JRAI Journal of the Royal Anthropological Institute

Learning to listen: auscultation and the transmission of auditory knowledge

Tom Rice *University of Exeter*

As part of their training, medical students in the United Kingdom are obliged to develop a degree of familiarity with the technique of stethoscopic listening, also known as auscultation. They must learn to handle and apply the stethoscope, and over time become adept at identifying and interpreting a range of sounds emitted by the body. The channelling and focusing of auditory attention demanded by auscultation is unfamiliar to students, and teaching doctors must bring awareness to sensory processes that otherwise operate at an unconscious level, or that resist verbal articulation. In this paper I provide a detailed account of the making of sensory knowledge in an attempt to move closer to what Cohen terms the 'micromechanisms' of 'embodied knowledge' (this volume). I do so by drawing attention to the sensory specificities of stethoscopic listening, the challenges posed by this form of auditory engagement, and the strategies employed by teaching doctors to overcome them. With the example of one student who is self-described as 'hearing-impaired', I also demonstrate how the assumption of a bodily homogeneity, implicit in many studies of embodied knowledge, obscures the complexity and specificity of individual circumstances that affect perceptual skill acquisition. In conclusion, I introduce the idea that stethoscopic listening is a 'dying art' and suggest that the inherent difficulties experienced in teaching and learning the technique might be a factor contributing to its demise. While the human capacity to teach and learn is impressive, pedagogic systems may struggle to meet the challenges that certain kinds of skill acquisition present. A failure to overcome the complexities of knowledge transmission decisively may have consequences for the perseverance of particular communities of practice.

How do we learn to listen? I became interested in this question whilst conducting ethnographic fieldwork at St Thomas' Hospital in London. The research was a continuation of a previous study that explored the acoustic dynamics of hospital life, focusing on patients' experiences of ward soundscapes at the Edinburgh Royal Infirmary (Rice 2003). Broadening the scope of that inquiry, the study at St Thomas' set out to examine the various ways in which medical professionals use and apply auditory knowledge in a modern clinical setting. I was granted Honorary Observer status by the Guy's and St Thomas' NHS Hospital Trust, and so was allowed to observe a wide variety of clinical interactions. Stethoscopic listening, however, stood out as a striking example of an acoustic technique which many medics use daily in their work.

The sounds that doctors interpret using auscultation could be understood as the acoustic traces of bodily processes. The pivoting and rotation of bones in their joints, the

Journal of the Royal Anthropological Institute (N.S.), S41-S61

movement of matter through the gut and water across the kidneys, for instance, all create noises which, to a trained ear, describe the condition and functioning of the body. The muscular action of the heart, the movement of blood through its vessels and chambers, and the flow of air in and out of the lungs generate a variety of sounds that are of value in assessing the state of the cardiovascular system. Auscultation is therefore particularly useful in this area of medicine. I spent much of my fieldwork in the Cardiothoracic Unit at St Thomas' shadowing doctors and observing their interactions with patients. I became increasingly interested in learning to listen, and, by adopting an apprenticeship-style methodology (e.g. Stoller 1989; Wacquant 2004), began participating in classes in which medical students were introduced to the auscultation of the heart.

The students with whom I studied were in their third year of medical school. While the time taken to qualify as a doctor varies depending on a person's route through the education system and the structure of their particular course, the students I came to know expected their medical training to take five years. Classes during the first two years (known as the 'pre-clinical' or sometimes the 'pre-cynical' years) generally take the form of lectures and tutorials. The emphasis is on anatomy and on the necessary aspects of chemistry and biology for understanding the constitution, function, and treatment of the body within a Western medical framework. Having completed their pre-clinical training, the subjects of my study were embarking on three 'clinical years', during which the focus is on sessions of supervised contact with patients on the hospital wards. They would be introduced to the procedures and techniques necessary for their future work as doctors. Auscultation was one such technique.

The students sometimes remarked that while the 'pre-clinical' phase of their education had, broadly speaking, been orientated towards 'brain work', the 'clinical' years would be devoted to 'body work'. In making this essentially Cartesian distinction, students were drawing attention to what they perceived to be two different kinds of knowledge that were in the process of transfer in the two educational stages. The classroom/lecture theatre years generally involve the passing on of information – theoretical, factual, and schematic – while the final three years, characterized by 'situated learning' in the clinical setting (Lave & Wenger 1991), are more concerned with the transmission of practical skills. The students were also demonstrating awareness of the fact that while medical work is directed towards the patient's body, it also implicates the doctor's body, or in their case, that of the medical student. Competence in diagnosis and in the management and administration of care demands well-honed senses and practised skills. Auscultation requires a carefully trained sense of hearing and an acute sensitivity to sound. The students would have to become attentive listeners in order to be good doctors.

In his book *Making doctors*, Simon Sinclair (1997), himself a qualified doctor-turned-anthropologist, presents a study of medical training based on fieldwork conducted among students at London's University College Hospital, where he himself studied. He describes classes in which students encounter a range of different clinical techniques, including auscultation. His aim is to show how these techniques and the pedagogies which teaching doctors bring to them serve to articulate wider 'dispositions' (Bourdieu 1980: 54) – attitudes which structure the practical and ideological approach that doctors, individually and collectively, take towards reality. These dispositions are themselves constituents of an integrated medical 'habitus' (Bourdieu 1980: 60). Sinclair sees medical school as a process through which that habitus is reproduced in new generations of doctors.

My research aims to reveal the detail and complexity of a practice which might otherwise be subsumed by, or regarded as merely another technique embedded within,

a more encompassing medical habitus. By focusing on the sensory complexities of auscultation, I respond to Downey's anxiety (this volume, voiced through Margolis 1999: 68) that crucial particularities of embodied knowledge may be engulfed or obscured by the 'slackness' of habitus as a conceptual structure. By challenging the sorts of presumptions about bodily uniformity which allow Sinclair, for example, to position medical students as vessels or blanks in and through whom the medical habitus is regenerated, I explore how schemes of perception are assimilated in diverse ways by those who encounter them. Perceptual abilities and aptitudes vary, meaning that creativity and resourcefulness are continually demanded of teachers and students alike.

The ethnographies of Feld (1996), Gell (1995), and Weiner (1991) focus on sound and auditory knowledge among the Kaluli, Umeda, and Foi, respectively, and their work is of particular relevance to my interest in the ways in which stethoscopic listening is learned. These anthropologists each observe and describe complex structured engagements with the sonic environment. Feld, for example, illustrates how an understanding of the ways in which Kaluli people engage with the layered soundscape of their forest habitat (produced by moving water, birdsong, and insects) is crucial for comprehending the nature of their intertwined language, topography, aesthetics, and cosmology (Feld 1990; 1991; 1996; 2003).

All three authors produce fascinating accounts concerning the importance of sound in the lives of the communities they study, and convey how informants hear their worlds. Feld produces especially evocative passages, describing how Kaluli terms such as 'lift-up-over sounding' capture the distinctive acoustic texture of the Bosavi rainforest (1996: 100). In a sense, the combination of his writings and recordings offer the reader/listener a lesson in how to hear like a Kaluli. Feld is also proactive in documenting his own processes of learning to listen as ethnographer and sound-recorder. He describes how he would play his forest soundscape recordings to his informants, allowing them to twiddle the knobs of the cassette player, creating 'an ethnoaesthetic negotiation' through which he was able to begin to understand how the Kaluli hear 'the dimensionality of forest sound, how they would balance a mix of birds, water, cicadas, voices and so forth' (Feld & Brenneis 2004: 467).

'Ethnographies of sound' tell us a great deal about how communities attach salience and meaning to particular sounds and categories of sounds (Gell 1995: 233). They show the manner in which sensory knowledge develops through ongoing interaction with the environment. Feld writes: 'One knows the time of day, season of year, and placement in space through the sensual wraparound of sound in the forest' (1996: 100). He continues: 'This way of sensing and hearing the world is internalized as bodily knowledge, part of the everyday "body hexis" (Bourdieu 1977: 8), the naturalized regime of "body techniques" (Mauss 1979 [1935]) basic to routine Kaluli encounters in their world' (1996: 100). Yet Feld's use of Bourdieu obscures a great deal that might be of value to a person interested in the teaching and learning of auditory knowledge. What particular perceptual skills does this 'body hexis' involve, and in exactly what ways is it reproduced among individuals or across generations? Feld's analysis also positions shared ways of knowing through sound as apparently unproblematic, unaffected by differences of perceptual sensitivity or interpretation. It is tempting to ask: what issues are presented at an individual and societal level for a person born deaf or hard of hearing into such an 'auditory culture' (Gell 1995: 236)?

Despite having been described as 'medicine's acoustic culture' (Sterne 2003: 191), it is clear that auscultation does not represent a system of auditory knowledge of the depth

or complexity of those described in the above examples. Indeed, the technique might be said to be firmly embedded in the 'visualist' culture which some anthropologists consider the West in general (e.g. Classen 1998; Tyler 1984) and Western biomedicine in particular (e.g. Draper 2002; Foucault 1973) to represent. Medical students will not learn to auscultate in the same way that, for instance, Kaluli acquire the 'naturalized regime of "body techniques"' which constitute their way of 'sensing and hearing the world' (Feld 1996: 100). Yet perhaps because it is encountered in adulthood, and because it situates listening as a conscious act that requires reflection and necessitates attempts at articulation, auscultation might represent a practice in which the dynamics of a kind of auditory skill can be accessed and described closely, rather than being couched in vague terms as 'body techniques'. Cohen's contribution to this volume draws attention to the importance of detail in accounts of the making and re-making of knowledge. She describes the potential of ethnographic engagement in communities of practice to reveal the 'micromechanisms' and 'processes' underpinning human knowledge. The example of auscultation presents a valuable opportunity to probe the underlying organizational and operational workings of a system of auditory knowledge.

While focusing on the minutiae of a kind of listening, I do not attempt to provide an account of auditory cognition like that offered by, for example, Lerdahl and Jackendoff (1984) and Jackendoff (1992) in relation to musical listening. And although I make occasional reference to points at which my own research and studies from psychoacoustics reinforce or complement one another, this is not an interdisciplinary study. It does aim to provide the kind of empirical data which, Cohen suggests, may be valid and useful in future attempts to engage with listening as a system of perception, but, more importantly, it centres on one of the key themes of this collection: namely examining the ways in which bodily, and, more specifically, sensory, factors enable and constrain the production and reproduction of human knowledge.

The 'lub dub'

My application to be an honorary observer obliged me to have a supervisor at St Thomas', so I approached Consultant Cardiologist Dr John Coltart, who was Head of Cardiothoracic Services at the time. Dr Coltart told me that my research interested him because he had long been conscious of the importance of listening in his everyday practice. He considered his ears to be one of his most important clinical tools, and, as he had been teaching auscultation for a long time, was interested in the qualities that made students good listeners. Agreeing to act as my supervisor, he also suggested that I attend his classes. Dr Coltart was in charge of teaching the so-called 'chest rotation' to a different group of students each academic term.

For the third-year medical students with whom I worked, the curriculum for the first clinical year was structured around three 'rotations', each being a three-month course on the abdomen, head, or chest. The 'abdomen' rotation involves an introduction to abdominal medicine and surgery; the 'head' rotation contains elements of psychiatry, neurology, and ophthalmology; and the 'chest' rotation consists of cardiovascular and respiratory medicine (including teaching on 'ear, nose, and throat' or 'upper respiratory tract' medicine). During the chest rotation, students learned to examine the cardiovascular system and became familiar with common signs and symptoms of related diseases. Cardiac auscultation was taught as part of the cardiovascular examination and was central to Dr Coltart's lessons, although he also taught special classes on other clinical topics such as heart failure and myocardial infarction or 'heart attack'.

On our first day of the chest rotation I sat with a group of eight medical students around a table in a seminar room. Dr Coltart asked, 'What sound does a heart make?' From our blank expressions it was apparent that none of us knew. This seemed at odds with the fact that most people know what a heart sounds like and, as Ackerman points out, '[w]e're used to associating the heart with sound' (1990: 190). Even though one might not actually listen to a heart very often, one is sometimes aware of one's own heart pumping and the texture of sound that it creates in the ears. The beating heart also has a high profile in popular culture and is often used in television and film soundtracks. But while recognizing the sound might be easy, describing it is evidently more difficult.

With no answer forthcoming, Dr Coltart responded to his own question:

> You might be familiar with the song by Peter Sellers and Sophia Loren in which they sing about her heart 'going boom boody-boom'. Well, this describes the heartbeat quite nicely. 'Boom boody-boom' suggests the heartbeat has four components: 'boom', then 'boo-dy', and another 'boom'. In fact the heart does have these four sounds, but because of the way our ears are designed we can't easily separate the many components. So in medicine we say the heart has two main sounds. We say it goes 'lub dub'.

Dr Coltart went on to explain that the first heart sound, the 'lub', is caused by the closure of the mitral and tricuspid valves, and the second, the 'dub', by the closure of the aortic and pulmonary valves. Figure 1, showing the valves and their position in relation to the rest of the heart, may be helpful here.

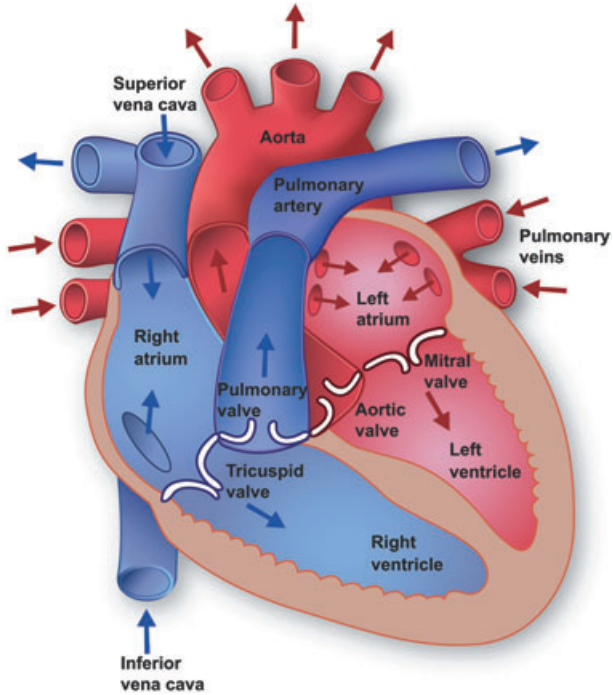

Figure 1. A simple diagram of the heart. (Image reproduced with permission of the Texas Heart Institute: *http://www.texasheart.org.*)

Dr Coltart went on to explain that normally when blood flows around the heart and across the valves, it does so smoothly, meaning that the only sounds that can be heard through a stethoscope are the closing snaps of the valves, which create the 'lub' and 'dub'. Sometimes, though, a physiological event triggers the blood flow to become turbulent and this turbulence produces what are known as 'heart murmurs'. For instance, if a valve becomes stiff for some reason (e.g. through calcification) and blood is forced through a narrower opening than is normally made by a valve (this restriction of blood flow is known as 'stenosis'), turbulence will be created and a murmur produced. If the valve fails to close properly, or becomes 'floppy', then blood passing through it will flow back (a development known as 'regurgitation') and another murmur will be produced, though at a different stage in the cardiac cycle and with a different sound. Problems with valves are not the only cause of murmurs. Holes in the septum (the muscle wall separating the two sides of the heart), for instance, can cause large volumes of blood to be forced back and forth between the chambers, producing a murmur known as a 'shunt'. Some murmurs appear to have no physiological basis at all, being caused by unexplained turbulence in the blood flow. These are known as 'innocent' or 'flow' murmurs. In general, though, heart murmurs are linked to malfunctioning valves. Dr Coltart claimed that murmurs are the cardiologist's 'bread and butter'. Most of our rotation was therefore devoted to learning to hear and identify them.

Cardiac auscultation is an example of what Chion describes as 'causal listening', namely 'listening to a sound in order to gather information about its source' (1994: 25). Doctors attend to murmurs to learn about the valves, vessels, and haemodynamics of the heart. Having provided his students with basic oral instruction as to how auscultation of the heart works, Dr Coltart went on to offer further, more sophisticated explanations of how subtleties of pitch, rhythm, and dynamics in a murmur express particular physiological changes. In doing so, he communicated an interpretative structure through which a range of heart sounds could be given diagnostic meaning, referenced to physical events in the bodily interior. As I will go on to illustrate, instructing the students actually to recognize the sounds occurring in patients was more complicated, and required a number of pedagogic strategies.

It is important to point out that auscultation of the heart tends to be used in the context of a more general examination which normally includes the taking of a clinical history, a series of careful observations from the foot of the bed, and the taking of pulses as well as many other small checks and procedures, all of which shape the listener's expectations of what will be heard. *The Oxford handbook of clinical medicine* makes this point plain. Its authors claim that auscultation is

> generally, but wrongly, held to be the essence of cardiovascular medicine at the bedside. A caricature of cardiology ward rounds is of the anxious junior gabbling through the history, while noting his chief's fingers twisting his stethoscope, impatient to 'get down to the main business' of listening to the heart – thereby blotting out all talk in favour of a few blissful minutes communing with the 'lub' and the 'dub'. This is absurd ... if you spend time listening to the history, and feeling pulses, auscultation should hold few surprises: you will often already know the diagnosis (Longmore, Wilkinson & Torok 2001: 39).

Auscultation belongs, then, within a web of interconnected techniques used in examining patients and is regularly used to confirm diagnoses formulated on the basis of other observations. None the less, medical practitioners regard it as an important skill in its own right, and for the purposes of this paper I focus on cardiac auscultation itself as an 'apprenticeship in hearing' (Downey 2002: 504).

Before listening

With the exception of the initial class, in which we were introduced to the theoretical principles of auscultation, sessions for the chest rotation took place on the cardio-thoracic wards. Dressed in white coats and clutching notebooks and stethoscopes, we followed Dr Coltart to the bedsides of patients whose conditions, he judged, were appropriate to our instruction. This almost invariably meant that the patients had a heart murmur of some kind. We formed a semi-circle around the bed with Dr Coltart at the head on the patient's immediate left, spatially indexing his status and authority in relation both to his students and to the patient. One of us then pulled the privacy curtain closed.

Dr Coltart emphasized the importance of maintaining good relationships with patients, and in a polite and good-humoured way he introduced us as 'young doctors' to those he had chosen as models or exemplars. He then asked for our observations. Was the patient sitting up? Were they speaking comfortably; breathing evenly and regularly; speaking and behaving compliantly? Was the patient over- or underweight? Were there scars from previous operations? Were there bandages, tubes, cylinders, at the bedside? After gathering answers to his questions, Dr Coltart demonstrated the cardio-vascular examination, drawing attention to particular signs of the patient. Among the checks involved were the inspection of the patient's hands and fingers, feeling of pulses in the wrist and neck, noting the colouration of the cornea and health of the teeth, and feeling for any abnormal vibrations through chest palpation.

Having demonstrated these examination stages, Dr Coltart proceeded next to the auscultation of the heart. He emphasized that the stethoscope's diaphragm (the part pressed to the patient's chest) should be cleaned with alcohol and warmed against the back of the hand so it would not feel too cold against the patient's skin. He then showed us how to move our hands over the chest in order to find the 'apex beat', the lowest and outermost point at which the beat of the heart can be felt. This is the point at which cardiac auscultation should begin. Inserting the earpieces of his stethoscope and taking the diaphragm carefully in his hand, Dr Coltart requested that we remain quiet in order to optimize conditions for listening in an often noisy ward. Doctors, like Ituri pygmies (Turnbull 1961) and Umeda (Gell 1995), preserve a degree of discipline around noise, recognizing the importance of quiet at times when careful listening is necessary. Drawing our attention to the need to push down with the diaphragm so as to make a firm connection with the flesh, Dr Coltart quickly listened at the apex beat, and then indicated how we should move the stethoscope to other 'key points' (see Fig. 2) where sounds produced by the heart valves can be most easily discerned. In doing so, he effectively marked out a map of listening points on the patient's chest. After the demonstration, Dr Coltart instructed his students to auscultate the patient's heart in turn. The students tried hard to imitate Dr Coltart's listening postures and to reproduce the assured air with which he handled the stethoscope. They found themselves struggling, however, not only with the more overt bodily actions, but also with the subtler perceptual processes of listening.

Non-sense

Using a stethoscope for the first time can be a slightly disconcerting experience. On inserting the earpieces, the sounds to which one is accustomed disappear. The outside world is sealed off; it becomes muted, distant. Scientists working in psychoacoustics have observed that during experiments carried out using headphones, 'physiological

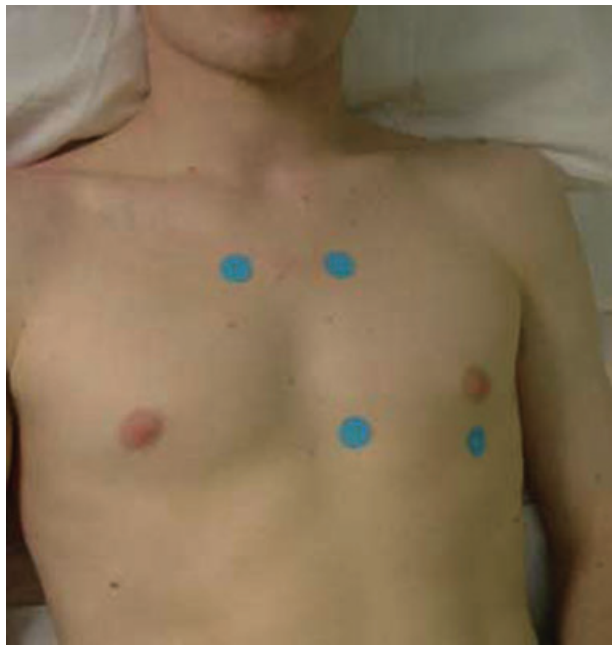

Figure 2. Key listening points for cardiac auscultation. (Image reproduced with permission of the Queen's University Belfast Clinical Skills Education Centre.)

noise of vascular origin' (i.e. noise created by the heartbeat and the circulation of blood, also known as 'self-generated noise') becomes trapped inside the ear (Anderson & Whittle 1971; Soderquist & Lindsey 1972). This effect is also produced by the earpieces of the stethoscope so that, paradoxically, the first heart sounds one hears upon inserting them are often one's own. One also quickly learns that the diaphragm of the stethoscope is highly sensitive. The tiniest knock or scrape transmits sudden and painfully loud sounds down the tubes into the ears. After experiencing a few of these unpleasant sonic shocks, one begins to handle the stethoscope with great care.

Placing the stethoscope on the patient's chest can also be perturbing at first because it involves entering the cocoon of warm air that surrounds his or her body. This air is charged with the patient's smell, pleasant or otherwise. Touching the skin, one becomes aware of its temperature and texture. The rising and falling of the chest can be felt, as can the patient's breath on one's face. It becomes easy to notice certain details of the skin, its colour, the presence of pigmentation, scars, and moles. Pressing down the diaphragm of the stethoscope also creates a sense of the skin's resistance, indicating its age and condition, the presence of muscle, bone, and fat.

Just as the physics of the stethoscope suggest that the vibrations of the chest wall are conducted through tubes directly to the ears of the physician, the sensation for the auscultator is one of a sudden rush of body sounds up the tubes, suffusing the ears. Instead of the doctor penetrating the patient's body with a kind of 'auditory gaze', the sensation is more one of the patient's body penetrating that of the listener. Yost writes that sounds presented over earphones are generally perceived by experimental subjects as being 'inside the head' rather than 'out in space' where actual sound sources usually

appear (1994: 178). The same is true for the sound conveyed to the earpieces of the stethoscope. Making sense of the cacophony is almost impossible at first. There is only the feeling of something like a sonic draught reaching the head and one becomes overwhelmed, or, as Ellman writes, 'stuffed with sound' (1993: 101). This is not to say that the other senses are negated or somehow deleted from experience, but the sense of hearing is given a definite immediacy and priority in the sensory present.

In the earlier lessons of the rotation, few of us could make any sense of what we perceived to be the meaningless 'noise' which invaded our ears. Shaking our heads we apologized to Dr Coltart, saying things like 'I'm sorry, I can't hear anything. I honestly can't hear anything'. As a student named Tom explained,

> When you first come in you don't know what you're listening for. You're just listening. You've got your ears open and everything's coming in and you're like 'Arrrgh!' The first time I came in I didn't know anything. I didn't know what were the heart sounds, I was just listening and thinking 'Oh my God'.

Mary agreed: 'You try to convince yourself that you're hearing something but actually you have no idea'. Like Tom and Mary, many students initially despaired of their inability to control the stethoscope and the sounds produced with it.

Focusing

Dr Coltart encouraged his students to focus and 'listen into' the sounds the stethoscope produced. The type of listening shifted from being directly 'causative' towards what Chion, citing Schaeffer (1967), refers to as 'reduced listening'. The focus was 'on the traits of the sound itself, independent of its cause and of its meaning' (Chion 1994: 29). Many students shut their eyes, screwing them up tight as if attempting forcibly to channel or divert their attention away from their eyes and into their ears. They seemed to be trying to create a sealed perceptual space in which auditory information could be purified and optimized by shutting out potential sensory distractions. Harjit was an eye-closer. 'If you close your eyes you can hear better. You have to suspend all your other senses and put all your energy into your ears', she said, later referring to this state as 'murmur mode'. Other students kept their eyes open to listen, but stared blankly ahead or into the middle distance as they did so. 'Your eyes may be open but you lose your vision. You stare into space but you don't see anything because your concentration is in your ears', said Dave. Here the gaze is disengaged. It has been vacated or shut off in order to allow sounds to become the focus of attention. Auscultation, then, requires an unusual acoustic effort, a special kind of concentration. 'A will', as Dave put it, 'to think yourself into your ears'.

In much the same way that experienced concertgoers might close their eyes and let their heads drop back, abandoning themselves to the music, the students' efforts to listen also constituted a kind of 'performance of listening'. This was perhaps helpful for convincing themselves that they were listening as attentively as possible, but it also served to demonstrate to their teacher that they were trying hard and that even if they were not actually able to detect anything meaningful, at least their self-application was good and they were making an effort. Students were later advised that a clear demonstration of listening communicates to the patient that conversation should be suspended and it is time for the doctor to concentrate. This 'performance of listening' therefore served as a technique for both shutting out extraneous sound and distracting presences, and, if necessary, shutting up the patient.

After finding their auditory focus, Dr Coltart told the students to listen for what he called the 'landmark' sounds, the 'lub' and 'dub', that compose the heartbeat. He suggested that if these were soft, then we should nod our heads with each beat, or tap out the rhythm with one foot, thus marking and reinforcing the sounds with bodily movements. He also encouraged us to listen whilst feeling the patient's pulse, as this would enable us to anchor or link the sounds of the heart to tactile sensations. It would also help us to discern whether there were delays between the heartbeat and the rise of the pulse. Such signs could be of potential clinical significance. Listening, then, could involve a kind of sensory cross-referencing, whereby tactile information is used to reinforce that in the auditory mode. After a few lessons most of us were able to recognize the 'lub' and 'dub' with some degree of certainty, although we periodically encountered patients whose heart sounds were indiscernible to us.

Next, Dr Coltart asked us to listen for heart murmurs and other abnormal heart sounds. He used both a temporal and a visual-spatial framework in order to describe the auditory focus that is necessary. To start with, he suggested that we try devoting units of time to the elements of what we were hearing:

> There's no way that you can hear all of the information that's there in one go. You've got to have points that you're listening for and that you can work from. You've got to listen for five seconds to everything, then for five seconds you've got to find the heart sounds, then you've got to listen for five seconds for any murmurs before or after those sounds.

He also suggested that we mark the first and second heart sounds using imaginary lines, and then, if additional sounds could be detected, draw or shade in the spaces on either side of the first or second heart sounds in which they occurred (Fig. 3). He depicted murmurs in this way on notepads and blackboards. This diagrammatic formulation of sounds was helpful to students who were not accustomed to working in sound alone and found it easier to visualize them. Dr Coltart claimed, however, that as one becomes familiarized with heart sounds and more confident at recognizing the different kinds of murmurs, one ceases to rely on mental images.

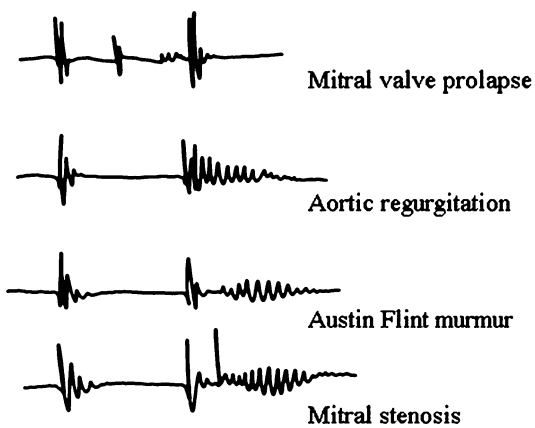

Figure 3. Heart murmur sketches.

Evidence from psychoacoustics suggests that people are able to separate specific 'acoustic objects' from their background, isolating particular elements for focused attention. Indeed, the ear works by attending to *parts* of complex sounds, rather than all aspects at once. As Moore explains:

> It seems that we are not generally capable of attending to every aspect of the auditory input ... rather, certain points are selected for conscious analysis ... it appears that the complex sound signal is analysed into streams, and we attend primarily to one stream at a time. This attended stream then stands out perceptually, while the rest of the sound is less prominent (2003: 294-5).

It may be that Dr Coltart's system for spatially and temporally demarcating the different parts of a sound facilitates this process of 'streaming'. Moore also identifies distinct 'analytic' or 'synthetic' modes of hearing. The 'analytic' mode allows the listener to attend to individual components of a sound, thus effectively muting other parts, while the 'synthetic' mode fuses elements into a single percept (2003: 282). Warren suggests that an element of training may be necessary in order for listeners to shift effectively between the 'analytic' and 'synthetic' modes (1982: 63). Following an experiment in which a series of tones were played to doctors through a stethoscope, Welsby, Parry, and Smith (2003) noted that practised auscultators were effective at filtering out extraneous or misleading sounds. This suggests that they had become adept at shifting between the analytic and synthetic modes of hearing.

Listening alone together

Daniel Shindler (2004) remarks upon students' 'enthusiasm for the stethoscope' when introduced to auscultation. Indeed, my fellow students were surprisingly keen to practise listening to murmurs. They visited the cardiothoracic wards after class, asking nurses on duty if there were any murmur patients to whom they might listen. They returned repeatedly to see patients whose murmurs were challenging. The consequences of this repeated listening for the patients is a subject I discuss elsewhere (Rice 2008). But despite their general enthusiasm, students nevertheless experienced difficulties with learning to listen.

In the contexts described in this volume by Marchand and Makovicky, the physical substance of materials with which teachers and pupils are working (wood and thread, respectively) is shown to be integral to the teaching process. Participants in the teaching interactions appear to have a strong visual, tactile, and even olfactory engagement with their materials. At the same time, a student's work with and upon that material indicates how well particular actions and techniques are being performed, and hence how well the student is progressing. Wood and thread bear the physical traces of a practitioner's skills (or lack of them), and hence can easily be made the subject of comparison and discussion. The medical students, on the other hand, found it difficult to establish common points of reference for the sounds they were hearing and it was difficult to gauge or have confidence in their own progress as listeners.

Auscultation is considered a solitary, isolating perceptual experience. This is partly because the sounds of the body are not publicly shared in the way that music played over a stereo, for instance, might be. Students were obliged to listen in sequence, one after the other, making it difficult to ascertain that everyone was experiencing exactly the same sound. Teaching stethoscopes have been developed to tackle this problem. As shown in Figure 4, these instruments have one large central diaphragm connected to

Figure 4. A teaching stethoscope. (Image reproduced with permission of St John Ambulance Supplies.)

two sets of earpieces, and as many as ten, enabling a teaching doctor and students to listen simultaneously. These instruments are rare, however, and I never saw one used during my time at St Thomas'. Auscultation was always a solitary endeavour, the doctor or student listening to sounds that he or she alone could hear. The listener was isolated in a particular perceptual moment.

One way in which Dr Coltart, and teaching doctors more generally, sought to get around the problem of the subjective isolation of listening was to provide students with CD recordings of various murmur examples with voiceovers describing their distinguishing features. The recordings allowed students to listen collectively to the very same sound and ensured that they were hearing the intended sound. Students found the CDs helpful, boosting confidence that they were hearing what they were *meant* to hear and not sounds produced by their own mishandling or misplacement of the stethoscope.

Dr Coltart also wanted students to be capable of instantly recognizing some of the most common heart murmurs, 'as one knows a dog's bark'. The ejection systolic murmur of aortic stenosis, for example, occurs when the aortic valve becomes stiffened and no longer opens fully enough to allow easy blood flow. As a consequence, the blood is forced through the narrowed valve, resulting in a distinctive, harsh, sometimes squeaky murmur. The CD familiarized students with such archetypal examples, and with other common heart sounds. They were then able to compare murmurs heard on the wards with these memorized sounds or sonic templates.

CD recordings detach heart murmurs from patients, effectively turning them into portable sonic objects. Practice listening was therefore no longer restricted to the hospital, freeing students to auscultate in their own bedrooms or while travelling to and from class. This also released them from the pressure they felt when listening in Dr Coltart's presence. Some listened to the CD while reading, which they claimed allowed the murmurs gradually to seep into the memory rather than being forcibly memorized. A few students visited websites where they could listen to heart murmur recordings and view phonocardiograms (digitally produced diagrams of heart sounds). These effectively served the same purpose as the classroom sketches drawn by Dr Coltart, though they tended to be more detailed, colourful, and aesthetically pleasing for the students (Fig. 5).

Though considered to be helpful, the recorded sounds are much 'bigger' and 'cleaner' than those procured through a stethoscope. When listening to a patient, sounds can be muddled and obscured by subcutaneous fat, vascular noise, and breath sounds from inside the body. Recordings and sound files lack the background noises of the wider ward/patient context as well as the realism of the stethoscope-user interface. After several days of listening students could reliably complete the 'heart sound quiz' at the end of the CD, but finding and recognizing the same murmurs through a stethoscope when faced with a live patient proved more challenging and required many weeks of practice. Even by the end of the rotation no student was consistently successful in this task.

Speaking sound

The teaching of auscultation also presents a linguistic problem, or a problem of vocabulary. While the previously mentioned ethnographies by Feld, Gell, and Weiner point to the highly sophisticated acoustic vocabularies exhibited by members of the Papuan societies they study, sonic terminology is generally held to be comparatively under-developed in Western societies. It is not simply that there is a 'Spartan economy of words' for engaging with auditory phenomena, but that, as Walter Murch argues, Western cultures have never developed the concepts or language to describe or cope with sound (Marchand, introduction, this volume; Murch 1994: xvi-xvii).

While standing at the bedside of patients, Dr Coltart often tried to produce evocative descriptions of particular heart sounds for his students, saying things like: 'It's that

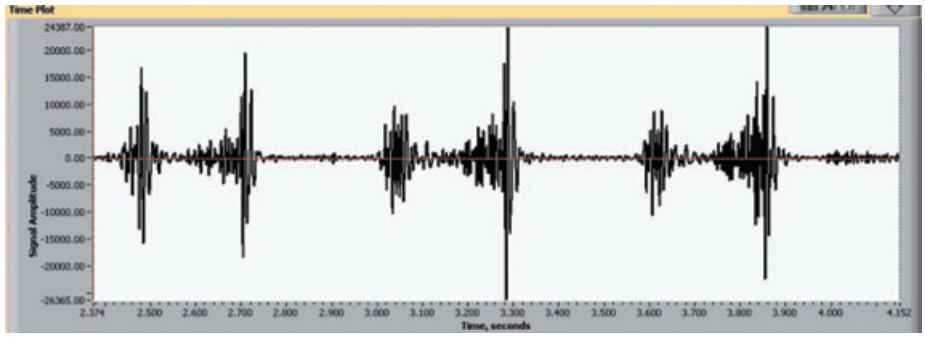

Figure 5. A phonocardiogram of the murmur of mitral regurgitation. (Image reproduced with permission of Bsignetics.)

long, low, rumbling sound I want you to be getting', or 'Can you hear that harsh, rasping, almost squeaking sound?' While terms like 'lub dub', and even 'murmur', are clearly onomatopoeic, Dr Coltart also resorted to more conspicuous forms of mimicry. 'It's the "ush, ush, ush" I want you to listen to', he might say, or the 'lup dup shh, lub dup shh'. On several occasions Dr Coltart acted out the murmur of aortic stenosis by saying 'eek, eek, eek', accenting the noise with an upward gesture of his fist to indicate the effort required to pump blood through the narrowed valve. Students also used onomatopoeia in describing what they heard to one another. The performance of sounds and use of nonsense words and syllables often had a comic effect, partly because of their perceived contrast with the serious manner and formal terminology that supposedly characterized clinical discussions. I would suggest, however, that these vocalizations were yet another attempt to break down the subjective isolation of listening, and make the stethoscopic auditory experience a shared and communal one through public language and gesture.

René Laennec, the man widely regarded as the inventor of the stethoscope, used simile to evoke the sounds that he heard in his patients and which he wanted other doctors to recognize. He described one particular lung sound, for instance, as 'a tinkling similar to that of a small bell just ceasing to ring, or of a fly buzzing in a china vase' (1846: 320). Elsewhere he described how the thickening of the bronchial tubes caused by pneumonia yielded a sound that sometimes resembled snoring, the cooing of a wood pigeon, or the rubbing of a bass string (Marks 1972: 71-2). Such acoustic analogies have largely disappeared from modern medical descriptions of heart sounds, but Dr Coltart nevertheless made reference to, for example, 'seagull murmur' and 'a gallop rhythm'. He suggested that the gallop rhythm, which is produced when a third heart sound is audible in addition to the expected two, should have the same cadence as the word 'Kentucky', the first heart sound forming the 'Ken', the second heart sound the 'tuc', and the third sound the 'ky'. The rhythm produced when a fourth heart sound is present was likened to the word 'Tennessee'. While a third heart sound comes after the two expected ones, the fourth heart sound precedes them. Interestingly, a third heart sound is not required for a fourth to be present, so in the three syllables of 'Tennessee' the fourth heart sound makes the 'Tenn', the first the 'ess', and the second the 'ee'. By invoking more familiar acoustic patterns, these metaphors make otherwise inchoate sounds more immediately comprehensible (Fernandez 1974: 120).

Those new to auscultation have difficulty communicating what they hear, but doctors have developed a formula for defining heart murmurs using a set of four parameters. They might refer, for instance, to 'a soft, grade II ejection-systolic murmur at the left sternal edge'. The murmur is thereby classified in terms of its tone, volume (on a scale of I to VI), place in the cardiac cycle, and location on the chest. This method greatly reduces the scope for possible confusion arising from attempts to evoke the actual sound of the murmur. It should be pointed out, however, that the ability to frame sounds through a set of reference-points has not entirely resolved the problem of establishing consensus on what has been heard. Murmurs can be very subtle. Also, like other kinds of diagnostic work, auscultation is interpretative or hermeneutic. Doctors form independent judgements and develop their own opinions. The knowledge which auscultation produces is always contestable. Despite efforts to 'fix' murmurs objectively through careful description, it is still common for doctors to disagree on the nature of what can be heard. In an excerpt on 'the heart sounds', *The Oxford handbook of clinical medicine* states that '[t]he first and second sounds are usually clear'; however,

'[c]onfident pronouncements about the other sounds and soft murmurs may be difficult. Even senior colleagues disagree with one another about the more difficult murmurs' (Longmore *et al.* 2001: 80). In auscultation, sounds cannot be reliably or unproblematically codified.

Simon Sinclair observes that heart murmurs 'are notoriously hard for novices to identify' (1997: 202). But despite the complexities involved in learning to listen, the students gradually increased their proficiency at detecting and interpreting heart sounds. This came with applying the pedagogic techniques invented by doctors, but, above all, with practice. Progression was not uniform, and as Downey points out, expertise arises 'in diverse fashion and unevenly' (this volume). But as one student, Alistair, put it, 'When we started we could hear a sound and that was about it. Then we could hear the two heartbeats and a load of muffle. Now we can listen to that muffle and usually understand what it means'.

Harder hearing

A few months into fieldwork my right ear became itchy and painful, and my hearing a trifle impaired. It seemed likely that I had caught something from a stethoscope. The earpieces are known to be a site at which pathogens accumulate, and people who share stethoscopes often develop ear infections. I had used a spare ward stethoscope on a number of occasions and so now was obliged to return to the hospital as an outpatient.

When I walked into the waiting room of the ENT (Ear, Nose and Throat) Department, I was surprised to see one of the students I had met on the chest rotation. Rhydd was equally surprised to see me. He explained that his ears felt continually blocked and he was finding it increasingly difficult to hear, so he came to have them syringed. I explained my own reason for attending the clinic, and he proceeded to tell me all about the doctor I would be seeing. The doctor, it turned out, had been one of his teachers. While talking together, Rhydd nodded and smiled at a girl walking past.

> 'Who's that?' I asked.
>
> 'Her name is Nirit. She's a third-year medic as well. She's going into the audiology clinic which is not surprising – she's deaf'.

This was interesting, and I wondered how she coped with the auditory practices that I understood to be so important to medicine. I asked Rhydd if he could arrange a meeting.

Nirit and I met a few days later in the café at St Thomas'. In speaking to her, I was in no way aware of her deafness and did not have to make any concessions in terms of altering my speech. She described herself as 'hearing-impaired' and explained that few people are totally deaf. She considers herself representative of that grey zone within the population who live between deafness and a totally hearing world. Nirit's hearing impediment is congenital. She has 70 per cent hearing loss in each ear, but explained: 'It isn't that I don't hear. I have found strategies to hear in spite of my impediment'. She wears hearing aids and lip-reads. Nirit went on to describe how she made the choice to live as a hearing person in a hearing world. This decision met with disapproval from some members of a group with which she worked. They expected her to assume a 'Deaf' identity and maintain solidarity with other Deaf people by refusing to adapt to the hearing world. Oliver Sacks (1989) observes the strength of this ideology among some deaf people in his book *Seeing voices*.

Nirit acknowledged that there are certain features of medical practice that make the path difficult for the hearing-impaired. Medics spend considerable time attending to weak or elderly people who often speak in a soft, unclear manner. Nirit is also aware that she is easily thrown by accents and unusual words, and hospital background noise further impedes concentrated listening. In the operating theatre, much of the face, including the mouth, is covered, thereby concealing lips, facial expression, and normal self-evidence of the speaker and making comprehension especially challenging. Though strategies may be employed (in the operating theatre, for example, surgeons can be asked to wear small radio microphones which relay their voices to a hearing aid), the numerous existing hurdles suggest that medicine is likely to remain a testing career for the hard-of-hearing.

For Nirit, four areas of medicine stood out as highly 'auditory' in nature, or, rather, as being specializations in which listening is especially important. These are general practice, paediatrics, respiratory medicine, and cardiology. Nirit's hearing impairment made her reluctant to go into any of these areas, and cardiology in particular. She would find it hard to cope with the responsibility were she unable to detect a sound that was an important diagnostic clue and jeopardize a patient's health as a consequence. 'I don't want to spend all my life wondering if a patient's well-being has been compromised by my hearing', she said.

The 'chest rotation' included instruction in the rudiments of two of the areas identified by Nirit, namely respiratory medicine and cardiology. A great deal of auscultation practice was demanded in these elements of the training, and the technique presented obvious challenges to Nirit. She acquired an amplified stethoscope (see Fig. 6) manufactured in such a way that the main tube extending from the diaphragm plugs into a small amplifier which, in turn, is connected to the earpieces. The sound picked up by the diaphragm travels up the tube, is amplified half-way, and continues in normal fashion to the earpieces. In addition to making the sounds from patients louder, the device can also be tuned to amplify high or low frequencies.

Nirit had been anxious about auscultation. She pointed out that she was used to listening because the fact that her *hearing* is impaired makes *listening* all the more important. She must actively seek out the sounds most people hear easily and take for granted. In day-to-day life, Nirit used lip-reading and other cues to fill in for missing

Figure 6. An amplified stethoscope. (Image provided with permission of Harris Communications, Inc.: *http://www.harriscomm.com.*)

sounds. In auscultation, however, supporting information was not immediately available, leaving her sense of hearing uncomfortably exposed. She explained that her amplified stethoscope also worried her because she did not know whether it was distorting sounds. She thought she might be hearing things that were not there. This feeling is reported by almost all students learning auscultation, but Nirit believed the problem to be more acute in her case, undermining her confidence in judging what she heard.

One teaching doctor offered Nirit extra one-to-one supervision in auscultation. He took her around the wards to practise listening on patients with exemplary heart murmurs and gave her more time to listen than she received during normal classes. Nirit found the technique of tapping or acting out elements of the sounds with gestures particularly helpful. She believed that doing this, even if only in her head, was a good way of confirming to herself the acoustic dynamics of the sounds she was detecting. She also appreciated the care taken by the teaching doctor to describe and mimic sounds accurately. She felt that this process of verbalization provided a way of moving the sounds out of her perceptual uncertainty into a space in which their features and characteristics could be shared and thereby verified.

By taking turns at listening and afterwards comparing thoughts, the teaching doctor and Nirit were together able to analyse and monitor her hearing. The teaching doctor directed Nirit's attention to areas of relative perceptual strength and weakness. He advised her to pay particular attention to certain parts of sounds and to trust her judgement on others. Gradually, Nirit's ear for heart murmurs became more reliable. The perceptual isolation she experienced, 'amplified' by the amplified stethoscope, was slowly dispelled, giving way to relative confidence. Her faith in both the technology and her own sense of hearing grew. By the end of the chest rotation, Nirit recognized that although some fellow students were better skilled, some were less competent than her. This was in fact the case for every rotation, not just those which drew heavily on auditory skills.

To use her amplified stethoscope, Nirit had first to remove her hearing aids and insert the earpieces of the instrument, listen, and then take them out and reinsert her hearing aids. While this would be fine for her medical exams, she felt that in a normal medical setting the same procedure might undermine patients' confidence in her diagnostic abilities. Patients might be suspicious of a doctor dependent on hearing aids, questioning his or her capacity for detecting the necessary clinical signs. A report produced by members of the Health and Sciences Department at Staffordshire University entitled *Enabling disabled doctors* suggests that doctors with visible disabilities of all kinds occasionally encounter assumptions of incompetence made by patients (Morgan & Chambers 2004). Nirit was concerned that patients might not realise that, in fact, her hearing is sufficient for carrying out her duties. While becoming confident with her use of the stethoscope, she nevertheless recognized that she would need to be creative in managing patient reactions to her methods and securing their trust.

The amplified stethoscope allows Nirit to use auscultation in the same way as other medical students. But the technique continues to hold greater challenges for her than for most of her peers. Nirit's example demonstrates that bodies, and the perceptual capacities they support, are not uniform or homogeneous, but are sites for the production of difference. Nirit's hearing problems do not prevent her from participating in what might be described as the 'common schemes of perception' which characterize the medical habitus (Bourdieu 1980: 60). But plainly, thinking in these terms could lead us to dismiss what is important and interesting in Nirit's example, namely that certain tasks are more problematic and fraught with doubt and uncertainty for her than for

other students. Her sense of hearing requires that she be singularly inventive and resourceful in her approaches to her medical training.

Conclusion

On a number of occasions I heard senior doctors remark that the stethoscope is 'a dying technology' and auscultation 'a dying art'. When asked to elaborate, they pointed to the increasing use of cardiac ultrasound or echocardiography in heart examinations and consequent diagnoses of heart disease. In echocardiography, ultra-high-frequency sound is used to produce detailed, real-time images of the functioning heart, its interior and haemodynamics. Echocardiography machines are presently expensive, cumbersome, and complicated to operate, and they require the services of a qualified technician. But new technology is rapidly making them more portable and user-friendly. In time, I was told, medical practitioners will walk onto wards carrying cardiac ultrasound devices in their pockets. Echocardiography will replace auscultation as the primary method for bedside heart examination, rendering the stethoscope obsolete. A number of written sources also make reference to the 'death of the stethoscope', again pointing to the impact of new technologies on diagnostic practice (e.g. Babu 1999; Kirsch 1998).

Daniel Shindler (2004) points out that the demise of the stethoscope 'has been wrongly but repeatedly foretold over the years'. He refers to 'the old tale of an early twentieth-century radiologist who placed a stethoscope prominently for all to see in a coffin-shaped display case. It was his mistaken belief that X-ray of the heart would shortly render the stethoscope obsolete'. There was certainly no evidence of stethoscopes being consigned to drawers or dustbins at St Thomas'. Indeed, auscultation was of considerable importance in the teaching curriculum. Given that the students with whom I worked would qualify in three years, it seems unlikely that they, as doctors, will certify the stethoscope dead. On the contrary, their practice would appear to ensure its continued use. Furthermore, the fact that auscultation is a low-tech, cost-effective method of making quick health assessments of the heart valves means that the technique is likely to retain its use value, notably in countries where health care is underresourced. None the less, the notion that the art of auscultation is endangered is of clear interest to discussions of this knowledge-making practice.

Writing on echocardiography, Draper points out a paradox in the technology, namely that 'sound is used to give light to the bodily interior' (2002: 777). It might be argued that auscultation does the same. In *The birth of the clinic*, Foucault imagines Laennec (the inventor of the stethoscope) listening to a patient's heart. Foucault suggests that Laennec is listening in order to visualize a heart he cannot see, thereby using his interpretation of its sounds to extend and augment his gaze (1973: 165). But in echocardiography, sonic information is transduced in such a way as to produce images that are visually legible. The heart is made materially accessible to the eyes, rather than the mind's eye. Sounds are no longer used to anticipate a visual gaze, but bring about its direct fulfilment.

While auscultation could be said to represent a means of visualizing the bodily interior, cardiac ultrasound belongs more immediately to what Duden calls medicine's 'visual command performance'. It epitomizes a drive for visual knowledge of the body which, she suggests, pervades medical culture (1993: 21). It could be argued that it is because echocardiography satisfies medicine's overarching project of visualization that many doctors consider that it is destined to bring about the end of auscultation. My research, however, offers a different set of perspectives on this speculated fate, grounded in observations about the teaching and learning of auscultation.

On one hand, doctors are inventive, resourceful, and ultimately quite successful at imparting the auditory knowledge which stethoscopic listening demands. They have developed a combination of techniques which productively direct the novice's attention, memory, and recognition skills. By practising in the learning environment of a hospital ward, the listening skills of most medical students progress and continue to develop throughout their careers. But, on the other hand, my research also reinforces the point that auscultation is 'a difficult skill to acquire' (Roy 2009: 4). The amount of practice and repetition required make the skill costly in terms of both time and energy for teachers and students alike. The inherent subjectivity of auditory experience and judgement, as well as the difficulty of fluent and confident communication about sounds, has made auscultation problematic for doctors since its inception. The challenges and constraints of listening as a way of knowing are made apparent in its transmission. While new diagnostic technologies like echocardiography will present their own set of problems and complexities as ways of knowing, doctors may find them more acceptable or manageable than those implicated in stethoscopic listening. At the very least, doctors may resist using and teaching auscultation in clinical practice as less-demanding and training-intensive diagnostic technologies emerge.

In his contribution to this volume, Downey writes that 'our remarkable ability to learn derives not merely from our intelligence as learners, but also from our skill as teachers'. This remark is optimistic, even congratulatory. Such a tone is almost irresistible when contemplating the wide and varied range of skills humans are able to acquire and pass on to others. The doctors with whom I worked did indeed demonstrate impressive practical intelligence in enacting pedagogic strategies for the teaching of stethoscopic listening. The doctor who took responsibility for coaching Nirit also showed admirable personal dedication and patience. But perhaps it could be argued that the medical profession has been unable decisively to overcome the challenges of auscultation and the difficulties presented by the transmission of this kind of auditory knowledge. A consequence may be that, in technologically advanced clinical settings like the cardiothoracic unit at St Thomas', cardiac auscultation will gradually disappear from the daily skill set of doctors and students.

NOTE

The research upon which this paper is based was made possible by an ESRC Ph.D. Studentship. The writing-up was supported by an ESRC Postdoctoral Research Fellowship held at the Department of Sociology, University of Cambridge, and was supervised by Georgina Born. I want to thank Trevor Marchand and Sophie Day for their input at various points in the development of this paper. Thanks also to Dr John Coltart and the students with whom I worked during my Observership at St Thomas' Hospital.

REFERENCES

Ackerman, D. 1990. *A natural history of the senses*. New York: Vintage.

Anderson, C.M.B. & L.S. Whittle 1971. Physiological noise and the missing 6dB. *Acustica* **24**, 261-72.

Babu, A.N. 1999. Death of the stethoscope (available on-line: *http://www.acpinternist.org/archives/1999/03/letters.htm*, accessed 11 January 2010).

Bourdieu, P. 1977. *Outline of a theory of practice* (trans. R. Nice). Cambridge: University Press.

——— 1980. *The logic of practice* (trans. R. Nice). Cambridge: Polity.

Chion, M. 1994. *Audiovision: sound on screen*. New York: University of Columbia Press.

Classen, C. 1998. *The color of angels: cosmology, gender and the aesthetic imagination*. London: Routledge.

Downey, G. 2002. Listening to capoeira: phenomenology, embodiment, and the materiality of music. *Ethnomusicology* **46**, 487-509.

Draper, J. 2002. 'It was a real good show': the ultrasound scan, fathers and the power of visual knowledge. *Sociology of Health and Illness* **24**, 771-95.

Duden, B. 1993. *Disembodying women: perspectives on pregnancy and the unborn*. Cambridge, Mass.: Harvard University Press.

Ellman, M. 1993. *The hunger artists: starving, writing and imprisonment*. London: Virago.

Feld, S. 1990. *Sound and sentiment: birds, weeping, poetics, and song in Kaluli expression*. Philadelphia: University of Pennsylvania Press.

——— 1991. Sound as a symbolic system: the Kaluli drum. In *The varieties of sensory experience: a sourcebook in the anthropology of the senses* (ed.) D. Howes, 79-99. Toronto: University Press.

——— 1996. Waterfalls of song: an acoustemology of place resounding in Bosavi, Papua New Guinea. In *Senses of place* (eds) S. Feld & K.H. Basso, 91-135. Santa Fe: School of American Research Press.

——— 2003. A rainforest acoustemology. In *The auditory culture reader* (eds) M. Bull & L. Back, 223-39. Oxford: Berg.

——— & D. Brenneis 2004. Doing anthropology in sound. *American Ethnologist* **31**, 461-74.

Fernandez, J. 1974. The mission of metaphor in expressive culture. *Current Anthropology* **15**, 119-45.

Foucault, M. 1973. *The birth of the clinic: an archaeology of medical perception* (trans. A.M. Sheridan Smith). New York: Vintage.

Gell, A. 1995. The language of the forest: landscape and phonological iconism in Umeda. In *The anthropology of landscape: perspectives on place and space* (eds) E. Hirsch & M. O'Hanlon, 232-54. Oxford: University Press.

Jackendoff, R. 1992. *Languages of the mind: essays on mental representation*. Cambridge, Mass.: MIT Press.

Kirsch, M. 1998. The death of the stethoscope: murmurs of discontent (available on-line: *http://www.acpinternist.org/archives/1998/12/stetho.htm*, accessed 11 January 2010).

Laennec, R.T.H. 1846. *A treatise on mediate auscultation and on diseases of the lungs and heart* [trans. A member of the Royal College of Physicians]. London: H. Baillière.

Lave, J. & E. Wenger 1991. *Situated learning: legitimate peripheral participation*. Cambridge: University Press.

Lerdahl, F. & R. Jackendoff 1984. An overview of hierarchical structure in Music. *Music Perception* **1**, 229-52.

Longmore, M., I. Wilkinson & E. Torok 2001. *The Oxford handbook of clinical medicine*. Oxford: University Press.

Margolis, J. 1999. Pierre Bourdieu: habitus and the logic of practice. In *Bourdieu: a critical reader* (ed.) R. Shusterman, 64-83. Oxford: Blackwell.

Marks, G. 1972. *The story of the stethoscope*. Folkestone: Bailey Brothers and Swinfen.

Mauss, M. 1979 [1935]. Body techniques. In *Sociology and psychology: essays by Marcel Mauss*, 95-123. London: Routledge & Kegan Paul.

Moore, B.C.J. 2003. *An introduction to the psychology of hearing*. London: Academic Press.

Morgan, L. & R. Chambers 2004. *Enabling disabled doctors: a scoping exercise*. Staffordshire University: Disabled Doctors Action Group.

Murch, W. 1994. Foreword. In *Audiovision: sound on screen*, M. Chion, vii-xxiv. New York: University of Columbia Press.

Rice, T. 2003. Soundselves: an acoustemology of sound and self in the Edinburgh Royal Infirmary. *Anthropology Today* **19**: 4, 4-9.

——— 2008. ' "Beautiful murmurs": stethoscopic listening and acoustic objectification'. *The Senses and Society* **3**, 293-306.

Roy, D.L. 2009. The pediatrician and cardiac auscultation. Unpublished manuscript.

Sacks, O. 1989. *Seeing voices: a journey into the world of the deaf*. Berkeley: University of California Press.

Schaeffer, P. 1967. *Traité des objets musicaux*. Paris: Seuil.

Shindler, D.M. 2004. Hand-held ultrasound and the stethoscope. *US Cardiology* (available on-line: *http://www.touchcardiology.com/articles/hand-held-ultrasound-and-stethoscope*, accessed 11 January 2010).

Sinclair, S. 1997. *Making doctors: an institutional apprenticeship*. Oxford: Berg.

Soderquist, D.R. & J.W. Lindsey 1972. Physiological noise as a masker of low frequencies: the cardiac cycle. *Journal of the Acoustic Society of America* **52**, 1216-20.

Sterne, J. 2003. Medicine's acoustic culture: mediate auscultation, the stethoscope and the autopsy of the living. In *The auditory culture reader* (eds) M. Bull & L. Back, 191-217. Oxford: Berg.

Stoller, P. 1989. *The taste of ethnographic things: the senses in anthropology*. Philadelphia: University of Pennsylvania Press.

Turnbull, C. 1961. *The forest people*. London: The Reprint Society.

Tyler, S. 1984. The vision quest in the West, or what the mind's eye sees. *Journal of Anthropological Research* **40**, 23-40.

Wacquant, L. 2004. *Body and soul: notebooks of an apprentice boxer*. Oxford: University Press.
Warren, R.M. 1982. *Auditory perception: a new synthesis*. New York: Pergamon.
Weiner, J. 1991. *The empty place: poetry, space and being among the Foi of Papua New Guinea*. Bloomington: Indiana University Press.
Welsby, P.D., G. Parry & D. Smith 2003. The stethoscope: some preliminary investigations. *Postgraduate Medical Journal* **79**, 695-8.
Yost, W.A. 1994. *Fundamentals of hearing: an introduction*. San Diego: Academic Press.

Apprendre à écouter : l'auscultation et la transmission du savoir auditif

Résumé

Dans le cadre de leur formation, les étudiants en médecine britanniques sont tenus de se familiariser avec la technique de l'écoute stéthoscopique, ou auscultation. Ils doivent apprendre à manipuler et appliquer le stéthoscope et finissent par apprendre à identifier et interpréter différents sons émis par le corps. Les étudiants n'ont pas l'habitude de la sollicitation et de la concentration de l'attention auditive que nécessite l'auscultation, et les enseignants doivent leur faire prendre conscience de processus sensoriels qui sont habituellement inconscients ou ne peuvent être décrits verbalement. Dans cet article, l'auteur fait un compte-rendu détaillé de l'acquisition du savoir sensoriel, en tentant de se rapprocher de ce que Cohen appelle les « micromécanismes » de la « connaissance incorporée » (dans le présent volume). Pour cela, il attire l'attention sur les particularités sensorielles de l'écoute stéthoscopique, les difficultés de cette forme d'engagement auditif et les stratégies employées par les enseignants pour surmonter celles-ci. Par l'exemple d'un étudiant qui se décrit comme « malentendant », l'auteur montre comment l'hypothèse d'une homogénéité des corps, implicite dans de nombreuses études des connaissances incorporées, occulte la complexité et la spécificité des circonstances individuelles influant sur l'acquisition de compétences perceptives. En conclusion, l'auteur propose l'idée que l'écoute stéthoscopique est « un art en voie d'extinction » et suggère que les difficultés inhérentes à son enseignement et à son apprentissage jouent peut-être un rôle dans ce déclin. Bien que la capacité humaine d'enseigner et d'apprendre soit impressionnante, les systèmes pédagogiques ont parfois du mal à résoudre les difficultés soulevées par certains types d'acquisition de compétences. L'incapacité de surmonter les complexités liées à la transmission du savoir peut certainement être lourde de conséquences pour la persévérance de certaines communautés de pratique.

Tom Rice received his Ph.D. in social anthropology from Goldsmiths and was a postdoctoral Research Fellow at the University of Cambridge. He is currently a Teaching Fellow at the University of Exeter. His research explores the sonic environments of institutions and the types of auditory knowledge used and applied in these settings. He has published articles on 'auditory anthropology' in *Anthropology Today, Critique of Anthropology,* and *The Senses and Society*.

Room 313, Department of Sociology and Philosophy, Amory Building, Rennes Drive, University of Exeter, Exeter EX4 4RJ, UK. contacttomrice@gmail.com