease-entities and their pertinent treatment [Ridderikhoff, 1989].

Psychiatric diagnostics is often seen as unclear and unreliable, and experts are not always in agreement. Therefore the DSM-system (Diagnostic and Statistical Manual of Mental Disorders) was introduced, a system that enhances inter-rating reliability. This is done by focusing on symptom diagnosis from finite information as compared to clinical diagnosis grounded on a greater information material like for instance etiological processes and current context. DSM was constructed without a fixed theory concerning etiology but by grounding criteria in symptom descriptions. However, the DSM system is not lacking theory concerning knowledge acquisition and diagnostic relevance. The focus on symptom diagnosis may increase the reliability but might also decrease the validity. A clinical diagnosis can never be replaced by a DSM-diagnosis and the DSM-diagnosis is also insufficient for planning treatment. DSM can be seen as an instrument that sorts symptoms, if they reach clinical significance and the criteria is fulfilled, into known clinical syndromes [Herlofson, 1999].

So called artificially intelligent (AI) computer systems are believed to both create new clinical knowledge as well as using clinical knowledge. Machine learning systems for example has great potential for developing knowledge bases and guideline development. Computerized decision support systems are knowledge-based and used in for example the areas of diagnostic assistance and therapy critiquing and planning with some success [Coiera, 2003].

Medical problem solving research might be divided into at least three areas, identification of cognitive processes physicians employ when making clinical judgments, computer supported medical decision making (decision analysis) and artificial intelligence [Mattingly and Fleming, 1994]. In solving a medical problem the cognitive concepts of task, task environment and problem space might be addressed. The task takes place in a particular environment and the problem space is the internal

representation of the task environment coupled with a goal. In this way the problem becomes mentally structured and understandable [Newell and Simon, 1972].

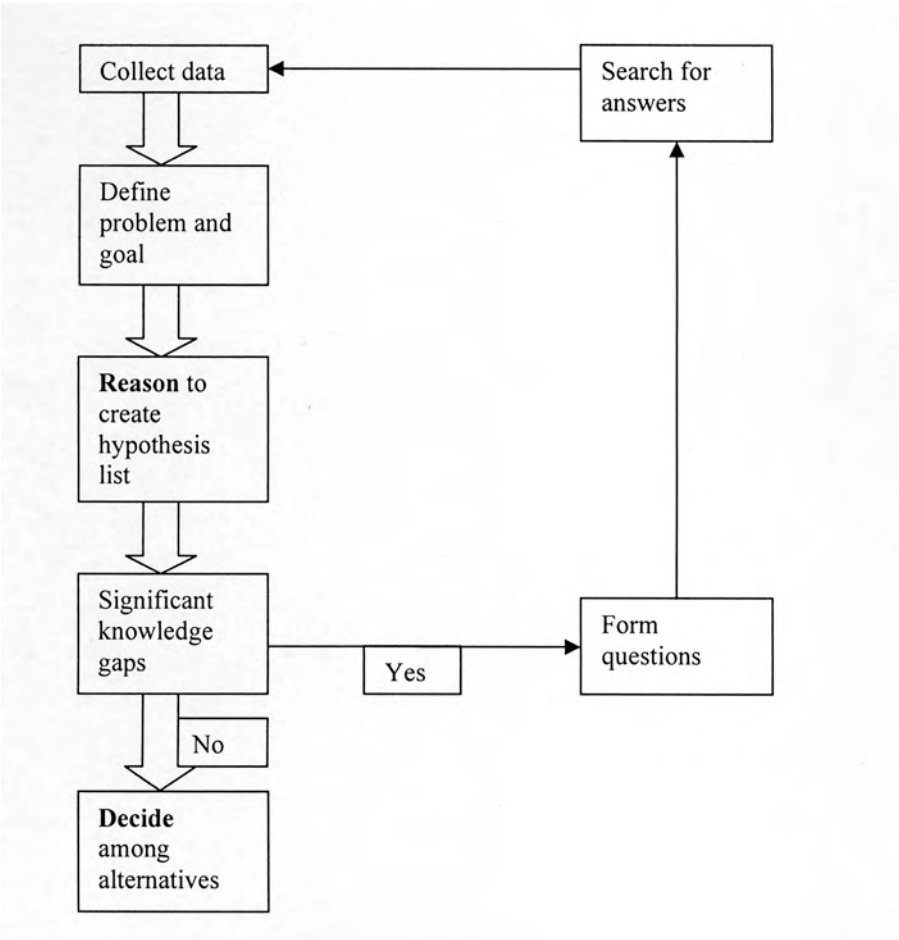
1.1 REASONING IN A CDSS

Medical decision-making research might be seen as an extension and elaboration of the original actuarial or "statistical" research developed by Meehl [Meehl, 1954] and others in the development of databases relative to the statistical probabilities of a disease being present, or treatment being effective, given various other factors [Mattingly and Fleming, 1994].

In a comparison of clinical and actuarial methods, the actuarial methods were found to be superior in diagnosing and predicting human behaviour [Dawes et al, 1989].

CDSS with a knowledge-based background are able to reason with data from individual patients to come up with reasoned conclusions. The reasoning and deciding process is often the same for most tasks when new data indicate a problem. Problem-solving is reasoning from the facts to create alternatives, and then choosing one alternative [Coiera, 2003]. See figure 1.

Figure 1 [after Coiera, 2003].



The problem and goal in our case is diagnosis making where the hypothesis is generated by making inferences from the given data. A hypothesis list of potential

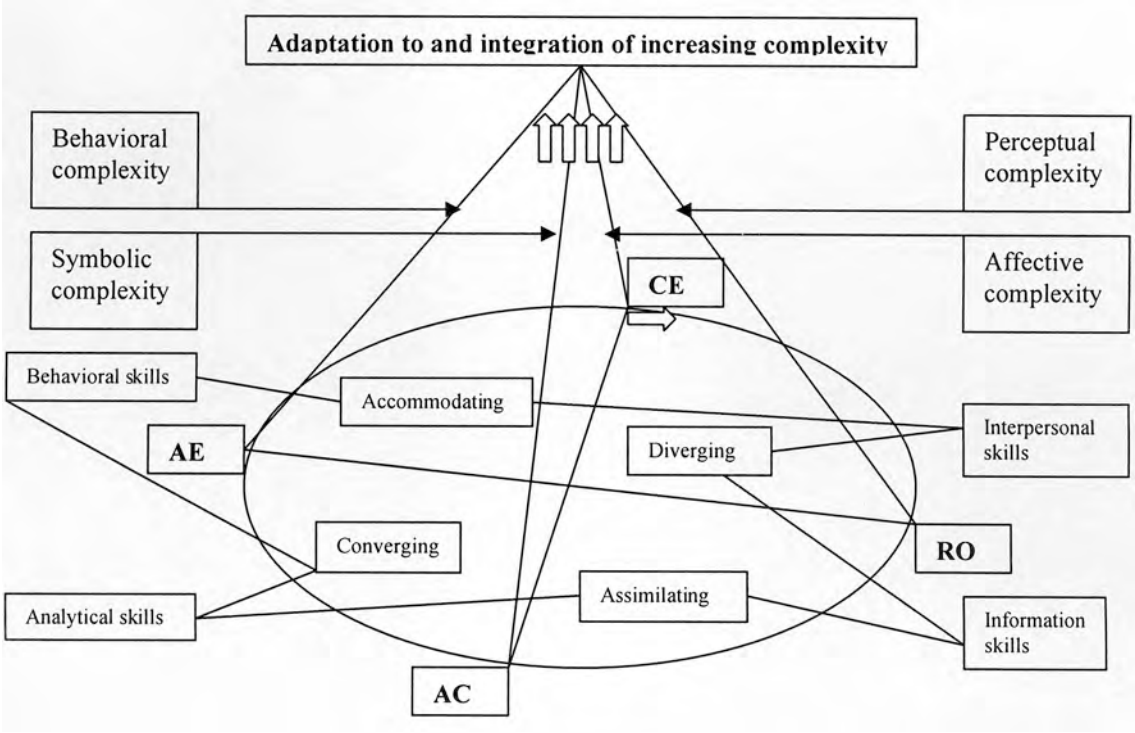
diagnoses is created and before deciding on the diagnosis many iterations of data gathering and hypothesis generation might happen. In a CDSS the process of reasoning or data interpretation requires a database, a knowledge base and inference rules. The rules of inference are based on logic in a CDSS with a decision tree format. For example, the CDSS system CB-SCID1 is designed in that way [Herlofson, 1999]. A decision tree might be useful where there are mutually exclusive multiple alternatives to follow where each path in the decision tree ends in a different outcome, in our case a different diagnosis [Coiera, 2003].

2 BACKGROUND

2.1 THEORETICAL BACKGROUND

Information systems can be designed and evaluated in a number of ways, from different aspects. For a CDSS in diagnostics clinical aspects like accuracy and time seems to be important. However, before a system comes to use the question of acceptance must be addressed. When accepted the individual use of the system might be important from a learning styles perspective specifying skills needed and adaptability from a mind-machine collaboration point of view. Finally the CDSS must be evaluated in a comparison with the ordinary paper and pencil method to get secure knowledge about the pros and cons of the computerized system. Learning styles and its importance for users of computer systems has been demonstrated in various areas, for example in Internet use [Jordanov, 2001], web-based teaching [Karuppan, 2001], interactive multimedia environment [Kettanurak et al, 2001], efficacy of computer training methods [Sein and Robey, 1991], hypertext environments [Melara, 1996], and in interactive learning systems [Baldwin and Sabry 2003]. The learning style construct has been analysed by Curry [Curry, 1983] and was used by Claxton and Murrell in their systematization of various learning style models [Claxton and Murrell, 1987]. In their systematization the Kolb learning style model [Kolb, 1984] was classified as an information-processing model which was determined to suit the purpose of this thesis. The comprehensive theoretical model of learning styles of Kolb that was applied includes learning styles, learning skills and adaptability measures with the common denominators, learning modes, Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC) and Active Experimentation (AE) learning modes can be analysed according to the model. See Figure 2.

Figure 2: Adaptation to and integration of increasing complexity [after Kolb, 1984]



According to the Kolb model the four learning modes CE, RO, AC and AE build the learning styles Diverging (CE and RO), Assimilating (RO and AC), Converging (AC and AE) and Accommodating (AE and CE). Learning styles are spontaneously demonstrated in various situations and might be developed and used more consciously like a strategy. This is a model of experience-based learning where all processes of the model are vital for the learning result. The user/learner moves around the four modes in a circular direction. First there is an actual concrete experience (CE). Second the learner reflects on this experience (RO). Third, the learner conceptualizes his/her observations and/or reflections into abstract theories or ideas (AC). Fourth, the learner tests the theories or ideas by active experimentation (AE). However, preferences for certain learning styles seems to be common and different situations might evoke certain learning styles. Learning skills are derived from and corresponds to the learning styles according to the Kolb model. The demands of reality, to handle a specific situation, require the use of learning skills (interpersonal, information, analytical and behavioral). Professionals often develop adaptive styles in meeting and adapting to increasing affective, perceptual, symbolic and behavioural complexity. This development might lead to more integrated professional behaviour.

This theoretical model was applied (for study 1, 2 and 3) in the investigation of computer supported diagnostics in psychiatry – acceptance, professional skills needed and adaptability focusing mind-machine collaboration in various aspects of the diagnostic procedure.

Finally an evaluation (study 4) of methods for decision support in psychiatry was done in a comparison between the diagnostic outcomes using a computerized decision support system versus manual diagnosis.

2.2 DIAGNOSIS

Medicine is referred to by the founder of cybernetics, Norbert Wiener, as a semi-exact science [Ridderikhoff 1989]. This is partly because of the fact that no general agreement on the definition of the concept “diagnosis” seems to exist in medicine.

Diagnosis has to do with differentiating between alternatives of symptoms and disease concepts as well as health concepts often heavily influenced by social and cultural factors. Diagnosis is often linked to prediction and treatment. The probabilistic way of diagnosis is elaborated in clinical decision-analysis where the diagnostic process is considered to be a sequential process in which the physician employs a test to obtain more (probabilistic) information in order to test the new information, and so on until a “final hypothesis” or “diagnosis” is reached. However, there are objective probability (mathematical or statistical probability) and subjective probability (also named inductive probability) [Ridderikhoff, 1989]. Statistical probability use often ends up with the need of some inference to the real world situations. The use of inductive probability is often closer to real world situations in that the particular patient who is suffering from a disease is reporting specific symptoms. However, inductive probability has the weakness of depending on personal knowledge [Ridderikhoff, 1989].

Psychiatric diagnosis with the DSM-system is a symptom-diagnosis building on a limited amount of information as compared to the full clinical diagnosis. The focus on symptoms in the DSM is a result of the ambition to construct the criteria for different symptoms in an a-theoretical stance concerning the aetiology of the disorders. The benefit of this construction is increased inter-rating reliability. However, this circumstance maybe at the cost of content validity. The DSM-diagnosis can never replace clinical investigation and cannot be used as the only measure for treatment planning. One strength of the DSM-system is its good procedure validity. The focus on criteria and symptoms yields a secure differentiation between various diagnoses leading you on the right track [Herlofson, 1999].

SCID1 (Structured Clinical Interview for DSM-IV axis 1 Disorders) is a paper and pencil instrument to facilitate making axis 1 DSM-IV diagnoses.

The questions are both structured and, as a complement, freely formulated, which makes this method a semi-structured interview support. A pre-clinical interview is always recommended before starting the SCID1 interview. Structured questions are used to facilitate judgement about the fulfilment of different criteria, yes or no answers. The fulfilment of a certain number of criteria makes a diagnosis, provided the instructions are understood and followed.

SCID1 is not a psychometric instrument *per se* and the result is partly dependent on the user's SCID1 training level and clinical experience.

2.3 COMPUTERIZED DECISION SUPPORT SYSTEMS, CDSS

Scientists former dreams and ambitions to create an "electronic brain" in artificially intelligent (AI) computer systems have caused many discussions and much controversy. In medicine the healthcare spectrum has broadened so instead of speaking of Artificial Intelligence in Medicine (AIM) it is typical to use terms like clinical decision support systems (CDSS) [Coiera, 2003]. Clinical decision support is often referred to the decision process made by health care professionals in relation to patient diagnosis, treatment and care. A clinical decision support system compares patient characteristics with a knowledge base and then the system guides the clinician by offering patient-specific advice.

Computer decision support systems (CDSS) might be classified into four types. The Australian National Health Information Management Advisory Council and National Institute of Clinical Studies use the following classification [NHIMAC & NICS, 2002].

1. The system provides categorised information that requires further processing and analysis by users before a decision can be made.
2. The system presents the clinician with trends of patients´ changing clinical status and alerts clinicians to out-of-range assessment results and intervention strategies. Clinicians are prompted to review information related to the alerts before arriving at a clinical decision.
3. The system uses deductive inference engines to operate on a specific knowledge base and automatically generates diagnostic or intervention recommendations

based on changing patient clinical condition, with the knowledge and inference engines stored in the knowledge base.

4. The system uses more complex knowledge management and inference models such as case management reasoning, neural networks (mathematical models that emulate some of the observed properties of biological nervous systems), or statistical discrimination analysis to perform outcome or prognostic predictions. Such systems possess self-learning capabilities and use fuzzy set formalism (mathematical representation of uncertainty and vagueness that resembles human reason in its use of approximate information and uncertainty to generate decisions) and similarity measures or confidence level computation as mechanisms to deal intelligently and accurately with uncertainty.

The use of these four types of CDSS varies in the automation and interpretation process. For the not so advanced systems the user has to interpret what the system tells you and moreover use human judgment before you take the final decision. For the advanced systems deciding automatically, that is the interpretation is automated in the system, you as a clinician must be aware of the quality of data and the reasoning behind a particular recommendation and the particular context in which the system is used. The advanced systems might also be at risk for automation bias in the user. Clinicians using an automated decision aid will act as the aid directs them to do irrespective of the correctness of the suggested action [Coiera, 2003]. Users of the not so advanced systems may be at risk committing errors due to the limitations of human cognition.

The CDSS used in this study was CB-SCID1 that might be referred to the first and the third category in the NHIMAC & NICS classification.

2.4 REASONING IN THE CB-SCID1

CB-SCID1 is a decision support system designed to support DSM-IV diagnoses in psychiatry. The system is based on the paper and pencil SCID1 method, including the DSM rules and decision tree. As it was a rule-based system from the beginning, it was straightforward to computerize it. The CB-SCID1 is considered to be of advantage when it deals with the administration in the program for instance, correction of criteria judgement, summing up of fulfilled criteria according to DSM rules, presentation of noted diagnoses and execution of some diagnostic conflict control. The program is functioning like this: the user is asked to judge whether various criteria, presented one by one, are fulfilled or not and the system chooses how to move on, based on user input. The system guides the user through the various branches in the decision tree, based on the “yes”, “no” or “unclear” answers about each criterion. The program forces the user to face all major clinical syndromes but it is always possible the move to the next branch in the decision tree by answering no and users are not forced to go into detail in any specific syndrome area. If the number of fulfilled criteria reaches a certain level (according to DSM-IV) the program automatically suggests the corresponding DSM-IV diagnosis. The CB-SCID1 start picture (for all patients) and final picture (showing a try to diagnose the Maria case) is shown in Figure 3 and Figure 4 respectively.

Figure 3: The CB-SCID1 start picture for all patients

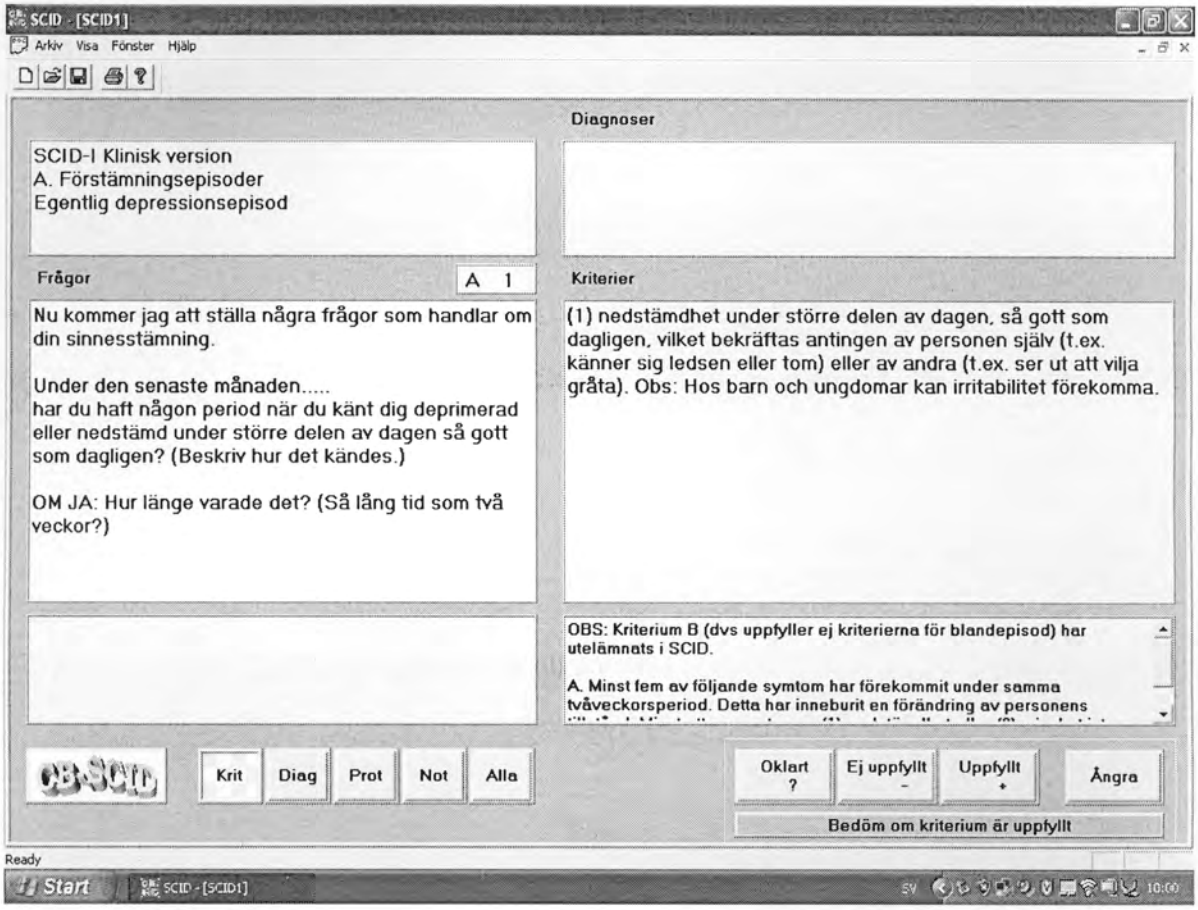
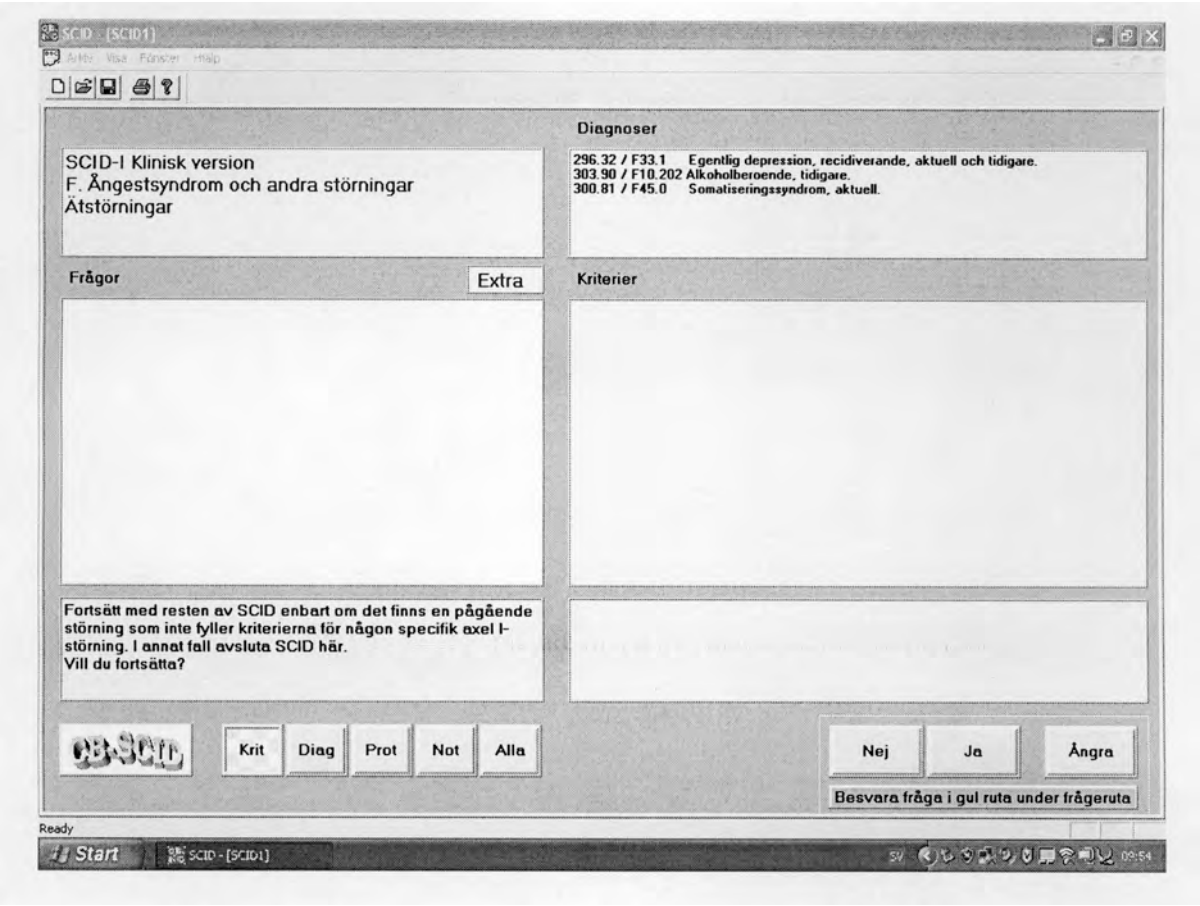


Figure 4: Showing a final CB-SCID1 picture in a try to diagnose the Maria case



2.5 REASONING IN THE MIND OF THE INDIVIDUAL PHYSICIAN OR PSYCHIATRIST

Solving the diagnostic problem as a task is a process going on in the mind of the psychiatrist in a problem space constituting the individuals´ representation of the task environment [Newell and Simon, 1972]. The reasoning, in the pursuit of a diagnosis, is probably mentally structured in the problem space. This reasoning in the mind of the psychiatrist is interacting with the reasoning in the CDSS. The result of this interaction may enhance or hinder the ultimate goal, a correct diagnosis, depending on the quality of software, user characteristics such as domain knowledge and training as well as preferred learning styles.

Clinicians are supposed to apply evidence-based reasoning when it comes to diagnosis, prognosis and treatment. Randomized controlled trials, meta-analyses or best external evidence from systematic reviews or primary studies are used in the answering to clinical questions [Sackett et al, 1997]. This kind of reasoning is scientific and directed to the practical problems of prediction and control, a type of instrumental reasoning, to best reach explicit given ends [Mattingly and Fleming, 1994]. The scientific reasoning in diagnostic work is dependent on hypothesis formulation and consideration. Hypothesis seems to be generated early, perhaps too early, few hypothesis are considered and new hypothesis are generated reluctantly sticking to status quo trying to find evidence for the existing hypothesis [Elstein et al, 1978].Other kinds or reasoning focus on face-to-face encounters between therapist and patients to better understand a particular patient (interactive reasoning [Mattingly and Fleming, 1994]) or understanding the whole condition, the illness, the meaning of the illness for the person, the family and the social and physical contexts in which the person lives (conditional reasoning [Mattingly and Fleming, 1994]). Narrative reasoning and thinking occurs through story making, telling retrospective stories or making prospective ones about what would happen in therapy, thus structuring therapy as a coherent event and not just a series of treatment activities [Mattingly and Fleming, 1994].

Clinical reasoning from medical scripts is characterized by knowledge structures associated with time sequences, developments, events or actions as they transpire. Perceptions activate illness scripts that interpret information about the characteristics of the situation. Inferences are made to rule in or rule out hypothesis in the diagnostic process where every hypothesis is an activated illness script. Two or more simultaneously activated illness scripts require deeper reasoning. Symptoms and signs can belong to several scripts. Scripts are generic structures that can interpret any instance of an illness provided there is memory of previous patients that is stored in the form of instantiated scripts. Script activation often occurs automatically, without conscious awareness. In other situations the configuration of data is so familiar that the solution leaps into mind almost instantly, a process called pattern recognition. Thus, it is the configuration of clinical features that activates an illness script [Charlin et al, 2007].

The script concept seems to be used with different definitions and purposes. For instance in the computer area scripts are short programs that can add interactivity, animation, and other dynamic features to a Web page or multimedia document or

defining scripting language like JavaScript [Beekman and Quinn,2006]. Even in the area of narrative analysis there are similarities with other areas in the script concept. The thinking process in scripts has similarities to narrative thought theoretically, cognitively. However, a story is a way to imagine possible lives, to feel emotions which is far away from scripts [Mattingly, 1998].

Heuristic reasoning guide most clinical decisions. However it is prone to biases and is limited by cognitive resources. Working memory is limited for number of items like thoughts, sensory impressions and plans as well as duration time. Both retrospective memory and prospective memory is dependent on working memory for processing work [Coiera, 2003].

Schema theory in its proposition that our knowledge of the world is constantly interpreting new experience and adapting to it might be compared to the process Piaget [Piaget, 1968] called “assimilation” (matching experience to a schema in memory) and “accommodation” (revision of hypothesis thus accommodating to the experience) [Winn, 2004].

Learning styles, which was focused on in Study 1, are stable and enduring patterns (not fixed traits) that arise from consistent patterns of transaction, called possibility processing structures, between the individual and his or her environment. The way we process the possibilities of each new emerging event determines the range of choices and decisions we see [Kolb, 1984]. Any individual can carry out only a small fraction of the acts for which his sense organs, nervous system and muscles equip him. We can proceed in most situations to act sensibly without having to make hundreds of conscious choices is that one develops organized ways of automatically processing most of the kinds of information encountered [Tyler, 1978].

Within various learning styles there are inherent ways of thinking and reasoning which we will focus on. Diverging style - view concrete situations from many perspectives and organize many relationships into a meaningful “gestalt”, Assimilating style - inductive reasoning, Converging style- hypothetical-deductive reasoning and Accommodating style - solve problems in an intuitive trial and error manner [Kolb, 1984].

3 AIMS OF THE THESIS

The amount of medical knowledge has increased enormously in the past years and no living person can handle this information flood on his/her own. The use of IT has been proposed to facilitate management of knowledge. But the user in this pursuit has to keep up with new domain knowledge and to learn and apply the demanded cognitive functions in the use of these IT-systems. To benefit from a CDSS (seen as a form of instruction) for diagnostics, individual variations in cognitive functioning and preferences have to be considered.

The aim of this Thesis was to analyse these individual variations in use and preferences with the concepts of learning styles, learning skills and adaptive styles. A further aim was to assess the potential of the CDSS under study (CB-SCID1) by a comparison with manual diagnosis with respect to time and diagnostic accuracy.

3.1 GENERAL AIM

Analysis of possibilities and restraints, from a cognitive perspective, of CDSS use for diagnostics in Psychiatry.

3.2 SPECIFIC AIMS

Study I: This study was undertaken to investigate and describe how different learning style preferences among psychiatrists might affect *acceptance, use and perceived usefulness* of the CDSS CB-SCID1 for DSM-IV-diagnostics.

Study II: The general aim of this study was to investigate the hypothesis that an application of CDSS in Psychiatry might also need other skills besides ordinary computer skills to be successful. More specifically, the aims were to investigate which skills that are believed to be important in clinical psychiatry, and to compare those to the actual skills among practicing psychiatrists. Moreover, an attempt was made to try to find which of these skills that might be important for CDSS use in psychiatry.

Study III: The aim of this study was to investigate the adaptability and reasoning strategies for various aspects of the diagnostic procedure for psychiatric specialists and non-specialists using a CDSS-tool. Further aims were to study the interplay between self-regulation and external regulation (mind-machine collaboration).

Study IV: This study was undertaken to compare the traditional "paper and pencil" diagnostic method SCID1 with the computer-aided diagnostic system CB-SCID1 with regard to processing time and the accuracy of suggested diagnoses.

To get a different and complementary perspective on diagnostics in Psychiatry also a narrative analysis of the same cases used in the CDSS trial was performed. The aim was to elicit knowledge for the development of old and creation of new computerized decision support systems for diagnosis.

4 MATERIALS

4.1 THE DSM – SYSTEM

The DSM-system is a multi-axial diagnostic system, which focuses on the following:

1. Which symptoms have currently forced the patient to seek help?

2. How does the patients´ overall pattern of experiences and behaviour, compared with what is generally expected in the patients´ socio-cultural milieu, look like?

3. Are there any somatic diseases, which have to be attended to?

4. Have there occurred any stressful events in the patients´ life along with the initial symptoms?

5. How serious are the problems just now, how is the patient functioning?

The DSM provided a reliable criteria-based system for symptom-diagnosis as compared to the more complete and time-consuming clinical diagnosis including etiological discussion and analysis of the course of events. However, a clinical diagnosis can never be substituted by a symptom-diagnosis but the criteria differentiate in a reliable way between different diagnoses and the decision tree for axis1 and the terminological homogeneity makes the system easier to use [Herlofson, 1999].

4.2 THE SCID INTERVIEW

The SCID-interview is a semi-structured support for DSM-diagnoses to further the reliability even more. SCID is not a psychometric instrument, patient answers are important but it is the criteria that are supposed to be evaluated by the diagnostician. In this study the SCID1-interview was used (related to axis 1 in the DSM-system)

4.3 THE CB-SCID1 – SYSTEM AND THE CB-SCID1_LOG – SYSTEM

The chosen CDSS in this study was CB-SCID1. This system, the SCID, a questionnaire to arrive at DSM-IV diagnoses and is in its computerized version using logical inference of logical data (true, false), symbolically representing connections and dependency between components in the psychiatric knowledge base presenting questions according to the ”paper” SCID manual. The CB-SCID1 also takes care of administration, diagnostic conflict control, consultation, reminders and appropriate text information in tune with the decision problem at hand (many sequential decisions to each criteria presented by the system).

The special version of the system, CB-SCID1_Log is identical to CB-SCID1 for the user, but might also log interaction details like session time, number of diagnoses, number if correct diagnoses and number of incorrect diagnoses.

4.4 SETTING AND SUBJECTS

4.4.1 Study I, II and III

49 practicing Psychiatrists, working in three different clinics, with different degree of expertise volunteered to participate in the studies. Out of these 31 were experts at a senior level (being registered as specialists in psychiatry), and 18 were non-specialists (physicians with a position in psychiatry but without a specialist exam in psychiatry). The interviews, filling in of questionnaires and diagnosis making with the CB-SCID1 (installed on a laptop) were conducted in their own workplace setting.

To be able to relate the Learning Styles of the 49 physicians in the study to the general situation in Sweden, a random sample of 250 (out of 1900 practicing psychiatrists in Sweden) were asked to fill in the Learning Style Inventory.

4.4.2 Study IV

63 clinicians from two different clinics volunteered to participate in the study. 30 were specialists in psychiatry, 24 were clinical psychologists, two were general practitioners (specialists), one was a specialist in clinical neurophysiology, one physician, two were physicians in psychiatric specialist training and three were in clinical psychologist training (last year).

The SCID procedures by the different subjects were randomized to prevent order effects for both methods (paper and pencil-based SCID1 versus computer-based CB-SCID1) and order of cases interviewed (easy case versus difficult case).All subjects used both methods and both cases but in different combinations according to a randomized list.

The interviews, and diagnosis making with the CB-SCID1 (installed on a laptop) and paper-and pencil SCID1 were conducted in their own workplace setting.

5 METHODS

We used the Kolb model that is well suited for the purpose of study I, II and III. This model is the most comprehensive one of the models classified by Claxton and Murrell [Claxton and Murrell, 1987] as an information-processing model as compared to other learning style models with another focus as for example personality trait models.

5.1 STUDY I

49 psychiatrists (specialists and non-specialists) from 3 different clinics volunteered to participate in this study and to use the CDSS to diagnose a paper-based case (based on a real patient). LS, attitudes to CDSS and complementary data were obtained via questionnaires and interviews. To facilitate the study, a special version of the CDSS was created, which automatically could log interaction details.

5.2 STUDY II

Perceived skills by psychiatrists about their own skills and perceived skill demand in the work situation in Psychiatry to do the job well were studied.

Forty-nine (49), practicing Psychiatrists, 18 non-specialists and 31 specialists were examined for Learning Skills measured with the Learning Skills Profile (LSP) by Kolb.

The Learning skills score were correlated to the log-file outcome variable in the CDSS for number of correct diagnoses. Perceived Job Skill Demands score for specialists was used as an indication of important skills in work. Looking at the skill elements for the important skills you might get an estimation of needed skills that might suit CDSS-work.

5.3 STUDY III

The aim of this study was to investigate psychiatrists´ adaptability in various diagnostic aspects and situations using a CDSS-tool, especially the interplay between flexibility in the user and CDSS-use in psychiatric specialists and non-specialists. The level of adaptive flexibility can be seen as an indicator of the level of integrative development. A higher level of development can be inferred from observation of systematic variability in response to different environmental demands.The Adaptive Style Inventory, ASI, is designed to assess the ways you adapt to different situations. The situations presented in the ASI are divided into four adaptive types: Valuing, Acting, Deciding and Thinking.

The situations studied were adapted to the ASI-format. The examples, specifying each situation, were constructed, by the authors in cooperation with a senior psychiatrist, for the purpose of the study. The examples were in each of the ASI-categories adapted from an EBM-framework emphasizing central tasks of clinical work where questions

arise from: 1.A question about the precision of the clinical examination. 2. A question of determining aetiology. 3. A question about making a differential diagnosis. 4. A question of selecting a diagnostic test. 5. A question about predicting prognosis. 6. A question about selecting therapy. 7. A question about attempting secondary prevention. 8. A question about seeking self-improvement.

5.4 STUDY IV

This study was undertaken to compare the traditional ‘paper and pencil’ diagnostic method SCID1 with the computer-aided diagnostic system CB-SCID1 to ascertain processing time and accuracy of diagnoses suggested. 63 clinicians volunteered to participate in the study and to solve two paper-based cases using either a CDSS or manually.

5.5 ANALYSIS

5.5.1 Study I

5.5.1.1 Statistical analysis

Answers to the structured questions in pre-assessment and post assessment survey about attitudes to items related to the research project were described in an ordered categorical scale. An analysis of correlation between the dimensions of the learning style inventory and the outcome log-file variables were performed. Results were calculated as mean, standard deviation, median and lower - and upper quartile, where appropriate. Comparison between the two independent groups, specialists and non-specialists, was performed by Mann-Whitney U Test and comparison between more than two independent groups (LS groups) was performed by the Kruskal-Wallis ANOVA by Ranks Test. Association between variables was calculated by Spearman Rank Order Correlations.

5.5.2 Study II

5.5.2.1 Statistical analysis

Answers to the structured questions in pre-assessment and post assessment survey about attitudes to items related to the research project were described in an ordered categorical scale. An analysis of correlation between the perceived skills of the learning skills profile and the outcome log-file variables, as well as a comparison between specialists and non-specialists in this respect, was also performed. Results were calculated as mean, standard deviation, median and lower - and upper quartile, where appropriate. Association between variables was calculated by Spearman Rank Order Correlations. The statistical analyses of disagreement between personal learning skill and job skill demands was calculated by the non parametric statistics Wilcoxon matched pair signed ranks test.

5.5.3 Study III

5.5.3.1 Statistical analysis

Associations between the preferential pattern for the four learning modes, flexibility for the four learning modes and the log-file variables session time, number of proposed diagnoses and number of correct diagnoses in the CDSS were analysed by Spearman rank order correlations. $P < 0.05$ was considered statistically significant.

5.5.3.2 Qualitative procedure

Directionality of Adaptability were analyzed from diagnostic aspects (central clinical tasks according to evidence-based medicine), situation as defined in the adaptive style inventory (valuing, thinking, deciding and acting) and dominant diagnostic reasoning strategy.

Methods for studying thinking and reasoning in performing clinical tasks require analysis of corresponding task knowledge structures. Representational data of these knowledge structures do not easily fit into standard statistical approaches. Quantification might mean stripping a body of data of its contextual links and meanings of complex cognitive processes. Cognitive task analysis (CTA) benefit from both quantitative and qualitative method [Crandall et al, 2006] and the qualitative procedure used in this study has similarities with the CTA-method Task knowledge structures (TKS) in the cognitive engineering field. The assumption in this method is that people possess knowledge structures in memory that relate to tasks. TKS often has a goal structure that represents the sequencing of task activities and a taxonomic structure that models knowledge about objects, their relationships and a connection to behavior. The TKS model is described in previous research by Johnson and Johnson [(Johnson and Johnson, 1991)].

5.5.4 Study IV

5.5.4.1 Statistical analysis

A randomization list for the subjects was generated before the trial. The randomization was carried out on the two conditions (computer/paper and pencil) and the “degree of case difficulty” (easy/difficult) and was applied to the starting combination in blocks of four subjects. The four starting combinations were: 1, Easy case on computer; 2, Easy case on paper and pencil; 3, Difficult case on computer; and 4, Difficult case on paper and pencil.

A subject starting with the easy case on the computer got the difficult case on paper and so on. To examine the distribution of easy and difficult cases within the professional categories, Fishers exact test was applied. In comparison between subjects solving the case on computer and those solving the case with paper and pencil, the Chi-square test was used for variables measured on a nominal scale. The Mann-Whitney U test was used to analyse ordered categorical data or continuous data. Associations between baseline information variables and the outcome measures were analysed by Spearman rank order correlations. $P < 0.05$ was considered statistically significant.

5.5.5 Ethical approval

All parts of this study have been approved by the ethical committee of Karolinska Institutet. All individual data were kept unidentified.

6 RESULTS

6.1 STUDY I

The LS preferences (according to Kolb) of the 49 physicians turned out as follows: 37 % were Assimilating, 31% Converging, 27% Accommodating and 6% Diverging.
The CDSS under study seemed to favour psychiatrists with abstract conceptualization information perceiving mode (Assimilating and Converging learning styles).
A correlation between learning styles preferences and computer skill was found.
Positive attitude to computer-aided diagnostics and learning style preferences was also found to correlate.

Using the CDSS, the specialists produced only 1 correct diagnosis and the non-specialists 2 correct diagnosis (median values) as compared to the three predetermined correct diagnoses of the actual case. Only 10% had all three diagnoses correct, 41% two correct, 47% one correct and 2% had no correct diagnose at all.

6.2 STUDY II

Learning Skills Profile (LSP) by Kolb revealed that the psychiatrists studied had personal skill scores above average. However, they also showed very low personal scores for computer skills and low personal scores for quantitative skills. For job skill demands scores they were higher than personal learning skills scores for all skills except Theory and Quantitative skills. Significant differences in the learning gap between personal skills and job skill demands were discovered in the Interpersonal skill group (Leadership, Relationship and Help), Information skill group (Sense Making) and Behavioural skill group (Goal Setting and Action). Correlation between personal skill variables and correct diagnoses were significantly found for Sense Making skill and Initiative skill. The combination of the skill elements for Sense Making and Initiative skills (the ability to adapt to new situations with new strategies and solutions, seek out and take advantage of opportunities and commit to objectives to meet deadlines) might be interpreted as “Information management skills” that seems to be needed for successful CDSS use.

6.3 STUDY III

The pattern of Concrete Experience, CE might be connected to pattern recognition and/or trial and error reasoning. The preferential pattern of, CE was significantly associated with faster processing in the CDSS relative to other preferential modes. The preferential pattern of Active Experimentation, AE was significantly associated with more proposed diagnoses probably connected to trial and error and/or pattern recognition reasoning.

Flexibility on Abstract Conceptualization, AC was significantly associated with longer session time in the program and probably connected with hypothetico-deductive thinking and/or probabilistic diagnosis/inductive schema reasoning.

Flexibility on AE was significantly associated with higher number of proposed diagnoses and nearly significantly with number of correct diagnoses and probably connected to trial and error and/or pattern recognition reasoning.

Directionality of adaptability measures (towards, away or neither from the demands of the situation for various diagnostic aspects) revealed that the adaptation for Acting and Deciding was mainly Away (processing) and for Thinking and Valuing it was Towards (perceiving).

For the diagnostic aspect of the deciding situation “Whether a clinical criterion is fulfilled or not ?” the majority moves away from the press, adapting away (processing) that is they seem not to be prepared to adapting toward the decision demand in the CB-SCID1 for this option.

Hypothetico-deductive reasoning was expected in deciding situations according to Kolb theory, but pattern recognition reasoning seems to be used.

Preferential match, capitalizing on learner strengths or preferences in CDSS use, seems to have been applied. Preferences for concrete adaptive learning mode were associated with faster procedures and the preferred pattern recognition might reflect low CDSS support. Pattern recognition was used in the deciding situation although hypothetico-deductive reasoning was expected. This result is not in line with EBM principles where hypothetico-deductive reasoning is advocated. Flexibility in abstract adaptive learning mode was connected to hypothetico-deductive thinking and/or probabilistic diagnosis/inductive schema and was also associated with longer time in the CDSS.

6.4 STUDY IV

No major difference between paper and pencil and computer-supported diagnosis was found. Where a difference was found it was in favour of paper and pencil. For example, a significantly shorter time was found for paper and pencil for the difficult case, as compared to computer support. A significantly higher number of correct diagnoses were found in the difficult case for the diagnosis ‘Depression’ using the paper and pencil method. Although a majority of the clinicians found the computer method supportive and easy to use, it took a longer time and yielded fewer correct diagnoses than with paper and pencil.

7 DISCUSSION

7.1 LIMITATIONS IN THE STUDIES

The use of written text on paper when presenting the cases to be diagnosed has limitations concerning interpretation mode. Some subjects may stick inflexibly to the actual written text. Other may fill in the empty spaces in the text using their clinical experience and imagination. Moreover, there may be frustration at not being able to put follow-up questions, since live patients were not actually used, in order to clarify the picture of the patient. The artificiality of the evaluation conditions, not using real live cases, is a limitation in the studies not testing the potential possibility that the software might work better under such conditions.

The greatest limitation in the studies might be the unclear status of the CB-SCID1 in terms of the life cycle of information systems. The CB-SCID1 has the status of a mature commercialized product on the market. Yet, one might wonder about the development process from requirement analysis to outcome assessment. What about the architecture design, software programming, unit test and acceptance test? It is difficult to evaluate the importance of user training and familiarity with CB-SCID1vis-á-vis probable software problems.

7.2 THE CB-SCID1 PROGRAM

It can also be discussed whether CDSS and paper and pencil methods should be seen as alternative methods or if CDSS should take a complementary role in the ordinary clinical work.

The fact that very few of the clinicians had tested the CB-SCID1 before the trial might, of course, influence the outcome of the studies. However all subjects were instructed in how to use the CB-SCID1system before the trial and a CB-SCID1-trained person was available during all sessions to answer any questions regarding the system and its functions.

7.3 THE DSM AND SCID

The DSM-IV-diagnosis is a symptom-diagnose derived from a deliberately limited amount of relevant diagnostic information, pattern of symptoms and development within predefined limits. This is not intended to be compared with the clinical diagnosis, which is building on patterns of symptoms, complete development, actual circumstances, anamnestic data, etiological discussion, laboratory tests, psychological tests etc. The symptom-diagnosis and clinical diagnosis perspective might be complementary to each other and it is recommended that a clinical interview always should be done before the SCID or CB-SCID1 interview.

7.4 ACCEPTANCE, PERCEIVED USEFULNESS AND USE OF THE CB-SCID1

Computer skill, computer anxiety and the attitude to computer-aided diagnostics are interpreted to be important variables in the acceptance of the CB-SCID1-system. Training as a means to increase computer skill to ease the acceptance of systems like CB-SCID1 seems to be important. A tendency for a more positive regard to computer-aided diagnostics exists in the non-expert group. The specialists, as proficient and on expert level might not have a need of such computer-aid, or at least a different need in accordance with their way of working as experts with an intuitive frame of reference compared to the step-by-step, rule-following work of the novice. The finding that the program seems to be more attractive to psychiatrists with learning styles which prefer Abstract Conceptualizations (Assimilating and Converging learning styles) is important and in accordance with Lu (Lu et al, 2001] who found that the willingness to use a CDSS rely heavily on preferences and perceived usefulness. The Cons in future perceived usefulness against the CB-SCID1 about the appropriateness of such a program, the conflict perspective about using it and the breaking up of dialogue might reflect the expert view emphasizing empathy and intuition. The Pros arguments seem to meet the non-expert view of emphasizing learning to diagnose, the program as a supporting structure, help and correction facility.

Working “backwards” in the program, that is regretting and changing, which is rather complicated in the program caused problems for almost everyone.
Revisiting and changing earlier decisions from judgments in the CB-SCID1 in a decision tree is more complex. Moreover the CB-SCID1 might have longer learning curve than more straightforward systems like SCAN.

The finding that the paper and pencil method was faster for the difficult case can, to some degree, be explained by the fact that the CB-SCID1is not wholly automatic. The system demands a thinking process that might be harder for a difficult case (with movements back and forth) during the decision process in the program.

Any expert with a possible intuitive way of thinking might be confused when they use a program addressed to non-expert that emphasize rule-following and logical step-by-step working procedures. Moreover, the fact that this study did not diagnose living patients and that it was done with the help of o computer program may affect the results in that tacit knowing could not come into play as much as in a real situation.

It has been reported that domain specialists might have different LS preferences, for example Baker III [Baker III et al 1985] using the Kolb model found that there is an identifiable surgical learning style: Converging (46%). This is in line with the Plovnick [Plovnick, 1975] results which suggest surgeons as Converging in Medicine. Our results concerning learning styles did not confirm the Plovnick results that psychiatrists should be Diverging (Diverging 6%, Assimilating 37%, Converging 31% and Accommodating 27%). This could depend on various reasons. The role for psychiatrists today is not the same as it was almost 35 years ago. The “Diverging” aspect of relational skill might be less vital compared to diagnostic methods of today and various modern treatment methods. Another possible explanation is, according to the Kolb

theory, Diverging-preference persons with Concrete experience and Reflective observation are predicted to be the least interested in computer work and thus that there is the possibility that the results is due to selection bias.

The skill profile analysis of the psychiatrists in this thesis revealed very low scores for Technology, which is computer skill. This result is confirmed in a comparison of computer use with other medical specialties where computer use in Psychiatry is reported to be low [Sturm, 2001]. The significant correlation between the Sense making and Initiative skills and correct diagnosis in the CDSS might point to that these skills might be important when using a CDSS successfully in Psychiatry. Besides the importance of computer skill, the characteristics of these information management skills may constitute meta-cognitive qualities requiring abstract conceptualization for willed action. For example the ability to adapt to changing circumstances and seek out and take advantage of opportunities. Also, it is interesting to look at the skill elements of the Initiative skill (as compared to Action skill and Goal setting skill in the Behavioural skill group that were perceived needing improvement) for instance "finding ways to make things happen" and "being personally involved/taking responsibility" that seems to have similar characteristics with the self-directed learner [Robotham,1995]. The self-directed learner is no passive receiver but takes responsibility for the achievement and outcome.

Meta-cognition is often characterized by both external regulation and self-regulation in learning situations. The external regulation is often executed in the CDSS seen as a form of instruction. Using a CDSS may demand stronger external control for the user and may demand alternative learning styles, thus applying alternative skills. The influence of the CDSS on the user may be grouped into categories due to the users learning activities and Vermunt [Vermunt, 1996] found in his empirical studies of learning styles that the Application directed learning style was superior. In that style you have to handle both external regulation and self-regulation, and this style might be the most useful in mind-machine interaction. Moreover, this style, in a skill perspective, has similarities to the Information skills and Behavioural skills in the Boyatzis and Kolb model that might constitute information management skill.

7.5 ADAPTATION TO DIAGNOSTIC ASPECTS AND SITUATIONS

Recent research in diagnostic reasoning point to the existence of an experience-based knowledge that is different from the analytical representations in older studies [Norman, 2005]. Pattern recognition was used in the deciding situation although hypothetico-deductive reasoning was expected. However, in the valuing situation where pattern recognition was expected, it was not the dominating reasoning strategy. So, the reasoning that seemed to be applied in the deciding situation was the reasoning from the valuing situation, which is pattern recognition. EBM principles does not seem to advocate the reasoning connected to valuing situations, as defined in this study, that is pattern recognition. However, Coderre [Coderre et al, 2003] found that the odds of diagnostic success were significantly greater when subjects used the diagnostic strategies of pattern recognition and scheme-inductive reasoning compared to hypothetico-deductive reasoning.

Case-based reasoning [Schank, 1982], suggests that problem solving is proceeded by the use of specific examples or cases that are stored in memory. These cases are retrieved and adapted to fit a given problem [Kolodner, 1993]. This view of problem solving emphasizes the role of similarity over general knowledge. It thus predicts that people will use surface-structural, using similar problems, as opposed to deep structure thinking for solving a given target problem [Blessing et al, 1996]. However, using a CDSS probably require conscious alteration between self-regulation and trust in the external regulation in order to experience support from the CDSS. Slovics' finding [Slovic, 1972] that decision makers tend to use only that information that is explicitly displayed in the stimulus object (the CB-SCID1 in this study) and will use it only in the form in which it is displayed might complicate CDSS use. In order to reduce the cognitive strain of integrating information any information that has to be stored in memory inferred or transformed will be discounted or ignored. Information acquisition will proceed in a fashion that is consistent with the display format [Bettman et al, 1977]. Jarvenpaa [Jarvenpaa, 1989, 1990] extended this research result to the problem of designing graphical displays to be used in computer based decision support systems. Jarvenpaa [Jarvenpaa, 1989, 1990] found that graphical format difference accounted for a large proportion of the variance in information acquisition and evaluation. Surface structure thinking, might reflect moving toward the press of the situation (the demands of CB-SCID1) while moving away from the press of the situation might reflect deep structure thinking in your own head.

7.6 EVALUATION OF CB-SCID1

No major difference between paper and pencil and computer support was found for the easy case. However, for the difficult case, a difference was found in favour of paper and pencil.

The correct diagnosis "Depression" (one of the three diagnoses in the difficult case) was found more often with the paper and pencil method than with the computer support could depend on the thinking and navigation processes. Somehow it might be easier to think globally in the paper and pencil situation than in the step-by-step sequential thinking process necessary in the CB-SCID1.

The CB-SCID1 system seems to lend support to structure in the presentation of the next question according to the DSM decision tree, but makes the processing aspect of global thinking and navigation back and forth in the CB-SCID1 difficult. The program might force the thinking to become sequential and global thinking become difficult. The thinking process might become fragmented and the navigation process in the program even more difficult.

CB-SCID1 might trigger errors due to automation bias, errors of commission, which is following the direction in the program regardless of the correctness of action, or only applying sequential but no global thinking leading to incorrect diagnoses. Missing the diagnosis "Depression" in the computer situation may be because of automation bias, errors of omission, or merely applying sequential but no global thinking.

The potential is great concerning computer-training for psychiatrists. Speed, diagnostic accuracy and learning could improve provided computer-training is offered. The specialists could probably improve in both diagnostic accuracy and speed using a CDSS. The non-specialists could benefit from using the CDSS as a teaching tool for diagnostic work and psychiatric domain knowledge.

With more user-knowledge after vast computer-training for psychiatrists the development of CB-SCID1 could be put further forward.

7.7 DSM CRITICISMS

The DSM diagnostic system has been the target of substantial negative criticism. For instance it has been argued that the system fails to predict treatment outcomes and understanding of underlying pathology, fails to include full understanding of contextual factors that might be important for both aetiology and treatment, directing patients away from subjective ways of understanding their experiences as well as problems with the scientific status of the DSM diagnostic process [Eriksen and Kress, 2005]. The predictive value in DSM (degree to which patients receive a certain treatment for a particular diagnosis) is higher for some disorders than others [Seligman, 2001] and the help is inadequate for the clinician to comprehend the pathological processes and thereby hinder them to prevent disorders to develop [Albee, 1999]. Because the DSM system locates the sources of aberration within the individual rather than connecting them to contextual factors it is difficult to understand behaviour change, for the patients themselves as well as for persons around the patient [Rosenhan,1973].Diagnostic classifications reflect the need to simplify complex phenomena. However, the pursuit of truth and accuracy in classifications of disorders might promote a reification of the diagnostic category [Duffy, 2002] and direct the patient away from his/her subjective way of understanding experiences [Eriksen and Kress, 2005]. Instead patients are referred to understand their experiences with the help of a diagnostic category. Some authors have challenged the use of psychological classification systems in general and the reliability and validity upon which the DSM classification is supposed to be grounded on [Jensen and Hoagwood, 1997, Widiger and Sankis, 2000]. DSM classifications cannot be considered reflective of the “true nature” of what is observed, they are indications of the nature of the observer in that particular time and place, the nature of the question being asked and the goal of observation and classification [Jensen and Hoagwood, 1997]. Clinicians use their own judgment to decide how often is “often” how frequent is “frequent” or how dysfunctional is “dysfunctional” in working with the DSM system as it is required [Sarbin, 1997].

7.8 DIAGNOSTIC REASONING

To analyse and understand the diagnostic reasoning process the Kolb model is helpful, as compared to other learning style models, in its emphasis on experience-based learning and information processing in the mind of the diagnostician in the interaction with the environment constituting the patient and/or the CDSS. Moreover the Kolb model is encompassing enough to define learning, how we perceive and process

information in diagnostic reasoning compared to learning models with a few personality constructs.

Man seems to have not only certain limitations in information processing capacity but also two different, anatomically dissociated, information processing neural systems, emotional and cognitive, [LeDoux, 1996]. The emotional system appears to compute information in a non-algorithmic, skilled-based manner compared to the ordinary computational mode of the cognitive system [Churchland, 2002]. However, the tendency in cognitive science to create theory around computational rather than biological mechanisms might be problematic. The critics mean, according to Winn [Winn, 2004] that cognitive scientists have lost sight of the metaphorical origins of the levels of cognitive theory and have assumed that the brain really does compute the answer to problems by symbol manipulation [Bickhard, 2000, Searle, 1992]. Some scholars [Wolfram, 2002] advocate that every action including all cognitive activity is a "program" that can be recreated and run on a computer [Winn, 2004].

The emotional and cognitive information processing systems seems to reflect the apprehension (emotional Concrete Experience) and comprehension (cognitive Abstract Conceptualisation) in the Kolb model [Kolb, 1984] and affect how you acquire, memorize and represent knowledge. The explicit system (cognitive) is rule-based, the content can be verbally communicated and is tied to conscious awareness. The implicit system (emotional) is skill or experience-based, content not verbalisable and can only be conveyed through task performance and is inaccessible to awareness [Ashby and Casale, 2002, Dienes and Perner, 1999, Schacter and Bruckner, 1998]. There is evidence according to Winn [Winn, 2004] that cognitive activity (thinking, learning and acting) is not separate from the context in which it occurs [Lave, 1988, Suchman, 1987]. Recent research suggests that the activities that connect memory and the environment are not circular but concurrent in nature [Winn,2004], concepts are bridges between the mind and the world only existing while a person interacts with the environment [Clark, 1997, Rosch, 1999].

The re-integrative result in the brain (multiple connections at various levels) of these two information processes (emotional and cognitive) is important for the end result in the brain [Fuster, 2000], and the output activity (involving executive function) (with or without CDSS use), in our case, the diagnosis, and for cognitive flexibility, abstract thinking and willed action [Dietrich, 2004].

7.9 NARRATIVE REASONING

7.9.1 Introduction to the narrative analysis

A narrative analysis to contribute to task analysis in the realm of decisions for of psychiatric diagnosis making was performed. What clinicians know and believe about their domain is critical to their decision making. The goal for this narrative analysis is to elicit knowledge about the diagnostic process that might inform system analysts to develop user specifications for new computer technologies. Incident-based cognitive task analysis is one of the most powerful knowledge elicitation methods. Details,

challenges, subtle cues, background influences and strategies in the form of stories might be useful [Crandall et al, 2006].

Narrative formats might capture the richness of detail and reveal the “story behind the story” [Crandall et al, 2006]. Chronologies depict sequences of events in a specific context and convey a persons´ lived experience appearing from that persons´ perspective [Crandall et al, 2006].

Two cases, Maria and Kristina, were investigated in the narrative analysis, the same cases that were used in the SCID1 and CB-SCID1 instruments in this thesis. The cases were picked from the DSM-IV Case Book [Spitzer et al, 1994], Maria is called “Sickly” and Kristina is called “The Socialite” in the Case Book..

7.9.2 Narrative analysis

The text material in this analysis is not done from original interview material. It is somewhat abbreviated and condensed for diagnostic training purposes.

Narrative analysis might shed some light on the interview material (text) for clinical diagnosis and symptom diagnosis. Both kind of diagnosis may have a connection to narrative analysis. Symptoms can be a key to events and stories, clinical diagnosis can be connected to context, processes and enactment of plots. Problem-setting, in our case the basis for diagnosis, often occur through storytelling [Mattingly, 1991]. Doctors and patients have a practical interest in constructing an “untold story” out of discrete episodes, to make sense and create sense out of situations [Goffman, 1974]. However, “doctor talk” often emerges as a kind of anti-narrative speech act which suppresses patient personal narrative such as adoption of passive voice and consequent elimination of agency [Anspach, 1988]. This might depend on the institutional context where the encounter between doctor and patient takes place. The problem can be described as a conflict between the “voice of medicine” and the “voice of the life-world” [Mishler, 1984].

The effort of story-making, of emplotment, is integral to healing power and serves as an aesthetic and moral form underlying clinical action, that is doctors and patients sometimes create story-like structures through their interactions [Mattingly,1998].

7.9.3 Research question for the narrative analysis

Does narrative configuration of text material of the 2 cases give new or conflicting information that has importance for diagnosis and treatment other than the SCID instrument for DSM IV diagnosis?

7.9.4 Narrative analysis of the two cases

The data is converted and analysed according to Polkinghornes [Polkinghorne, 1995] two types of narrative. Paradigmatic analysis of narrative from stories into themes that cut across the stories that inductively allows themes to emerge and concepts to develop from the stories. The other form of narrative analysis uses plot to tie together

experiences in order to create the context for understanding meaning and giving meaning to experience configured from interpretation of the stories.

The analysis will focus on the three main categories by Mishler [Mishler, 1995]: *reference and temporal order*, sequence of real events and their ordering in the narrative account, *textual coherence and structure*, language use and how stories achieve structure and coherence, and *narrative functions*, the purposes stories fulfil, the settings in which they are produced and the effects they have.

Criteria to assist in developing a narrative for case 1, Maria, and case 2, Kristina, is described in the following paragraphs.

7.9.4.1 Description of the cultural context in which the storied case study takes place (Maria)

Maria, 38, married woman, herself one of 5 children reared by her mother after her father (alcoholic) left, now having 5 own children (married at 17) ranging in age from 2 to 20 years old and her husband is said to be an alcoholic. Unhappy marriage with frequent arguments with her husband partly related to sexual indifference and pain during intercourse. She worked just 2 years after graduation from high school at 17 and her husbands´ periods of work instability lead to financial problems. A central context for Maria is hospitals and contacts with various doctors.

7.9.4.2 The nature of the protagonist, both physical and cognitive (Maria)

Maria can be said to have a self-narrative that seems to be connected to a victimic identity as compared to an agentic identity [Polkinghorne, 1996].

The self-narrative is her idea that her physical and psychological problems have a medical explanation that the doctors not yet have found out. This self-narrative can be seen as paradigmatic because this theme cut across all narrative stories in her interaction with doctors in different clinics. The grounding for this self-narrative may be her early history as a sickly child. Some people try to understand their lives through narratives that exclude central events in their lives, often events from childhood, for instance an overpowering sense of ones´ future as being totally bereft of possibilities and choices as in depressive states. The narrative seems inadequate to articulate events and experiences and this lack is the basis for suffering [Schafer, 1983, 1992]. In this less coherent and poorly integrated narrative, emotions are more frequently expressed and use channels other than language (somatization?) not being able to use positive coping strategies. [Ville and Khlat, 2007] The corresponding plot might be dangerous, a threatening plot, compared to other narratives and plots that appear to be beneficent and integral to healing [Mattingly, 1998].

7.9.4.3 Identification of important significant others (in the development of the plot) in affecting actions and goals for the protagonist (Maria)

Her father deserting the family when she was 10 is an untold and neglected narrative that had potential but was not openly told and used constructively but accentuated her victimic identity and contributed to the development of the plot. An alternative possible

story-like structure from the interactions during her fathers deserting the family might have been developed into a more rewarding therapeutic emplotment with healing power, a quest for a more dramatic plot [Mattingly, 1998]. Instead, a self-narrative of being a depressed victim is developed. She has been depressed since her father deserted the family, and the doctor recommended that her mother give her a little wine before each meal. That her physical and psychological problems have a medical explanation that the doctors not yet have found out seems to be the plot that engages significant others especially the doctors.

7.9.4.4 Concentration on the choices and actions of the protagonist in pursuit of goals and movement towards an outcome (Maria)

To enact the plot she seeks doctors for chest pains leading to the narrative of a "nervous heart", for abdominal pain leading to a narrative of a "spastic colon". She sees chiropractors and osteopaths for various pains suffering leading to a narrative of "backaches, pain in extremities and anaesthesia of fingertips". After vomiting, chest pain and abdominal pain she was admitted to a hospital. This culminates in hysterectomy. After the hysterectomy she had anxiety attacks, fainting spells, 30 minutes spells of unconsciousness, vomiting, food intolerance, weakness and fatigue. She then creates a narrative as an explanation for the fact that she stills feel depressed, the narrative is "because her hormones were not straightened out" addressing the hysterectomy. She still sticks to her self-narrative, that there will be a medical explanation to her physical and psychological problems.

7.9.4.5 Description of the cultural context in which the storied case study takes place (Kristina)

Kristina, a married 42 year old socialite, with a position in the cultural council.
She was an only child herself with a very close best friend since grade school, they were like sisters.

7.9.4.6 The nature of the protagonist, both physical and cognitive (Kristina)

The protagonist has never had any mental problems before.
The cognitive capacities of the protagonist seems to be very high with great responsibility in the qualified work situations she is engaged in.

7.9.4.7 Identification of important significant others (in the development of the plot) in affecting actions and goals for the protagonist (Kristina)

The two significant others in the Kristina case is her best friend and her husband in the development of the plot. After her best friends´ death and the following funeral she happens to see a woman driving a car just like the one her friend had driven and becomes convinced that her friend is alive. Kristina spontaneously creates a story that the auto accident and the funeral had been staged as part of a plot. The plot is directed toward deceiving her and she senses that the mystery must be solved to escape alive distrusting everyone except her husband who she is pleading to help save her life. In this situation Kristina is creating a story-like structure in her interaction with her husband that becomes a dramatic therapeutic emplotment with possible healing power

depending on the actions of the husband and the receiving doctor in the emergency room.[Mattingly, 1998]

7.9.4.8 Concentration on the choices and actions of the protagonist in pursuit of goals and movement towards an outcome (Kristina)

Kristina chooses to create a story with a dramatic plot, hoping that she will get help to solve the mystery that she enacts towards her husband to move to a solution of the mystery as an outcome. There seems to be an interwoven relation between telling stories and making practical decisions [Mattingly, 1998].
The treatment situation in the emergency room, that Kristina in a way created by choosing this dramatic plot may point to alternative future stories that might be seen as possible and creative [Josephsson et al, 2006].
If the doctor is willing to listen to her story he/she may look at the problem as an acute crisis that will spontaneously vanish (no history of mental problems before her best friends´ auto crash) or alternatively focus on the severe symptoms and start medication with anti-psychotic drugs.

7.9.5 Overall finding in the narrative analysis

The CB-SCID 1 system yields a symptom or syndrome diagnosis and answers the question what? which symptoms? what constellation of symptoms building a syndrome? and this diagnosis seems to be necessary but insufficient. Adding clinical diagnosis may answer the etiological question, how the problem emerged, cause and effect, but to a greater extent narrative analysis answers the question how also with a forthcoming perspective? how does the patient handle symptoms in the ongoing life, how does the patient create stories and how is the plot developing ? The narrative analysis creates new possibilities and alternatives to both diagnosis and treatment as compared to the pigeonholing of symptoms via pre-determined DSM-criteria into pre-determined psychiatric syndromes. One example from the narrative analysis is the importance of how to understand psychiatrically, meet and handle the somatization syndrome of the Maria case, and at the same time not disregard the risk of genuine somatic diseases.

However, the CB-SCID 1 may be good at identifying if a symptom reaches clinical significance and if it is suited together with other symptoms to build a syndrome. Psychiatrists might benefit, as a complement, from narrative analysis in identifying in patients therapeutic plots that can be used in the construction of diagnosis and treatment plans.

The meaning and function of Marias victimic self-narrative may be the stability and coherence of identity that it serves. Other life areas like work, marriage, children and leisure were not so prominent in her life and could not fulfil any identity purpose.
Her sticking to the self-narrative, that there will be a medical explanation to her physical and psychological problems might metaphorically correspond to a 10 year old hopes of help from doctors with feelings of depression after the father deserted the family. More help than the doctor recommended that her mother give her a little wine before each meal. It is interesting to note that her rather heavy drinking problems ended

at 29 after proper treatment at an alcohol treatment unit, and has thereafter remained abstinent. Maybe the alcohol problem was not so much involved in the plot. Moreover, although Maria probably constructed a victimic self-narrative, patients are seldom without power. The doctor-patient relationship, especially the power aspect became clear in the Maria case. She might have invited doctors into her self-narrative asking them for the meaning of the experiences she has had. As the doctor responded, a story about the patients´ life was constructed [Widdershoven and Berghmans, 2001].
.

The syndrome DSM diagnoses for Maria were:

Correct Axis 1 diagnoses for the Maria case were:

- Major Depressive Disorder, recurrent, mild
- Somatization Disorder
- Alcohol Dependence, in sustained full remission

In case 2, The Kristina case, there is no need to reconfigure the text into a narrative. The narrative and plot is already there, created directly by the patient. The husband and the doctor at the emergency room will be the significant others that have to solve the mystery.

The syndrome DSM diagnosis for Kristina was:

Correct Axis 1 diagnosis for the Kristina case was:

- Brief Psychotic Disorder with Marked Stressors.

7.9.6 Methodological discussion in the narrative analysis

The prime method for data analysis used is to understand both processes and concrete events from a narrative perspective. In our case, what happens in treatment situations, especially in diagnostic situations that have importance for treatment outcome? How might single events be integrated and emplotted in the patient's life story [Frank, 1995, Polkinghorne, 1996]?

However, parts of other narrative methods have also been applied, for instance from Mattingly [Mattingly, 1998], from Polkinghorne [Polkinghorne, 1995], from Mishler [Mishler, 1995] and from Josephsson [Josephsson et al, 2006].

The analysis is done from the original English text and not from the translated Swedish text which was used in my research papers. In the present narrative analysis I discovered some problems with translation (done by others) and that some sentences were skipped, for instance:

"Apparently, she was taken to a doctor for this, and the doctor recommended that her mother give the patient a little wine before each meal."

The correct DSM-IV diagnoses for the two cases could of cause be discussed. Here they are used as a kind of golden standard to make the comparison with the narrative analysis outcome possible.

The Maria case might be seen as a tough case where difficult and challenging decisions must be supported by a CDSS. The focus on tough cases has been utilized in the method of decision-centred design for cognitive task analysis in the technological development of human-machine systems [Hutton, Miller and Thordsen, 2003]. Tough cases might elicit relevant knowledge and “tell the right stories to system developers and program managers to lead them to appreciate why building cognitive requirements into the design might matter” [Crandall et al, 2006].

8 CONCLUSIONS

The results supported a number of conclusions:

- those with preferences for abstract conceptualization mode in information management perceived future use of the system positively
- computer skill was low for most psychiatrists under study
- a high skill in initiative and sense making skills seemed to be important for successful use of the system
- preferences for concrete adaptive learning mode was connected to faster procedures in the system and that this might indicate low support from the system
- flexibility for abstract adaptive learning mode was connected to longer time system use
- pattern recognition was applied in the deciding situation where hypothetico-deductive reasoning was expected from an evidence-based medicine perspective
- no major difference in terms of correctness of the proposed diagnosis was found between the computerized method and the manual method for diagnosis and where a difference was noted it was in favour of the manual method
- the use of decision support systems for diagnosis in Psychiatry has to be developed before they can be used on a routine basis

The narrative analysis show the need/importance of doctor-patient-interaction in the making/creation of diagnosis and using “prognosis” as positive future scenarios in the patients´ life.

9 FORTHCOMING RESEARCH

Further research is needed on the use and applicability of CDSS systems like CB-SCID1. The system as such needs to be tested by highly skilled users. The role of the CB-SCID1 in clinical practice work processes must be clarified. The CB-SCID1, producing symptom diagnoses, is not enough for treatment planning. A clinical diagnosis that contains more information, for instance background information, actual circumstances and aetiological discussion seems to be required. A question is how the DSM-system (in the CB-SCID1) with its good procedure validity, which makes the system reliable to differentiate between diagnoses, might be utilized in clinical practice.

Another research area that might be interesting is a comparison between for example the CB-SCID1 system, the SCAN system and the CIDI-Auto system. Such studies should focus on, among other things, comparisons of for example diagnostic accuracy and time need for each of these systems, and also on comparisons between the CDSS systems results and manual diagnosis.

The criticism that the DSM-system fails to predict treatment outcomes, understanding of underlying pathology and contextual factors [Eriksen and Kress, 2005], plus the challenge of the reliability and validity upon which the DSM classification is supposed to be grounded on [Jensen and Hoagwood, 1997, Widiger and Sankis, 2000] might cause psychiatry to look for other knowledge systems like for instance narrative reasoning and analysis. Therefore should researchers also consider such studies in the future. Tough cases might elicit relevant knowledge in the technological development of human-machine systems [Hutton, Miller and Thordsen, 2003] and “tell the right stories to system developers and program managers to lead them to appreciate why building cognitive requirements into the design might matter” [Crandall et al, 2006].In that pursuit future researchers should look at the constructivist approach that have proposed an alternative conceptual framework to the computational view of cognition [Duffy and Jonassen, 1992, Duffy, Lowyck and Jonassen, 1993] and that concepts are bridges between the mind and the world only existing while a person interacts with the environment [Clark, 1997, Rosch, 1999]. Computational cognition based on the assumption that there is a direct relationship, or “mapping” between internal representations and the world outside (Kosslyn, 1985) might be problematic because of the tendency to create theory around computational rather than biological mechanisms (Winn, 2004). The emotional system appears to compute information in a non-algorithmic, skilled-based manner compared to the ordinary computational mode of the cognitive system [Churchland, 2002]. Narrative reasoning and analysis to elicit knowledge with incident-based cognitive task analysis about the diagnostic process might be beneficial. Details, challenges, subtle cues, background influences and strategies in the form of stories might be useful [Crandall et al, 2006]. For the patient this perspective might not like the DSM system direct patients away from subjective ways of understanding their experiences as well as problems [Eriksen and Kress, 2005]. For the physician this perspective is in line with recent research in diagnostic reasoning that point to the existence of an experience-based knowledge that is different from the analytical representations in older studies [Norman, 2005].

10 APPENDIX

10.1 TEXT FOR NARRATIVE ANALYSIS

10.1.1 The text for the first case, Maria

Maria, a 38-year-old married woman came to a mental health clinic with the chief complaint of depression. In the last month she had been feeling depressed, had experienced insomnia, frequently wept, and had been aware of poor concentration, fatigue, and diminished interest in activities. The patient relates that she was sickly as a child and has been depressed since her father deserted the family when she was 10. Apparently, she was taken to a doctor for this, and the doctor recommended that her mother give the patient a little wine before each meal. Her adolescence was unremarkable, although she describes herself as having been shy. She graduated from high school at 17 and began working as a clerk and bookkeeper at a local department store. She married at about the same age, but the marriage was not a success; she had frequent arguments with her husband, in part related to her sexual indifference and pain during intercourse.

At 19 she began to drink heavily, with binges and morning shakes, which she would relieve by having a drink as soon as she got up in the morning. She felt guilty that she was not caring adequately for her children because of her drinking. At 21 she is admitted to a mental hospital, where she was diagnosed with alcoholism and depression. She was treated with antidepressants. After discharge she kept dinking almost continually; when she was 29, she was again hospitalized, this time on the alcohol treatment unit. Since then she has remained abstinent. She has subsequently been admitted to psychiatric hospitals for a mixture of physical and depressive symptoms, and once was treated with a course of electroconvulsive therapy, which produced little relief.

The patient describes nervousness since childhood; she also spontaneously admits being sickly since her youth with a succession of physical problems doctors often indicated resulted from her nerves or depression. She, however, believes that she has a physical problem that has not yet been discovered by the doctors. Beside nervousness, she has chest pains and has been told by a variety of medical consultants that she has a ”nervous heart”. She often goes to doctors for abdominal pain, and has been diagnosed as having a ”spastic colon”. She has seen chiropractors and osteopaths for backaches, for pains in the extremities, and for anaesthesia of her fingertips. Three months ago, she experienced vomiting, chest pain, and abdominal pain, and was admitted to a hospital for a hysterectomy. Since the hysterectomy she has had repeated anxiety attacks, fainting spells than she claims are associated with unconsciousness that lasts more than 30 minutes, vomiting, food intolerance, weakness, and fatigue. She had surgery for an abscess of the throat.

The patient is one of five children. She was reared by her mother after her father left. Her father was said to have been an alcoholic, who died at 53 of liver cancer. Despite a

difficult childhood financially, the patient graduated from high school and worked 2 years. She was forced to quit because of her sickliness.

She married her present husband at age 17 and has remained married. Her husband is said to be an alcoholic who has had some periods of work instability. They have argued about sex and finances. They have 5 children, ranging in age from 2 to 20 years old. The patient currently admits to feeling depressed, but thinks that it is all because her ”hormones were not straightened out”. She is still looking for a medical explanation for her physical and psychological problems.

10.1.2 The text for the second case, Kristina

Kristina, a 42 year old socialite, has never had any mental problems before. A new performance hall is to be formally opened with the world premiere of a new ballet. Kristina, because of her position on the cultural council, has assumed the responsibility for coordinating that event. However, construction problems, including strikes, have made it uncertain whether finishing details will meet the deadline. The set designer has been volatile, threatening to walk out on the project unless the materials meet his meticulous specification. Kristina has had to calm this volatile man while attempting to coax disputing groups to negotiate. She has also had increased responsibilities at home as her nanny has had to leave to visit a sick relative.

In the midst of these difficulties, her best friend has been decapitated in a tragic auto crash.

Kristina, herself is an only child, and her best friend had been very close to her since grade school. People have often commentated that the two women were like sisters. Immediately following the funeral, Kristina becomes increasingly tense and jittery, and able to sleep only 2-3 hours a night. Two days later she happens to see a woman driving a car just like the one her friend had driven. She is puzzled, and after a few hours she becomes convinced that her friend is alive, that the accident had been staged along with the funeral, as part of a plot. Somehow the plot is directed toward deceiving her, and she senses that she is in great danger and must solve the mystery to escape alive. She begins to distrust everyone except her husband, and begins to believe that the phone is tapped and that the rooms are ”bugged”. She pleads with her husband to help save her life. She begins to hear a high-pitched, undulating sound, which she fears is an ultra-sound beam aimed at her. She is in a state of sheer panic, gripping her husbands´ arm in terror, as he brings her to the emergency room the next morning.

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12 SUMMARY IN SWEDISH – SAMMANFATTNING PÅ SVENSKA

Syftet med denna doktoravhandling var att analysera möjligheter och begränsningar, från ett kognitivt perspektiv, för ett CDSS för diagnostik inom psykiatrin. För att dra nytta av CDSS för diagnos måste individuella variationer i kognitivt fungerande hos användaren studeras. Dessa individuella variationer analyseras i denna avhandling med hjälp av begreppen inlärningsstil, inlärningsfärdighet och anpassad inlärningsstil. Fyra studier genomfördes inom ramen för denna doktorsavhandling. Studie I undersökte det datoriserade beslutsstödssystemets acceptans hos användaren utifrån inlärningsstil. Studie II undersökte vilka färdigheter som är nödvändiga för en lyckad användning av systemet. Studie III syftade till att kartlägga anpassningsförmåga genom olika sätt att resonera om diagnos kopplat till olika diagnostiska aspekter och situationer utifrån ett perspektiv hämtat från bevisbaserad medicin. Studie IV utväderade det datoriserade beslutsstödssystemet genom jämförelse med manuell diagnos. För att få ett kompletterade perspektiv på diagnos, som kan generera kunskap för utveckling av system, genomfördes också en narrativ analys av de två patientfallen.
Resultaten gav underlag för ett antal slutsatser:

- att personer med preferenser för abstrakt varseblivningsmönster vid informationshantering upplevde systemets framtida användbarhet positivt
- att datorkunskapen var låg bland de deltagande psykiatrikerna
- att kombinationen hög färdighet för initiativ och ”sense making” verkar vara viktiga för ett framgångsrikt användande av datoriserade beslutsstödssystem
- att preferenser för konkret adaptivt inlärningsmönster var kopplat till snabbare handläggning i systemet och att detta kunde tyda på svagt stöd från systemet
- att flexibilitet för abstrakt adaptivt inlärningsmönster var kopplat till längre tids handläggning i systemet
- att mönsterigenkänning tillämpades i beslutssituationen där hypotetiskt-deduktivt resonerande var väntat utifrån bevisbaserad medicin
- att ingen huvudsaklig skillnad mellan datoriserad metod och manuell metod för diagnos fanns och att där skillnader fanns var det till den manuella metodens fördel
- att utveckla användningen av datoriserade beslutsstödsystem för diagnos inom psykiatrin innan de används rutinmässigt

Den narrativa analysen visar på behovet/vikten av läkare-patient-interaktion vid ställandet/skapandet av diagnos och att använda ”prognos” som positiva framtida scenarier i patientens liv.

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