

REGIONAL ANAESTHESIA

What defines expertise in regional anaesthesia? An observational analysis of practice[†]

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Background. Published work on knowledge in regional anaesthesia has focused on competence, for instance by identifying numbers of procedures required to achieve competence, or by defining criteria for successful performance of blocks. We aimed to define expertise in regional anaesthesia and examine how it is acquired.

Methods. We observed anaesthetists performing 15 regional anaesthetic blocks and analysed the resulting transcripts qualitatively and in detail.

Results. Expertise in regional anaesthesia encompasses technical fluency but also includes non-cognitive skills such as handling of the patient (communicating, anticipating and minimizing discomfort) and recognizing the limits of safe practice (particularly deciding when to stop trying to insert a block). Such elements may be underplayed by the experts who possess them. Focusing on a small number of regional anaesthetic procedures in detail (as is standard with such qualitative analytical approaches) has also allowed us to develop a model for the acquisition of expertise. In this model, trainees learn how to balance theoretical and practical knowledge by reflection on their clinical experiences, an iterative process which leads to the embedding of knowledge in the expert's personal repertoire of individual techniques.

Conclusions. Expertise in regional anaesthesia extends beyond competence at technical performance; non-cognitive elements are also vital. Further work is needed to test our learning model, and the hypothesis that learning can be enhanced by deliberate promotion of the tacit elements of 'expertise' we have described.

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The anaesthetist's education must encompass cognitive, psychomotor and affective elements.¹ Current training syllabuses are set in terms of measurable competencies and quantifiable attributes. Concerns have been expressed for some time that trainees in anaesthesia receive insufficient experience in regional anaesthetic techniques.^{2,3} Attempts have been made to identify the minimum number of procedures necessary to achieve competence^{4–6} and improve the validity and reliability of assessment with the use of objective outcomes.⁷ There are many textbooks of regional anaesthesia and guidance on how to teach⁸ but we are not aware of any study describing how regional anaesthesia training is actually carried out in practice. Further, moves

towards competency-based training have raised concerns that a rounded education in the total professional task of the expert anaesthetist may be lost.⁹ Our aims in this study were to define such expertise in regional anaesthesia and to examine how it is acquired.

Methods

The approval of the local Research Ethics Committee was granted for the study from which these data are drawn,¹⁰ and

[†]An abstract outlining the ideas elaborated in this paper was presented at the European Society of Anaesthesiologists' meeting in Nice, France, April 2002.

written informed consent obtained from patients being cared for by the anaesthetists under observation. We adopted a qualitative approach, grounded in detailed observation of regional anaesthetic techniques.¹¹ Such research approaches are often used for the in-depth study of complex phenomena within the social context in which they occur and, as in this study, typically combine a range of methods.^{12 13} Operating sessions were purposively sampled to cover a range of different types of surgery and anaesthetic practice and levels of anaesthetic expertise. Observation was conducted principally by the same person (D.G.), but some sessions were conducted in tandem with one of the other researchers (C.P. or M.M.) to allow comparisons and internal validity checks on the data collection. Detailed contemporaneous notes were taken and transcribed immediately after the session. We also have some data on regional anaesthesia from the interviews conducted with anaesthetists and anaesthetic staff as part of the larger study.¹⁰

Analysis

The analysis began with individual close readings and annotations of the observational and interview transcripts. Collectively, through discussions and comparison of the various readings of the data, the dimensions and boundaries of the emerging themes and categories were refined.¹⁴ This *inductive* approach is typical of such qualitative work. Here, rather than using the data to test a pre-defined hypothesis, the results are suggested by the data themselves.

Results

We observed 15 attempted regional anaesthetics, of which 12 were successful (Table 1) and one tutorial on the subject of peripheral nerve blocks. Anaesthetists are denoted in interview and observation transcripts by A1, A2 etc. ODP denotes 'operating department practitioner'.

Table 1 Regional anaesthetics observed (n=15)

Block	Grade of operator	Grade of supervisor	Successfully inserted?
Spinal 1	Senior house officer	None	No
Spinal 2	Senior house officer	Senior house officer	No
Spinal 3	Specialist registrar	None	No
Spinal 4	Consultant	None	Yes
Lumbar epidural 1	Specialist registrar	Consultant	Yes
Lumbar epidural 2	Consultant	None	Yes
Lumbar paravertebral 1	Senior house officer	Consultant	Yes
Lumbar paravertebral 2	Consultant	None	Yes
Femoral 1	Senior house officer	None	Yes
Femoral 2	Consultant	None	Yes
Ilioinguinal	Consultant	None	Yes
Penile	Senior house officer	Consultant	Yes
Ankle	Senior house officer	None	Yes
Interscalene	Specialist registrar	None	Yes
brachial plexus			
Cervical plexus	Specialist registrar	Consultant	Yes

Markers of expertise: flexibility and confidence

The slick practice of the expert performing a straightforward block meant that such cases were less illuminating than those where experts encountered difficulties, were called in to help others, or when trainees were working alone. Thus, for instance, we observed a consultant anaesthetist's first attempt to insert a femoral block in an awake patient, only to postpone the attempt as soon as it became apparent that it would hurt the patient. He subsequently successfully performed the block despite the abnormal anatomy of the

Here, two trainees attempt a spinal on a patient with a fractured neck of femur. A1 has 2½ years experience and A2 has 18 months experience.

A1 'To put this injection in your back, do you want to sit up or lay on your side, which is easier?'

Patient 'I'll roll this way, then I can hang on to this young man'

In one very swift movement the 2 ODP's turn the patient onto her side.

Patient 'Arrgh, oh boy, oh boy'

A2 'Very cold on your back' she paints a square in the middle of the pt's back with pink solution.

ODP1 '... draw your knees up' he pulls the patients knees up towards her chest, they get to about 45 degrees.

Patient 'Arrgh'

A2 'That's fine, injection now...'

A1 'Just a couple of minutes and that pain will go away.'

A2 injects, then covers the patient with the sterile green towels, this covers the patient's hip and ODP1's hand.

ODP1 'Just feeling your back'

A2 inserts the introducer. She then withdraws it, presses on the patient's back with her thumbs, inserts it again and feeds the inner needle straight in, takes it all out again, feels the patient's hip. She then takes the lidocaine syringe and injects a little bit further up the patient's back.

A2 'Small injection again... Pull...'

ODP1 'Just going to pull you towards me OK?'

A2 inserts the introducer, kneels down, tries but is unable to feed the inner needle in, repositions the introducer and feeds the inner needle in, advances the inner needle fractionally, she does this repeatedly. A2 shakes her head and takes the spinal needle out.

A1 'Happy or want me to have a go?'

A2 'One more try'

A2 inserts the introducer, unable to feed the inner needle in, repositions the introducer, still cannot feed the inner needle in.

A2 'Want to have a try?'

A1 washes his hands, moves round to the patient's back, feels it, inserts the introducer.

A1 'Last go... we'll have to send you to sleep if not...'

A1 tries to feed the inner needle up, angling it in different directions.

Patient 'Ow'

A1 'Sorry'

A series of beeps from the anaesthetic machine.

A1 inserts the needle again, removes it.

A2 'Feel is very good but then...'

A1 (feeling the patient's back) 'I think we'll leave it.'

ODP1 '... hasn't worked... put you to sleep...'

A1 '... roll you back'

Patient 'Aargh'

ODP1 and assistant roll the patient on to her back.

A2 looks towards A1, A1 nods.

A1 'Slowly drift off to sleep now'

A2 slowly injects about 10 ml of propofol.

Fig 1 Extract from observation transcript.

femoral nerve in that patient, and in fact succeeded when he moved to the opposite side of the patient from where he would usually stand to perform the block. Expertise was also readily recognizable when it was absent, as in the extract in Figure 1 where two trainees, one (A1) 6 months more experienced than the other (A2), are working together. The patient had a fractured neck of femur and had been

undergoing insertion of dynamic hip screw. Our impression here is that both anaesthetists are focusing on the technical aspects of needle insertion rather than, for instance, issues of patient comfort. (It is mostly their assistant who takes on the role of communicating with the patient, explaining what is happening.) There are outward markers of expert practice—such as the reference to the ‘feel’ of the needle and the

Here a trainee anaesthetist with 3 years experience (A3) attempts a spinal before asking a consultant (A4) for help. ODP1 assists.
A3 (talks loudly to the patient) ‘we’re going to do that injection in your back ... I’ll just wash my hands and get ready.’
A3 washes his hands. (ODP1 prepares the equipment needed for the spinal)
A3 ‘Is that her BP?’
ODP1 ‘Yep’
A3 dries his hands and puts on sterile gloves. ODP1 explains to the patient they are standing just behind the patient (*at the head end, out of the patient’s view*) preparing things for the spinal.
ODP1 sits the patient forward slowly. ... his left arm goes across the patient and behind her back to support her and his right arm supports the left side of her back (almost hugging). The patient clings on to ODP1’s left arm and shoulder. A3 cleans the patient’s back with pink sterile solution.
ODP1 ‘Drop your chin on your chest’ When she does this ODP1 is very encouraging following every command with ‘that’s good’, ‘that’s great’.
A3 ‘Sharp scratch’
ODP1 talks in very soft soothing tones to the patient, explaining what the patient will feel next.
Patient ‘Ooh!’
The patient is sat in the middle of her bed (as near to upright as she can manage). A3 has a green sterile towel laid out where her pillows used to be.
Patient ‘Ooh’
ODP1 ‘Well done’
A3 ‘Sorry’
The patient makes a comment about a torture room.
ODP1 ‘We try not to make it that way, sorry.’
ODP1 ‘Another scratch and a sting, some local anaesthetic’
A3 ‘Is that sharp or just pushing?’
Patient ‘Sharp. It can’t be helped.’
15.55
A3 ‘Try to sit her up a bit more’
ODP1 ‘... bend a little bit more in the middle’
A3 has had a few attempts to insert the spinal needle by this time, has been unable to feed the inner needle further in.
A3 ‘OK, bit more local coming up’
A3 inserts the spinal needle, takes it out, feels her back again.
ODP1 ‘We will have to look a little bit lower in your back, little sharp scratch and sting, the space in your back is proving a little elusive’
A3 takes the needle out again, reinserts, cannot feed up the inner needle.
A3 ‘One more go then I might need to ask someone else to give me a hand.’
16.00
A3 is trying to insert the needle in the same place but from different angles. He takes it out, reinserts it midline, still cannot feed inner needle up, takes it out. Feels her back again and reinserts the outer sheath, there is a slight give and A3 feeds the inner needle further in, he removes the centre wire from the inner needle and looks closely, he moves it in a bit further and looks closely, repeats this process a couple of times then takes the whole thing out. A3 takes his gloves off and leaves the room. ODP1 explains that A3 has gone to get some help and asks the patient if she would like to lie back in the mean time. The patient says she would. ODP1 helps the patient lie back down.
A4 comes in and introduces himself.
A4 ‘A3 having a bit of a struggle, I gather—right let’s have a crack then’
(A4 prepares for the second spinal)
A4 ‘... a few more sterile swabs’ ODP1 explains to A3 where they are kept and A3 finds them, and opens the packet dropping the sterile inner packet onto the sterile trolley.
A4 cleans patient’s back again.
A3 ‘What size spinal needle?’
A4 ‘24’
A4 ‘Is that your bones?’ He says this to the patient as he is pressing on her back.
Patient ‘I think so’
A4 ‘Sometimes it’s useful to ask the patient. ... Not easy to feel’. A4 injects some local, as he is doing this he asks A3 what he felt, A3 says just bone, he says he got through once but didn’t get any spinal fluid back. A4 takes introducer for spinal needle and inserts it smoothly (looks fractionally pointed upwards). A4 very quickly feeds the inner needle in and removes the centre wire, fluid begins to flow slowly down the channel, A4 injects the local anaesthetic. There are some comments of ‘first time’ and ‘in front of the researcher as well’.
A4 ‘Just luck, all I did was go straight in the midline approach, bull’s eye of your pepper pot (*referring to the middle of all the pinpricks of A3’s attempts*), just luck.’

Fig 2 Extract from observation transcript.

confident statement that ‘the pain will go in a minute’ but the procedure was unsuccessful. Furthermore, their attempts continued for about 20 min before they opted to substitute general anaesthesia. In contrast, the consultant referred to above had greater skill but was paradoxically much readier to suspend his attempts at performing the block.

The extract in Figure 2 shows the further development of expertise. The trainee (A3) with 3 yr experience appears to relate to the patient more readily than his more junior colleagues in the excerpt presented above. When he cannot perform the spinal he promptly asks for help. The consultant who comes to assist him (A4) asks the patient to point to the middle of her back to help him locate the spinous processes, but otherwise appears to do the same as the trainee. His final comment, that it was ‘just luck’, may be true but may alternatively reflect the fact that his skills are so deeply embedded in his practice that he is not aware of them at the level they can easily be articulated.

The relationship between theoretical and practical knowledge

The typical initial path to learning regional anaesthesia—basic science followed by practical instruction—is outlined in this transcript excerpt:

‘Firstly I was shown the model of the spine and the spinal processes. It’s important to have an idea of where you are putting the needle so you can visualise it in your mind. You’ve got to be familiar with the anatomy. Then it’s a question of seeing, and then doing yourself. The first time I asked one of my colleagues to show me exactly what to do. He took me through it step by step. Then it’s just seeing and doing.’

[Interview with trainee anaesthetist, 5 months’ experience]

We observed some formal teaching in regional anaesthesia. The researcher’s observation notes are shown in Figure 3. The tutorial was given by a consultant anaesthetist (A5) and a trainee of 5 yr experience (A6). There are two distinct types of knowledge in use here: (i) ‘explicit’, formal knowledge (basic anatomy and research evidence on applied pharmacology) and (ii) the practical aspects drawn from clinical experience (what to explain to patients beforehand and the language of ‘pops’ to describe the ‘feel’ of block insertion through evoking images of interlocking and fitting into place). It is evident that although the junior anaesthetist (A6) is familiar with obstetric epidural blockade in practice, his teaching on paravertebral blocks draws more on textbooks. The unambiguous instructions relating to safe practice in regional anaesthesia are worthy of note. Although much of this material is introductory, even the most inexperienced trainee would have had 5 months’ experience of clinical anaesthesia, with many blocks, by the time this tutorial took place. However, the interview transcript above suggests that informal theoretical teaching had also taken place before the trainee had performed his first spinal.

As experience grows, the traditional teaching technique of demonstration followed by practice is seen. Practical

A5 (Consultant anaesthetist) and A6 (senior specialist registrar) host the tutorial. The subject, ‘local anaesthetic blocks of the trunk and lower limbs’ is written on a large white board on the wall. A7, A8, A9, CP (other researcher) and I attend.

The atmosphere is informal with few presentation aids (only white board and pen). About half wear theatre blues and half normal clothes. A5 and A6 sit to either side of a rectangular desk and on the other side of them the white board. The remaining chairs are arranged in two rows behind the desk.

A6 begins by asking A7 what he explains to a patient before doing a block. A6 adds to A7’s response that some patients ‘hate that awful numbness’ that accompanies nerve blocks and that it is necessary to notify the ward nurses of the block as they need to protect the limb from injury. A6 then asks A5 to write a list of trunk blocks on the board, A6 contributes. A7 then has to draw the dermatomes on the board from neck to waist and A6 for the lumbar area. So far all discussion has been on anatomy.

A6 begins talking about intercostal blocks. ‘Usually when you go for a block blind you feel a pop through the fascia. You haven’t got that here’.

A6 ‘This is the one time you put a needle under the rib and not over’

‘You never do bilateral intercostal blocks because of the very high risk of pneumothorax.’

A7 asks whether there is a given or average depth. A5 replies it depends on how fat your patient is. You go to whatever depth you need to to get the needle onto the rib then just ‘walk down’.

A6 then goes on to talk about interpleural blocks.

A6 ‘How would you locate the pleura?’

Somebody answers ‘loss of resistance’. A6 says that’s ‘one book technique’. A7 says ‘the way I’ve seen it done is with a consultant here who uses a bag of fluid’.

A5 comments that paravertebral blocks sound perfect but why do you think it is not often used? ‘There is no good landmark’. This seems to be a consensus.

A6 says that he has never seen one and all that he knows is from the book. There are lots of ‘always’ and ‘never’ rules: ‘Always aspirate then inject’. ‘Never use adrenaline in penile blocks’. Also much reference to ‘the textbook recommends’ (*this may be just as A6 hasn’t seen or done a paravertebral*).

Lots of talking of ‘pops’: ‘pop through the fascia’

‘pop your needle in’

‘pop through Buck’s fascia’.

A5 takes the second half. She repeats the drawing-on-the-board exercise, asking each trainee to mark out areas covered by certain blocks. Again this begins very anatomical (more so than last tutorial). A6 asks ‘what would be your favoured approach?’. A5 talks of ‘drop a perpendicular’.

A5 ‘I’ve always been taught. . .’

‘never inject if the injection is causing pain’

A5 goes on to explain that the needles are not cutting needles and therefore should just knock a nerve out of the way.

A5 ‘what I do is. . .’

A6 ‘my preferred technique. . .’

When talking about obstetric anaesthesia A5 and A6 refer to their own practice a lot (it is their specialist area).

A5 cites lots of research evidence proving that fentanyl has a spinal site of action.

A6 - Epidural drugs ‘must be preservative free’.

A5 about to close the tutorial when A6 says ‘I suppose we should cover the exam questions’.

A5 asks ‘the only contraindication to obstetric epidural’. A7 answers ‘patient refusal’.

A7 asks when do epidural abscesses ‘typically appear’?

A9 asks ‘what factors affect the spread of the spinal drug?’

Fig 3 Field notes from observation of tutorial on regional blocks for senior house officers.

demonstrations take place in the operating room, as in this transcript of the performance of a penile block:

A10 puts some gloves on.

A10 ‘..basically you go down to the symphysis pubis, go just below and off to one side...’

A11 picks up the 20 ml syringe (with orange needle) and feels where to inject. A11 also feels where to inject. They are both standing to the right of the patient, A11 parallel to abdomen, A10 to thighs. A11 unsheathes the needle, A10 says an orange needle isn’t large enough.

A11 ‘a green?’

A10 ‘probably a blue’

A10 replaces the orange needle with a blue one. He explains where and how to inject.

A10 ‘some people say you feel a ‘pop’ through the fascia...’

A11 has inserted the needle and injected some.

A10 ‘now stop, come back and re-angulate...’

A10 repositions the needle, A11 continues the injection.

A10 ‘That’s it’

A11 removes the needle, disposes it and his gloves and goes back to the patient’s head.

[OB15 Consultant anaesthetist(A10) and senior house officer (A11), general surgical list]

Embedding and individualizing

Trainees may initially find the variety of different methods practiced by experts confusing (one had been shown four different methods of performing the same block in the first 6 months of his training). With time, however, they develop ‘personal’ techniques, deepening their knowledge of each block by learning, in the words of one of our respondents, ‘how it feels’, and acquiring a sense of what feels ‘normal’. The knowledge is not simply transferred from the expert to the trainee, it is ‘worked on’ by the learner and incorporated into his/her practice. Interweaving of practical experience and textbook material is seen again in the experienced trainee’s account of how she would go about learning a new block (Fig. 4). Also in evidence is the need to spend time working on her own to get used to the technique. Her final comment encapsulated the expert’s long-term familiarity with one technique and how that technique is described.

Discussion

In this study we have been able to start to characterize expertise in regional anaesthesia. Clearly this encompasses technical fluency, but moves beyond competence at needle insertion to incorporate unwritten strategies for increasing success. True mastery is also manifest in handling the patient (communicating, anticipating and minimizing discomfort) and recognizing the limits of safe practice (knowing when to stop trying). We suggest that the latter demonstrates what we call an ‘appropriate confidence’. It is probably no surprise that these elements of practice, which take the practitioner from simply competent to expert,

‘First of all you ask your programme director to allocate you to a list with eye blocks. You have to read about the block first—what drug you use, what the complications are. Then you watch the consultant doing eye blocks, so he does one or two. Then he lets you do one with supervision and if it all goes right, he will let you do another one with supervision. Maybe he will leave you alone while he is with previous patient and let you do one on your own, but he will talk through it. You go through it again with him. Then you can start to see if there is another way of doing it. In this hospital there are three people doing eye blocks, each in their own way. The more you retain of each, the more you start to feel it click in and you start to feel comfortable with the technique. Sometimes you see complications but you can always ask your supervisors if they have experienced complications and how they would deal with them. As you start to gain confidence in your technique then you start to find the way you like it yourself. Listening to consultants when they talk about their way is like listening to couples when they talk about their marriage.’
[Interview with specialist registrar, 3 years’ experience]

Fig 4 Extract from interview transcript.

are located in the non-technical or ‘affective’ domain of knowledge and skills. These have received growing attention in the past few years as investigators have begun to explore their significance for both assessment of trainees^{15 16} and the safety of anaesthetic practice.^{17–19} Though we have fewer data relating to how knowledge is acquired in regional anaesthesia, we are also able to offer, for further testing, an initial model. This seems to progress through the following stages: (i) the acquisition of anatomical fact; (ii) exposure to practical procedures under supervision; (iii) reflection and linking in new knowledge from experience to existing theoretical material; (iv) by means of working independently, continuation of this process; and (v) the incorporation of knowledge into personal ‘routines’ and styles, with the flexibility to adapt to cases which are out of the ordinary. Some previously published data from our larger study on anaesthetic expertise in general¹⁰ suggested that exposure to a range of techniques and independent working are both necessary to allow the individual learner to incorporate them into his/her own practice.

Previous work on training in regional anaesthesia has been largely quantitative and has concentrated on defining numbers of procedures required for the development of competence.^{4–6} In focusing on a small number of procedures in detail, we have tried to respond to Kopacz²⁰ concerns over judging competence by the number of attempts alone and his suggestions that more attention be paid to quality. We do not claim to be representative in any statistical sense. Qualitative methods such as this are more concerned with creating a valid representation of the phenomena under study, in this case the acquisition of regional anaesthesia skills and knowledge within their specific social context.²¹ Qualitative methods are often unfamiliar to anaesthetists but are generally considered appropriate when there is little prior knowledge of a subject, or when hypotheses are needed and we believe these preliminary observations advance our understanding of what ‘quality’ in regional anaesthesia from the practitioner’s point of view might entail. We preferred

handwritten notes to video recording as we considered that the presence of the researcher (previously an anaesthetic nurse in the study department) was less intrusive than a video camera, and thus less likely to cause practitioners to behave differently from normal.

Expertise in anaesthesia, in common with other fields, rests on the successful relationship between different forms of knowledge. Particularly important in the professions is the largely unwritten 'tacit' knowledge used by practitioners.²² Examples in this paper are the references to the 'feel' of procedures and the consultant asking the patient to confirm that he was feeling the bones in her back before attempting a spinal. It is often assumed that practical, tacit knowledge of a subject follows in a linear fashion from theoretical knowledge, but our data suggest that the acquisition of practical skills in regional anaesthesia actually builds on and refines the theoretical knowledge that went before. Practice thus provides the context for the theoretical knowledge as it becomes embedded in 'skills' and as the learner develops an appreciation of how the dimensions of regional anaesthesia practice (theoretical knowledge, patient care, manual dexterity, confidence, etc.) intersect. Our model is supported by educational theory (the *experiential learning cycle*^{23–26}) and other notions of 'reflection-on-action'.²⁷

The difficulties of ensuring adequate training in regional anaesthesia have been well documented.^{2, 3, 28, 29} It is clear to us that the clinical workplace provides the right educational forum and social milieu for learning the 'total professional task' of regional anaesthesia.^{30–32} Organization of training is clearly important in that theoretical material should precede first attempts at a block²⁹ but revisiting theoretical material as practical experience grows should also be encouraged. A balance should be struck in the timing of supervised and independent attempts. Specifying a minimum recommended number for the commoner regional blocks²⁹ is a helpful guide but we believe that creating the right educational climate can encourage 'deeper level' learning of reflection and explanation. Cleave-Hogg and Benedict³³ have outlined how clinical teachers might promote greater complexity of thinking with which to understand and act on professional and life tasks and problems. Tweed and Donen²⁴ have suggested an experiential model for the anaesthesia curriculum, constructed to expose trainees to the necessary clinical encounters to stimulate reflection and learning. Within this, seniors could attempt to convey their tacit knowledge by trying to articulate what they are thinking as they perform blocks or as they watch others do so. We hope therefore that what might be termed 'art' of expert regional anaesthesia will be preserved as anaesthesia moves towards competency-based training and assessment.

This small study highlights a number of questions for further study. A larger sample would allow our initial model of expertise development to be confirmed or refuted—particularly the idea that both exposure to a range of techniques and opportunities for independent

working—and might also capture more of the tacit knowledge which usually goes undocumented. Our suggestions for the promotion of affective, non-technical skills should be evaluated formally. In particular, we would be interested to explore what changes in the anaesthetist's attitude to the task as experience develops, and how we might accelerate this and other aspects of the development of expertise.

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