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Saturday June 3, 2006

13:00-13:45

Room: N109 &amp; N110

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*“One sentence floated back into my memory ‘A transverse lie is a wholly unfavourable position’. Too true. Wholly unfavourable both for the woman and for a doctor who only qualified six months ago...”*

The young doctor is in great trouble. He is the only physician in the small Russian country hospital. The patient is a young woman in labour and the doctor has confirmed the midwife’s diagnosis: transverse lie. He realises that he must perform a podalic version under chloroform anaesthesia and he will be the obstetrician *and* the anaesthetist. The physician is the Russian author Mikhail Bulgakov [1]. His first reflex is to rush off to his room to read his textbook of obstetrics, but gets still more confused, stating ironically:

*“My reading had borne fruit: my head was in a complete muddle”*

Then, while he and the midwife are scrubbing their hands, the midwife starts to talk:

*“Anna Nikolaevna described to me how my predecessor, an experienced surgeon, had performed versions...Those ten minutes told me more than everything I had read...From her brief remarks, unfinished sentences and passing hints, I learned the essentials which are not to be found in any textbook”*

This is a messy, acute situation, full of uncertainty, a moment when expertise is really challenged. It is a type of situation that is common in anaesthetists’ everyday work [2]. Mikhail Bulgakov realises that having learnt the lesson in his books has not made him an expert, whereas the experienced midwife gives him so much practical knowledge in ten minutes that he manages to handle this difficult situation.

Who is an expert? What does it take to do a good job as an anaesthetist? Although most anaesthetists do a good enough job, only some stand out as the real experts. What is special about them? Most trainees grow steadily into their role as anaesthetists, but a few of them, after years of training, have still not left the novice stage. Why is this so?

When discussing expertise in anaesthesia, focus has traditionally been on separate attributes such as knowledge and skills. The anaesthetist’s work does require comprehensive theoretical knowledge as well as practical skills. However, defining expertise simply as lists of such attributes does not show the whole picture, because competence at work is also linked to the way professionals understand their work [3]. Anaesthesiology therefore should be described from different perspectives.

**DESCRIBING A PROFESSION**

If one wants to study a phenomenon like anaesthesiology, it can be done in different ways. One can study the phenomenon as a representation of a real object in the real world. The researcher then aims to describe the object as precisely as possible. This is how most researchers in science, including medicine, see research. From this perspective, competence is best described by dividing it into its component parts. Defining anaesthesiology in this way would mean creating lists of skills and knowledge needed for an anaesthetist to work.

An alternative research approach is to study conceptions, the different ways a group of people experience the phenomenon. Describing anaesthesiology then would mean studying variations in how anaesthetists experience and understand their professional work, thereby also defining the different aspects that together constitute the anaesthetist’s work. This research approach has been used predominantly in educational science [4].

**KNOWLEDGE, SKILLS AND ATTITUDES**

Anaesthetists have to master many skills and possess a sound base of theoretical knowledge. Furthermore, they must be able to communicate and cooperate with patients, relatives, colleagues and other team members [5]. Hence, expertise in anaesthesiology can be defined by lists of knowledge, skills and attitudes. Work itself can, likewise, be described as lists of work tasks. The expert anaesthetist is the professional who has a superior set of competence attributes which correspond to the work tasks. The potential shortcoming of this way of defining expertise arises when we try putting together the component parts into a whole in clinical work.

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## PROFESSIONAL ROLES

An alternative approach to structuring curricula for specialist training is role descriptions, first developed in Canada [6]. A number of competencies were identified and grouped into roles: medical expert, communicator, collaborator, manager, health advocate, scholar and professional. Later on, specific requirements for specialist training in anaesthesiology were added. Like the “attribute lists” approach, this model divides up the different roles into their component parts; the competencies. For instance, the “professional role” for anaesthetists was defined as a list of over twenty key elements [7].

Expertise, however, depends on choosing and combining elements of knowledge in a complex way, learnt from experience [2]. Therefore, we will concentrate on a more holistic way of describing anaesthesiology, starting with a study of how anaesthetists experience and understand work.

## WAYS OF UNDERSTANDING THE ANAESTHETIST’S WORK

Six ways of understanding anaesthetist’s work were found from two qualitative interview studies with specialists and trainees [8, 9] :

- (1) Give anaesthesia according to a standard plan; *the novice*
- (2) Use the experience from every new patient to learn something new; *the learner*
- (3) Organise and direct the operating theatres to make the operations list run smoothly; *the coordinator*
- (4) Give anaesthesia and control the patient’s vital functions; *the professional artist*
- (5) Help the patient, alleviate their pain and anxiety; *the good Samaritan*
- (6) Give service to the whole hospital to facilitate the work of other doctors and nurses, caring for severely ill patients; *the servant*

Understandings (1) and (2) were predominant among trainees.

Some of these ways of understanding are more comprehensive than others. Anaesthetists with the *Samaritan* way of understanding had the individual patients in focus and felt responsible for providing their safety. This also included managing anaesthesia safely and controlling the patient’s vital functions. All specialist anaesthetists with the *Samaritan* way of understanding work also expressed the *professional artist* understanding, whereas the reverse was not the case. Thus, it was possible to focus on the patient as a physiological object without taking into account the patient as a person. Of the six ways of understanding work, the *servant* understanding was shown to be the most common.

Professional development has been described as a continuous process towards expertise [10]. However, among the specialist anaesthetists in this study, there seemed to be no development towards more comprehensive ways of understanding during a career: some anaesthetists with long experience had a narrow way of understanding, seeing only one or two aspects of work. Furthermore, the trainees showed a pattern of understandings quite similar to the experienced anaesthetists, except for the fact that none of the specialists had the *novice* or the *learner* understanding as their predominant one.

All the ways of understanding work have a “what” (stating the anaesthetist’s focus) and a “how” (describing the meaning created). The metaphors represent ways of relating to work and not types of anaesthetists.

**TABLE 1. SIX WAYS OF UNDERSTANDING WORK AMONG SWEDISH TRAINEE AND SPECIALIST ANAESTHETISTS**

Aspect in focus (“what”)	The meaning of work (“how”)	Metaphor
The procedure of anaesthesia	Follow protocol	Novice
Own competence and skill	Learn from clinical experience	Learner
The team	Organise and lead	Coordinator
Physiological parameters	Monitor, balance and control	Professional artist
The patient as a person	Guide safely through anaesthesia	Good Samaritan
The hospital system	Serve patient, nurses and other doctors	Servant

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## THE PATIENT AS A SUBJECT

One important finding of this study is the difference between anaesthetists with the *good Samaritan* way of understanding work, seeing patients as subjects, and those with the *professional artist* understanding, focussing on patients as physiological objects. In another interview study on interactions between anaesthetists and patients in the operating theatre, Klemola and Norros [11] found a similar difference; one group of anaesthetists recognised the uniqueness of each patient, whereas in the other group, the patient was described only as an object, or was not mentioned at all. When observed in the operating theatre, anaesthetists from the first group were characterised by more appropriate decisions during complicated anaesthetics; they adapted the anaesthetic better to patients' individual physiological reactions and more often anticipated when changes in anaesthetic depth were necessary [12]. These observations suggest that being patient centred is important in anaesthesiology.

If we agree that the rationale for improving the competence of anaesthetists is to make hospitals function better to fulfil patients' needs, then the most comprehensive *servant* way of understanding work would represent the highest level of competence. An anaesthetist with this understanding will support other doctors and nurses and guide the anxious patient through the perioperative period and safely take care of his/her vital functions.

So, if a comprehensive way of understanding anaesthesiology is an important goal of training, how can this be achieved?

## UNDERSTANDING AND LEARNING ANAESTHESIA

The traditional view of learning, sometimes metaphorically represented by "meccano building" (by adding bits and pieces and securing them together, the building grows bigger and bigger), no longer appears to fit. Instead, the similarity between trainees' and specialists' ways of understanding work suggests another way of describing professional learning; from a very early stage many trainees have a complete picture of the work, but that picture is blurred. During professional development, the picture gets clearer and more distinct.

To master all aspects of work, trainees often have to change their way of understanding. This constitutes a challenge in competence development, because when professionals develop competence; they start from their present way of understanding work and usually only refine that understanding, rather than adopting new understandings [13]. For instance, when challenged by difficult clinical situations, trainees with the *novice* way of understanding usually want more rules or guidelines instead of trying to deepen their understanding of physiology. To become experts, however, they need to take a greater step in their competence development by changing their way of understanding work.

To achieve a change of understanding, a new, hitherto unperceived aspect of anaesthesia must be brought into the trainee's focus of awareness. In a learning situation where only one aspect of the work varies, while other aspects are kept stable, the learner will have the best chance to focus on this aspect. It is therefore important that the teacher is consciously aware of the different aspects of the work, knowing when to bring each of these aspects into focus.

## HANDLING ACUTE SITUATIONS

One dimension of the *coordinator* understanding is *the situation*, varying between calm work and crisis. Expert anaesthetists must have discerned this aspect and should keep it in conscious awareness, ready to put it to the fore when necessary. To become vigilant experts, trainees should train to define crisis situations and formulate cues to specific crisis management protocols [14].

## LEARNING STYLES

The learning process itself can be understood in different ways. The way people experience learning has a great impact on how scientific knowledge and professional competence is developed. Two different learning styles will be discussed in the following section.

In the literature of educational science, two main approaches to learning have been described; *surface learning* and *deep learning* [15]. The concept was based on studies on university students by educational researchers in the 1970s. They found that students understood the meaning of a scientific text in two qualitatively different ways, resulting in different learning outcomes. The two ways of learning were described as (1) *surface learning*, directed at memorizing factual knowledge and extrinsically driven (e.g. by the wish to get a job or to pass an exam) and (2) *deep learning*, aimed at understanding the meaning behind the text and intrinsically driven by internal goals (e.g. helping patients).

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To achieve a change of understanding, learners must have a deep learning style, where they actively seek the meaning of phenomena. Deep learning is also a prerequisite for understanding physiology in a way that enables trainee anaesthetists to solve complicated physiological problems in anaesthesia.

## **TWO DIMENSIONS OF KNOWLEDGE**

For a long time, the emphasis in medical education has been on explicit, factual knowledge, presented in textbooks and formal lectures. Medical students have been expected to “know what”. A characteristic feature of proficient anaesthetists, however, is the ability to act quickly in difficult and often messy situations. This requires a kind of competence that comes from years of experience, when formal knowledge has been internalised after having been used in a great number of clinical situations. Therefore, during specialist training, focus should be switched to a different aspect of knowledge, a type of knowledge acquired through training, experience and reflection. We call this *tacit knowledge*.

### **THE TACIT DIMENSION**

Tacit means silent. Tacit knowledge is not, or cannot be, described by means of explicit statements. Michael Polanyi, chemist and philosopher, in his book from 1966, *The Tacit Dimension* [16], describes the process of learning as a stepwise process, where the shift to a higher level of knowing or understanding happens as a change of perspective: explicit knowledge is internalised and gets a tacit dimension. An illustration of this process in anaesthesia practice is the development of routines, described by Smith and colleagues [2] in an ethnographic study on anaesthetic staff at work; the correct sequence of actions in a specific situation “becomes telescoped into the seamless practice of the expert”. This stands in sharp contrast to the novice’s conscious and deliberate efforts to remember the correct sequence.

### **TWO TERMS OF TACIT KNOWLEDGE**

Tacit knowledge is structured in two terms, *proximal* and *distal*. The proximal term is only shown in the appearance of the distal term. In performing a body movement, we are aware of the individual muscle movements (the proximal term) only in terms of the intended movement (the distal term). The distal term expresses the meaning of the tacit knowledge. To make something function as the proximal term of tacit knowledge, this “something” must be included in us; we must dwell in it. This process of things getting to function as the proximal term in tacit knowledge, i.e. getting a tacit dimension, is called internalisation.

If we look too closely at that which constitutes the proximal term of tacit knowledge it may lose its function. The expert anaesthetist who “never fails when putting in an intravenous line”, may fail when asked to demonstrate his or her skill (the distal term) to a novice, describing each detail of her or his technique (the proximal term).

### **DESCRIBING TACIT KNOWLEDGE**

Tacit knowledge can be described, but not by means of propositions; instead one must use metaphors and examples [17]. Propositions are statements which are either true or false. Metaphors and examples are instead characterised as being more or less successful in showing something. Therefore, trainees should not expect teachers to explain in detail how expert anaesthetists reach the solutions of clinical problems. Instead they should try to see the problem solving process from their seniors’ perspective, thus making use of examples from clinical work to see new aspects of work.

### **TRANSFERRING TACIT KNOWLEDGE**

In many clinical situations the anaesthetist’s first task may be to define the problem to be solved, while confronted with many different sources of information. In such situations trainees may become bewildered by the abundance of electronic signals. They are then best helped by working in an apprenticeship model together with experts who can interpret factual information [2]. In addition, the explicit knowledge of books must be interpreted: what is important and what is not. Trainees trying to use all the knowledge that they have acquired will be confused. Experts can show them which knowledge is most important and what action should come first. Thus, trainees working closely together with experienced consultants represent an important way of transferring the tacit knowledge of anaesthesiology.

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## DISCUSSION

What characterises expert professionals? All learners start out at novice level, learning the simple rules and guidelines of their work. Their ambition is to handle routine situations, avoiding serious mistakes. Sooner or later, most professionals go on to a new competence level, acquiring increasing amounts of knowledge and skill. Some professionals will remain at this level, getting more and more experience from routine work, restricting their field of work to keep work tasks within the frame of routine procedure. Others proceed to the expert level.

To take the step towards expertise, professionals must be willing to work at the edge of their capability, keeping alive their curiosity about the consequences of their actions [18]. The ability to handle new, messy and difficult situations by reformulating problems to make them solvable is important and experts must appreciate the value of being exposed to such situations. Understanding the learning process is also essential: anaesthetists, if they are to remain experts, must be willing to keep reconstructing their knowledge, accepting that continuous learning is a prerequisite for expert professional competence [19].

Anaesthetists learn while they work, but which attributes they acquire and how they develop competence is related to the way they *understand* work. By understanding work in a comprehensive way, experts can use their clinical experience to develop their competence in all aspects of anaesthesiology. As teachers, they will have a greater repertoire of aspects to choose among when reflecting on clinical experiences together with trainees.

Let us turn back for a moment to Mikhail Bulgakov. After having successfully performed the podalic version and extracted the baby, thereby saving the lives of both mother and child, he returns to his room and, sipping his cooling tea, he reads his textbook again:

*“And an interesting thing happened: all the previously obscure passages became entirely comprehensible, as though they had been flooded with light. And there...I realised what real knowledge was...one can gain a lot of experience...but even so, one must go on and on reading, reading...more and more”*

Finally, expert anaesthetists must be deeply dedicated to their work. No one could put this better than Sweden's first anaesthetist, Torsten Gordh Sr, interviewed at the age of 96:

*“The core of anaesthesiology is the awareness that anaesthesia is a state between life and death; it makes you take it really, really seriously”*

## ACKNOWLEDGEMENTS

Our thanks to professor Urban Rosenqvist, Department of Public Health and Caring Sciences, University of Uppsala, Sweden, and to Professor Torsten Gordh Jr and Dr Gunnar Enlund at the Clinic of Anaesthesia and Intensive Care, Uppsala Academic Hospital, for valuable comments on the manuscript.

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