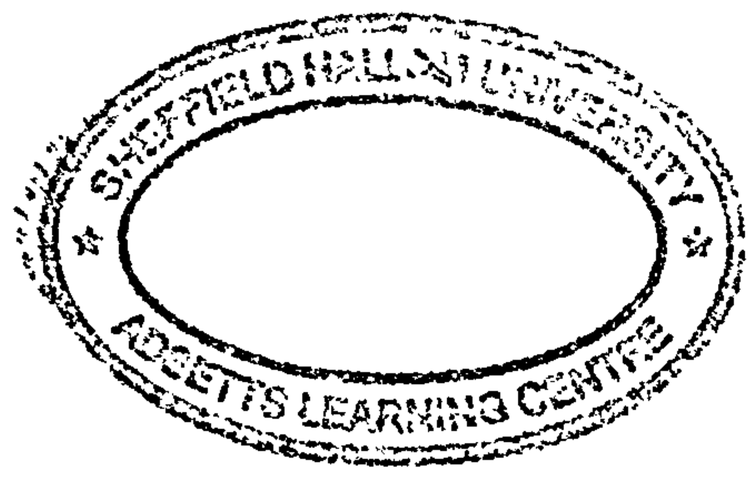
Transmitting craft knowledge:
designing interactive media to support tacit skills learning



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Contents

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Abstract

This research has used a practice-led approach to explore, from the perspective of an interactive media designer, the problem of how to understand and transmit the practical knowledge of skilled craft practitioners. It has involved two practical research projects, each exploring the skills of both expert and novice craft practitioners in the fields of traditional bowl turning and clog making.

In the first project I experimentally used a systems-orientated approach to explore the tacit knowledge within the practice of an experienced traditional bowl turning practitioner. This involved eliciting craft knowledge from the expert, using a low-fidelity prototype learning resource as a means of representing that knowledge, and observing learners applying the knowledge through using the resource to support their learning.

In the second project I undertook a series of video-recordings with a traditional clog maker, during which I developed a less intrusive elicitation technique based on increasingly focussed observation and interviewing. This overcame the defensiveness encountered with the first practitioner with whom I used an elicitation approach based on his descriptions of his practice.

In the light of the outcomes from the practical work, I reconsidered the current context for craft knowledge and developed a framework to understand craft learning. Drawing on three important theorists: Michael Polanyi and his theory of tacit knowledge, John Dewey and his theory of experiential learning, and Donald Schön and his theory of reflection, I reassessed the learning I had previously observed and proposed a new model of how craft knowledge is learned.

I propose that the guidance offered by the expert can be seen as a series of bridges that provide the novice with a means of accessing the personal knowledge of the expert. These bridges are not necessarily *the* way to undertake a task, but *a* way that the expert feels to be helpful at that time. As a novice increasingly learns from the feedback from their own actions, they can progress their skill by moving through different modes of reflection.

This research makes three specific contributions to knowledge. In the field of multimedia design it establishes a methodology for transmitting craft knowledge, refining principles previously published through my MA research, and it establishes techniques for eliciting craft knowledge which are interwoven with the process of developing the transmission resource. In the field of learning and pedagogy it establishes a framework for understanding craft skills learning drawing on recognised theory and validated through appraisal of the practical work undertaken.

1 Introduction

"... as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns - the ones we don't know we don't know[1] ..."

Donald Rumsfeld, former US Secretary of Defense.

Figure 1: Timber framed building joint.

The central problem for this research is, from the perspective of a designer of interactive media, how to understand and transmit the expert knowledge of skilled craftspeople, with particular interest in craft skills that may be disappearing even though there are people interested in preserving those skills and learning them. For example, many traditional rural skills are essential for preserving our heritage of buildings and other aspects of rural life, but there are few people left to pass on the knowledge and learners do not have the time for traditional apprenticeships (Heritage Lottery Fund 2002). My main aim is to develop a body of knowledge to assist with the development of interactive learning materials that support learning of craft skills.

From the late eleventh to the early nineteenth century, craft guilds maintained quality in the crafts by ensuring an appropriate level of skill was acquired before individuals entered into professional practice (Epstein 1998). During this period craft training was commonly a three stage process: starting with apprenticeship to an established master, followed by a journeyman phase where they would travel away from where they had trained to gain employment on a day rate with a variety of other master craftsmen undertaking more skilled work, before finally becoming masters in

[1] I would also propose that there are unknown knowns, things we don't know we know, commonly called tacit knowledge and one of the main areas of investigation in this research.

their own right. This ensured that new practitioners gained a breadth of knowledge before becoming master craftsmen and helped distribute the knowledge they had acquired to other practitioners (Epstein 2004).

The situation nowadays is very different with few traditional trade apprenticeships remaining, a decline partly due to the increase in manufacturing and partly to imports of cheap, hand crafted items from countries with low labour costs. Whilst a recent Construction Industry Council (2004) survey found 80% of construction firms experienced skills problems within their existing workforce and 65% experienced significant difficulties in recruiting staff with appropriate sets of skills, a Countryside Agency (2004) survey reported a sustained *revival* of rural crafts since 1980. New markets had been found away from the declining agricultural and traditional rural communities and instead "they service the lifestyle needs of green consumers, craft enthusiasts and the new genus of country dweller".

Figure 2: Timber framing course, Derbyshire 2006.

The report estimated that 50-60% of this workforce were part-time and seasonal workers or "serious hobbyists" and these new recruits were typically 23-40 years old, from urban, middle-class backgrounds, with a wide range of former occupations, frequently not related to their chosen craft. The training currently available was considered inadequate to suit the needs of such people, with the added complication that the sector was dominated by the self-

employed and micro-businesses employing fewer than 5 workers who were not well suited to current government-funded schemes. The Countryside Agency report (ibid p25) concluded:

> *"Key among these [problem areas that need addressing] is the potential loss of some crafts altogether within a generation. These failing crafts should be identified and steps taken urgently to record them for posterity. Another key problem is the lack of appropriate training for the crafts sector. New initiatives, and new ways of delivering training, are vitally needed if rural crafts are to realise their full potential or, indeed, to survive. This calls for investment, commitment and, most of all, imagination."*

My interest in rural craft skills dates to around fifteen years ago when I was doing administrative work for the National Trust at a medieval hunting forest where my husband, Robin, was employed as a forester. In its prime, the trees on this property had been carefully managed and, as well as providing cover for the animals that were hunted there, they would have provided fodder for domestic animals, firewood and large quantities of timber for a range of different craftsmen. In seeking to raise funds to restore this woodland we started to look for markets for its produce, only to find that sawmills were not interested in our knobbly, bendy timber and local furniture makers wanted neatly sawn, kiln dried planks. Even the 'National Trust kitchen' advertised in their magazine was made from Canadian maple.

Figure 3: Ancient pollard oak tree.

Over time, however, we did find a few craft practitioners who were interested in the timber, many of whom were the first of the new wave of rural craft practitioners described in the Countryside Agency report, above. This was the origin of Robin's fascination with the lost craft of pole-lathe bowl turning, a skill which he reconstructed through trial and error after examining in a museum the tools and produce of the last practitioner who died in 1958. This hobby soon became his full-time profession and examination of his craft skills form the first part of the practical work undertaken in this research (see Chapter 3, p26).

My increasing awareness that there were many other such traditional craft skills that were in decline provided the impetus for my MA research (Wood 2003). This project began with the idea of

creating a multimedia archive of traditional craft skills and developed into an inquiry into the design of interactive media to support the learning of craft skills.

Figure 4: Traditional basket maker Owen Jones teaching.

To gain insight into learning in a craft context, I observed courses run by two traditional craft practitioners who were also experienced teachers: a basket maker (see Figure 4) and a baker. Both ran regular two or three day courses providing an introduction to their crafts mostly for recreational rather than professional purposes. Relating these observations to previous research I had undertaken into learning theories lead me to conclude that the teaching methods utilised on the bread making course and the early part of the basket making course provided a suitable model from which learners could acquire the tacit element of a craft skill.

A review of literature in the fields of surgical skills training and educational psychology identified further elements that could be seen in the craft learning and could be added to the structure of the learning resource (see Figure 25, p44). The learners firstly need an introductory phase that was passive and observational, where they gained an overview of the complete task with any common key skills and strategies. Next they required a guidance phase that was active and participative, where they undertook the task as a series of critical steps with associated common errors. Finally, and most importantly for the tacit element of the skill, the learners must address the development phase where they master the skill through repetition. To enable the learners to achieve this they needed the facility to evaluate their outcome, identify and solve any problems, and the encouragement to repeat the task.

This theoretical framework was then used to construct a prototype multimedia resource for the making of slide whistles which was evaluated and progressively developed with a variety of learners. In addition to observing the learners, questionnaires were used to evaluate the learners' levels of skill and to provide structured feedback on their learning experience. I concluded that the model developed through the observation of craft teaching produced an effective framework for the construction of a simple multimedia

learning resource.

The research described in this thesis is a continuation of the investigation, focussed on refining the learning resource framework and developing techniques for eliciting craft knowledge. It is based on the proposition that computer-based interactive learning materials are well suited to support such learners, allowing them to develop their skills at their own pace and in a style to suit their own craft practice. Such learning materials could both help continuation of traditional craft skills and also stimulate their use in new creative practice of contemporary craft practitioners.

Summary of contents:

In Chapter 2, I describe the methodology I have developed through this research which has been led by my design practice. I show that the process I have undertaken can be viewed as a series of experiments in which I have simultaneously framed and resolved the research problem in an exploratory manner. I also explain my use of systematic video recording of the work with craft practitioners and writing of event logs as a means of stimulating immediate reflection and facilitating ongoing use of the material.

In Chapter 3, I describe my first practical project in which I used a systems-based approach as a 'frame experiment' for exploring the tacit knowledge within the practice of a craftsman who turned bowls on a foot-powered lathe. Whilst this approach was quite challenging for participants, it was made possible by working with a group of close associates and resulted in the production of material suitable for assisting learners in this field of practice.

In Chapter 4, I describe my second practical project in which I undertook a series of recordings with a clog maker and his apprentice using a less-intrusive, observation based experimental approach to elicitation. The constraint of being unable to validate with learners the knowledge I elicited led me to undertake a further investigation into an area of the elicited knowledge where I felt some uncertainty about assumptions made by the craft master. Tracing the possible origins of the practitioner's beliefs and my

own led me to a greater understanding of the personal nature of such knowledge, highlighting the importance of the modes of interpretation used in the learning resource.

In Chapter 5, I describe the decline and revival of clog making skills and use this as a basis for a review of theory relating to the learning of craft skills. I reassess the observations of the bowl turning learners described in Chapter 3 in the light of this theory and explain my subsequent development of a framework for understanding how craft skills are learned.

This research makes contributions to knowledge in the fields of multimedia design, learning and pedagogy, and the specific fields of craft practice investigated. In the field of multimedia design it establishes a methodology for transmitting craft knowledge, refining principles previously developed in my MA research. It also establishes techniques for eliciting craft knowledge which are interwoven with the process of developing the transmission resource. In the field of learning and pedagogy, it establishes a framework for understanding how craft skills are learned drawing on the theories of Dewey, Polanyi and Schön and validated through reappraisal of the practical work. In addition it establishes specific knowledge and resources to support learning in traditional bowl turning and clog making.

2 Methodology

"Voltaire said 'Theology is to religion what poison is to food', and there are many who would draw the same parallel between methodology and design."
Nigel Cross *Developments in Design Methodology* 1984

2.1 Introduction

Figure 5: Working with a craft practitioner (top) and with a learner (bottom).

Over the last three years I have become increasingly aware of the similarities between my own practice as a designer and that of the craft practitioners I have been studying. Through working with them to find ways to help them communicate their practice, I have become more aware of my own practice and my own difficulties in communicating it to others. Much as they have had a tendency to resist description of their methods in fear of it over-simplifying their hard-earned skills so I too feel the urge to preserve the "culture of mystique in the creative design activity" (Swann 2002). However, through teasing out an understanding of the knowledge of these crafts practitioners, I have come to a greater understanding of my own craft of designing.

This chapter firstly provides an overview of the methodological approach adopted in this research and its implications for related research in the future. It also provides an overview of some specific research methods used, showing their derivation from my MA research project and their development through practice during the main body of this PhD research. Fundamental to my methodology is practice-led design research and, whilst this process might be viewed as action research, I propose that it has some essential differences due to the dual role played by myself as designer-researcher. Polanyi's theory of indwelling (1966) is used to explain the working of this dual role and how my choice of participants with whom I had a close relationship

facilitated exploratory empathic indwelling. I propose a development to this which will form the basis of my post-doctoral research: working with an 'expert learner' to facilitate communication of craft practice.

I conclude the chapter by describing some practical techniques I have developed for documenting the research. I show how the combination of 'always on' observational video recording and subsequent writing of event logs has provided an accurate and accessible record of the process I have undertaken.

2.2 Methodological overview

2.2.1 Design research

Methodologically, the practice-led design research I have undertaken has much in common with action research, but for the latter there exist a range of definitions many of which are fundamentally different from my research. The definition provided by Archer (1995) has some accord: "systematic enquiry conducted through the medium of practical action, calculated to devise or test new, or newly imported, information, ideas, forms, procedures and to generate communicable knowledge." However, many protagonists' theories are more firmly based on the original concept developed by Kurt Lewin in the 1950s centred on an 'action research spiral' involving cycles of planning, action and fact-finding about the results of the action (Smith 2001). Whilst these elements are clearly identifiable in the research I have undertaken, they have not occurred as a sequence of separate and logically undertaken steps, rather the boundaries have been blurred and at times elements have been undertaken simultaneously.

Henrik Gedenryd in his study of cognition questioned the validity of such linear or looping models. He surveyed a wide range of design methodologies and concluded they universally followed the sort of linear or iterative pattern portrayed by action research, he referred to them as rational action models and showed them to involve distinct phases of analysis, synthesis and evaluation (1998 p57). However, he also reviewed literature relating to a wide range of design practices and concluded there was no clear division between analysis and synthesis, the two being part of the same activity, and the designer, rather than following a linear or cyclical process, would follow a meandering path including many dead-ends before arriving at his final conclusion (ibid p62).

Rittel & Webber (1984) called the type of problems faced by the designer wicked problems: "they defy efforts to delineate their boundaries and to identify their causes, and thus to expose their problematic nature." In such a situation defining the problem presents as much of a challenge as finding a solution and the designer's response is to work on both simultaneously in "an argumentative

process in the course of which an image of the problem and of the solution emerges gradually among the participants, as a product of incessant judgement, subjected to critical argument." (ibid p138). Gedenryd (1998 p76) described this as a pragmatic theory of design based on the designer choosing his own boundaries: artificial constraints which allowed the designer to control and examine the problem but, being self-imposed, were completely flexible. Schön (1983 p63) referred to this as performing 'frame experiments' and described how through close coupling of problem setting and problem solving the designer was able to simultaneously use and test their knowledge.

Considered in the light of Polanyi's theory of tacit knowing, this use-test duality (Gedenryd 1998 p91) could be seen as a kind of indwelling: "we are attending from the theory to things seen in its light and are aware of the theory, while thus using it, in terms of the spectacle that it serves to explain" (Polanyi 1966 p17). Performing such an action relies on the tacit knowing of the designer, where the underlying theory is only known through the act of using it. In terms of practice-led research this could be seen as problematic as such interiorised knowledge is recognised as difficult to articulate and the very act of attending to such interiorised knowledge can destroy its meaning, resulting in difficulties recording and communicating the research. However, Polanyi proposed that whilst the initial process of attending to it can often be destructive, subsequent re-interiorisation can bring about deeper understanding, "the detailing of particulars which by itself would destroy meaning serves as a guide to their subsequent integration and thus establishes a more secure and more accurate meaning of them" (ibid p19). The requirements for a doctoral thesis to document and communicate the research process have ensured that throughout the research my interiorised knowledge has been 'broken open' for inspection and subsequently re-interiorised[2].

So, whilst the elements of planning, acting, observing and reflecting described by protagonists of action research have all at times been

[2] At the end of this chapter (p21) I discuss key research methods developed to document the process and facilitate the breaking open of this interiorised knowledge.

present, the process I have undertaken has been far from linear or iterative, but rather one of varying degrees. At times 'practice' has been more dominant and at times 'research' has been more dominant but at all times I have been both practitioner and researcher and this dual role has been achieved through indwelling. The difference between the two types of research is represented in the diagrams below, with action research on the left and practice-led design research on the right:

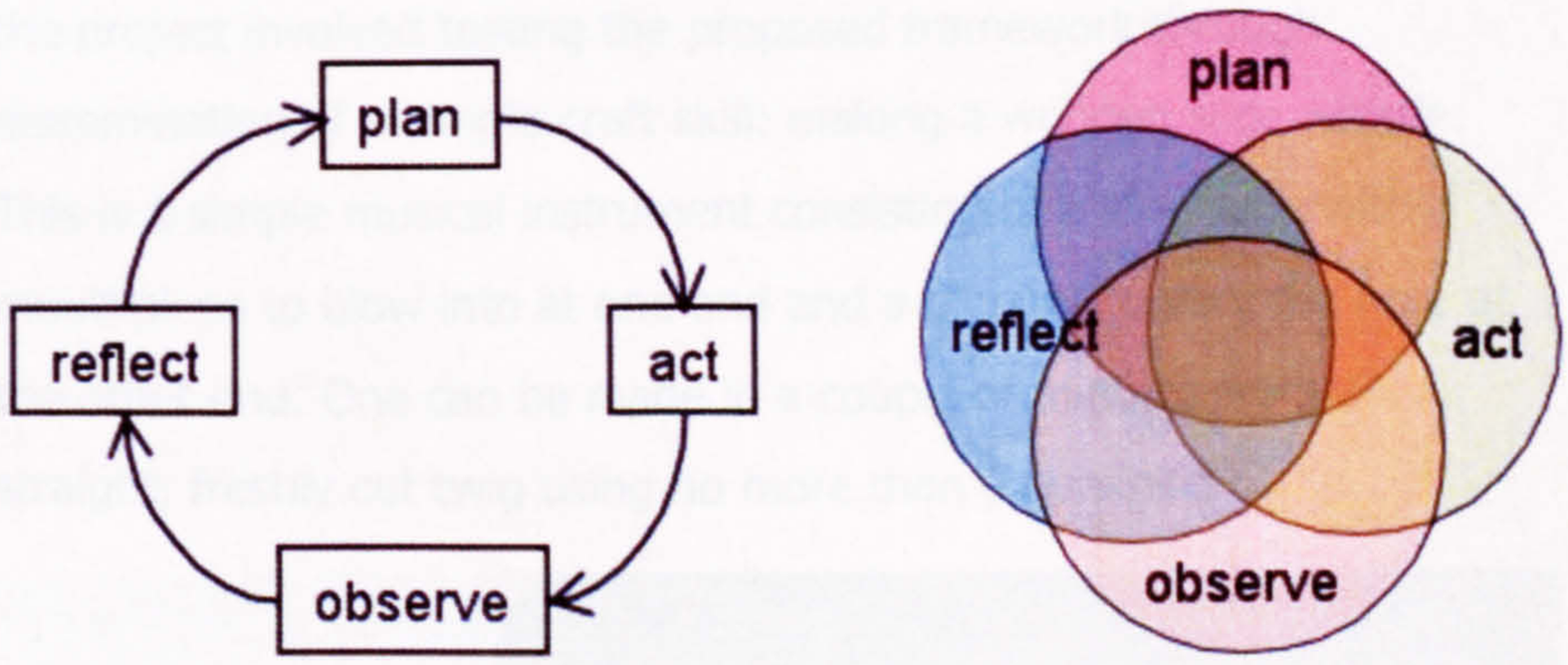


Figure 6: Action research (left) and practice-led research (right).

2.2.2 The designer-researcher

To advance understanding of the dual designer-researcher role, I reflect here on its origins in the part of my MA research that provided a test-bed for the methods used in this research. I shall describe how basing a learning resource on my own learning quickly provided seemingly accurate interpretation of the skill, but also provided complications during testing as I was both expert and designer-researcher. As a result during this research I chose not to learn the skills I studied, but selected experts and novices from close associates to facilitate the shift in indwelling this necessitated.

In explanation of this there is a need to differentiate between two kinds of indwelling described by Polanyi (1966 p30). Whilst he did not name them individually, for clarity I will refer to them as personal and empathic indwelling. Personal indwelling is the most commonly recognised kind, consisting of dwelling in one's own practice, in Polanyi's words, "the performer co-ordinates his moves by dwelling in them as parts of his body". Empathic indwelling is dwelling in someone else's practice with a view to developing one's own practice: "the watcher tries to correlate these moves by interiorising them". Polanyi

illustrates the point by describing how a chess player will re-enact a master's game to gain a feeling for the skill. So, by not learning the skills studied, the focus of indwelling in this research moved from the personal indwelling seen in my MA research to empathic indwelling and thus clarified my role as designer-researcher as described below.

Firstly, I shall provide a brief overview of my MA research (Wood 2003) in which I developed a framework for structuring an interactive resource to support learning of craft skills[3]. The final, practical part of the project involved testing the proposed framework through dissemination of a simple craft skill: making a wooden slide whistle. This is a simple musical instrument consisting of a long tube with a mouthpiece to blow into at one end and a plunger to vary the note at the other end. One can be made in a couple of minutes from a straight, freshly cut twig using no more than a penknife.

Figure 7: A wooden 'slide' whistle.

I initially learned the skill by working alongside an expert who demonstrated the making process and explained his understanding of the issues involved before giving advice as I went through the making process several times myself. I then gained a greater understanding of the skill by working on my own making many more whistles, problem solving through trial-and-error. I concluded this phase by experimenting with deliberately modifying whistles in a variety of ways to discover why some whistled better than others and how they could be altered for the better. Throughout this process I made a detailed record by making notes and photographing my work using a digital camera.

To interpret this in the light of Polanyi's theories, the process started with a period of empathic indwelling whilst working with the expert but this was relatively brief in comparison to the subsequent period of

[3] This framework was also used in the current research, see p43.

Figure 8: Sample from the interactive whistle making resource.

personal indwelling whilst I repeated the making on my own, internalising the skills. The final phase saw the internalised skills being 'broken open' through the exploratory phase of making and destroying, and the recording of the process.

These records formed the basis of a paper-based prototype learning resource, structured according to the proposed framework I wished to test. A preliminary evaluation was carried out, firstly through discussion with the expert and then by using it as a basis for teaching a novice, which led to some useful modifications. I then had a video taken of myself making a whistle and used this and the photographs taken previously to produce a working, interactive version of the learning resource using Macromedia Director (Figure 8). This was evaluated with other novice learners and concluded with recommendations for future developments of the resource.

Whilst the evaluation of the interactive resource produced a useful outcome for the MA research, in retrospect I was not entirely satisfied with it. My aim had been to test the interactive resource and I had regarded my role as a designer-researcher working with some self-directed learners. However, the learners' aims had been to learn the skill and in this context they perceived my role as that of an expert in that skill. So, on encountering difficulties their natural tendency had been to short-cut by asking myself for help rather than using the resource, which was a predictable and manageable problem and could be overcome by operating the resource on behalf of the learner[4]. However difficulty arose when the learners asked for further assistance with the interpretation and it became difficult to judge whether this was a genuine failure of the learning resource or the learner showing a preference for asking myself because it seemed easier. I found it very difficult not to teach by drawing upon my own expertise as I struggled between my roles as designer-researcher and craft expert.

Basing the research around my own learning had quickly produced seemingly accurate interpretation of the craft skill, but the testing resulted in a complex situation that I found difficult to unpick: it was difficult for me to understand my own actions, let alone those of the

[4] as described by Rettig (1994) in his article describing use of low-fidelity prototypes in software development.

novices I was observing. In addition, to minimise intrusion on the novices with whom I was not well acquainted I had decided to rely on note taking to record the process rather than videoing. At the time, writing up my MA thesis immediately after the event, I could draw as much as I needed from it by using my notes to aid memory, but subsequently it has not been easy to review it in the light of new knowledge. As a result firstly I took the conscious decision not to learn the skills I was studying and secondly to develop a non-intrusive video recording method which is described on p21.

By stepping outside the learning process in this research, I have had to seek to achieve empathic indwelling in the actions of the expert to produce interpretation *without* going through the process of imitating to internalise the skills and then breaking them open. Similarly I have needed to achieve empathic indwelling in the actions of the novices to understand their responses to the learning resource without first being a novice myself. So, for my first experimental project described in Chapter 3, it was appropriate that I worked with a craft practitioner with whom I was closely acquainted: my husband Robin Wood, who had a general understanding of my aims and was prepared to be co-operative with the experimental nature of the research and allow learners and myself open access to himself and his workshop.

Similarly, the novices I worked with were self-selected from close acquaintances of both Robin and myself, which resulted in relatively straightforward communication during the practical sessions. Whilst this was clearly not a random sample, it offered numerous advantages. Firstly they were enthusiastic, having volunteered because they were keen to acquire the skill, and they were easily accessible as they lived locally and had flexible jobs so were in the habit of calling in regularly. In addition they were all around the age, and had taken the sort of lifestyle choices, as the people who are currently turning to the traditional crafts for a career (Heritage Lottery Fund Report 2002)[5]. As they were all known to each other, it would have been interesting to explore the potential social aspect of their learning. Unfortunately time

5 see Introduction p6

6 "Transmitting Craft Knowledge: eliciting and passing on the skills of craft masters with the help of interactive media" AHRC award number AH/D001838/1 awarded 17/5/06.

did not allow it during the scope of this project, but this is planned for my post-doctoral research project[6].

By using a small group of learners for the bowl turning research rather than learning the skill myself I was able to perceive my designer-researcher role with greater clarity and be more confident in my development of the learning resource. Recruiting these participants and the craft practitioner from close acquaintances assisted empathic indwelling during the first tentative, experimental stage of this project. However, this presented shortcomings in terms of being able to apply the methodology to other craft skills as such relationships could not be assumed. So, in the second part of the practical work, recording a clog maker and his apprentice (see Chapter 4), my aim was to refine techniques developed with the bowl turners, this time working with a practitioner and a craft less known to myself.

The observation-based approach adopted with the clog makers was a technique that could be more generally applied, although subsequent appraisal revealed I was relying on my own specialised knowledge in validating the elicited knowledge (see section 4.3, p92). As described below, the presence of the apprentice proved useful in preparing the expert for articulating his knowledge and, whilst in the circumstances I was unable to work directly with him, this indicated a way in which I wish to develop these methods.

2.3 Documenting the research

To manage the dual designer-researcher role it was important to have an accurate recording process that allowed consideration from different perspectives and in the light of new knowledge as it emerged. However, for the research setting to be realistic, the recording process must not distract those under observation from their practice and equally must not require too much attention from myself.

When I reviewed the documentation of practical work undertaken during my MA research, including use of handwritten notes, photography, audio and video recording, I concluded that video recording could most closely meet these requirements through reinforcing the strengths and managing the problems. The major strength of video recording was being able to capture a very rich record, including those events whose significance only became apparent later. However, the "always on" policy led to generation of a large number of tapes that needed to be catalogued and referenced and this was managed through a simple event logging procedure. In future research this could be managed more effectively with video analysis software that was in its infancy at the start of this project.

2.3.1 Observational video

Figure 9: Canon MV5i video camera.

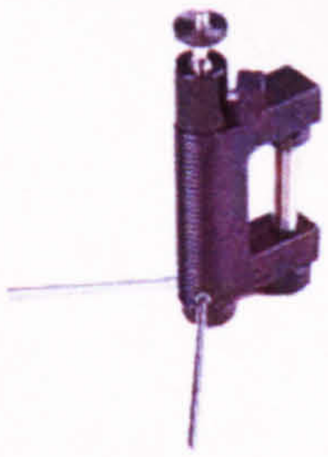


Figure 10: G-clamp mini tripod.

To minimise intrusion on those being observed I used a Canon MV5i digital video camera, chosen for its small size (10cm x 9cm x 5cm), and I avoided using additional lighting or external microphones unless I felt it was absolutely necessary. As observational video for research purposes, the pictures and sound did not need to be transmission quality, just sufficiently good for comprehension and transcription.

I also aimed to minimise my interaction with the camera during the recordings, whenever possible setting up and testing everything before the sessions started, but with experience I developed the ability to quickly assess conditions and set up the equipment with minimal disturbance. I left the camera running at all times, only switching it off when the workshop was empty. I favoured recording from a fixed point, using a wide-angle lens where necessary and a discreet G-clamp

mini tripod if there was a suitable fixing. When this was not an option I used a good quality tripod that would remain stable when being jostled in a busy workshop, could easily be panned to follow the action and offered a quick-release option for hand-held recording. Whilst I always kept a charged battery in the camera to allow freedom of movement during hand-held shots, for fixed-point recording an external power supply was used if available to avoid battery changes. The only unavoidable attention the camera needed was changing the tapes, but at least the timing of this was predictable and the operation could be swiftly undertaken if I kept a spare blank tape in my pocket with the cellophane wrapper already removed.

The bowl turning learners in the first practical project seemed to acclimatise rapidly to the camera's presence and those who I left to work alone would switch the camera off themselves when they went for a break and back on when they returned. The clog makers in the second practical project mostly ignored the camera and would swear loudly, stand right in front of the lens or fall over the tripod in a completely unselfconscious manner. The times when they acknowledged its presence were largely positive: the expert would deliberately come in front of the camera to explain points he considered it was important for me to record or he would ask if I wanted to come closer to get a better picture.

So, this 'minimalist' approach to observational video recording had the benefit of minimising intrusion on the participants, and causing very little distraction to myself. Having developed confidence in my equipment and my ability to set it up, I could immerse myself in the sessions with the secure knowledge that everything would be available for subsequent review.

2.3.2 Event logging

Whilst the 'always on' policy with the camera ensured that nothing was lost, it did generate a large number of tapes that needed systematic processing and cataloguing to enable their ongoing use. After capturing them onto computer to facilitate non-linear access, I wrote event logs for each session. These acted both as a means of promoting

immediate reflection and to provide a summary of dialogue and action to assist with later appraisal.

Firstly I named, dated and numbered each tape as soon as possible after it came out of the camera, then captured them in their entirety onto computer and burned two copies to DVD, one as a working copy and the other as a backup, with the originals forming an ever-growing archive. Initially I compressed them using the standard DVD format (mpeg2), which offers the advantage of including chapter information and indices, but the movie industry demands this encryption prevents stills or short clips being taken from them, so I changed to using QuickTime. For the broader scope of the research, I used both stills and clips from the observational video in the development of the learning resource[7] as well as when disseminating the research to a wider audience. QuickTime enabled fast, easy access to the material without needing to re-capture it from the source tape.

I then watched the DVDs in their entirety and wrote event logs for each[8]. These consisted of simple 2-column tables created in Microsoft Word: one for the time code from the DVD, the other for a description of the event. The descriptions summarised both activities and speech, aiming at a clear and concise narrative of the proceedings rather than a complete record. Whilst this was still a time-consuming process it had two outcomes, the first an immediate review of the session that would inform the next stage of the research, the second was to facilitate subsequent review of the material.

By writing the event logs immediately after the recordings had taken place, I was able to review them from the dual perspective of designer-researcher. They served both as a reminder of events that had taken place and allowed me to observe myself in action. Whilst some of the outcomes were explicit, such as decisions about camera angles or specific lines of questioning, many were tacit and I only became aware of them later, such as the conflicting opinions of the

7 see section 3.3.3 p49

8 sample event logs are provided in Appendix II - references in the text to specific instances in event logs take the form [HS2.3 t0.32]: HS = participant's initials; 2.3 = session 2, tape 3; t0.32 = time code 32 minutes

practitioners on the properties of timber described in section 4.3, p92.

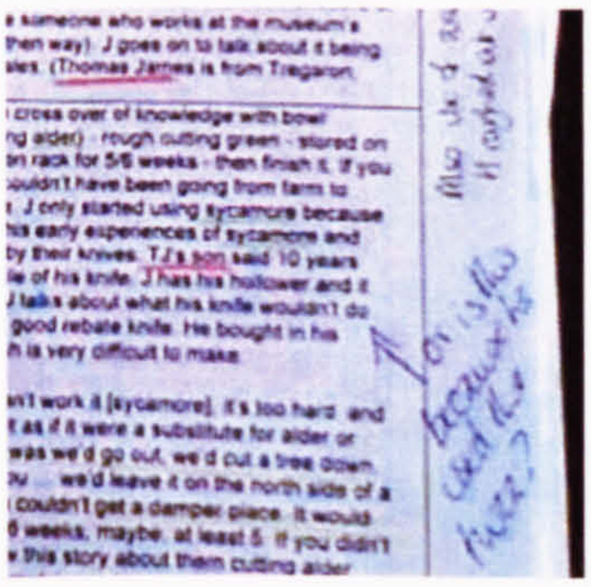


Figure 11: Annotated event log detail.

Hence, the longer-term use of the event logs was as a referencing system to enable review of the material, which amounted to over 36 hours of videotape. The event logs were read as a narrative to refresh my memory of what had happened during each session and, as observed by Suchman and Trigg (1991), they also greatly helped the search for specific remembered occurrences that could then be located on DVD and reviewed again. At this point the logs could be elaborated and dialogue transcribed verbatim to allow deeper consideration. They could be searched for specific key words or highlighted to show specific instances: my paper versions of the event logs are now a dog-eared riot of highlighter pen, multicoloured underlinings and margin notes, and I also have various electronic versions similarly highlighted.

As Buur *et al* (2000) propose, "video recordings ... are no longer hard data but rather the first attempts to create stories that frame the design problem and impose order on the complexity of everyday life" and event logs are a vital part of the recordings, with the act of writing them promoting reflection and the resultant document providing an overview of events.

2.3.3 Future development

At the instigation of this research project I had surveyed the available video analysis software and concluded that there was nothing that offered significant advantage over the QuickTime/Microsoft Word process described above which I had developed during my MA research. Most software focussed on dialogue analysis and did not appear well suited for the heavy emphasis on non-verbal activity inherent in my observational video. Three years later, the use of video recording in research is commonplace and there are several competing brands of software that offer a broader range of analysis tools (e.g. Atlas Ti, Transana). Having had an initial look at these I feel they could speed up the event logging process and the event logs they produce could be easier to examine from different perspectives. A critical examination of such software will form an early part of my post-doctoral research.

2.4 Conclusion

The methodology I have developed during this research has been that of practice-led design research, a pragmatic approach made rigorous through systematic documentation. In the practical work with craft practitioners, I have undertaken several 'frame experiments': seeking to simultaneously frame and solve the problem of recording and interpreting their practice in an exploratory manner. I have documented the work through extensive video recording and used the process of writing event logs both as a means to stimulate immediate reflection and to enable ongoing use of the material.

This has resulted in three specific outcomes which are presented in this thesis. Through the practical work I have firstly developed techniques for transmitting craft knowledge based on the principles previously developed in my MA research. Secondly, I have developed techniques for eliciting craft knowledge which are interwoven with the process of developing the transmission resource. Thirdly, I have developed a framework for understanding the learning of craft skills drawing on established theory and validated through reappraisal of the practical work.

In the following chapters I describe the practical work I have undertaken, firstly with a bowl turner (Chapter 3) and secondly with a clog maker (Chapter 4), showing the development of techniques for eliciting and transmitting craft knowledge. I review this in Chapter 5 in the light of relevant theorists and outline the framework I have developed for understanding the learning of craft skills.

3 Practical work I: bowl turning

"Boys won't learn work like this now," he said. "It's not as easy as it looks and unless you learn when you're a lad you can never catch the knack of it." He uncovered a pile of beautifully turned bowls of all sizes in a corner of the hut ... each bowl had the individuality which only a man's hands can give to an object.

George Lailey, interviewed by H V Morton, *In Search of England* (1930).

3.1 Introduction

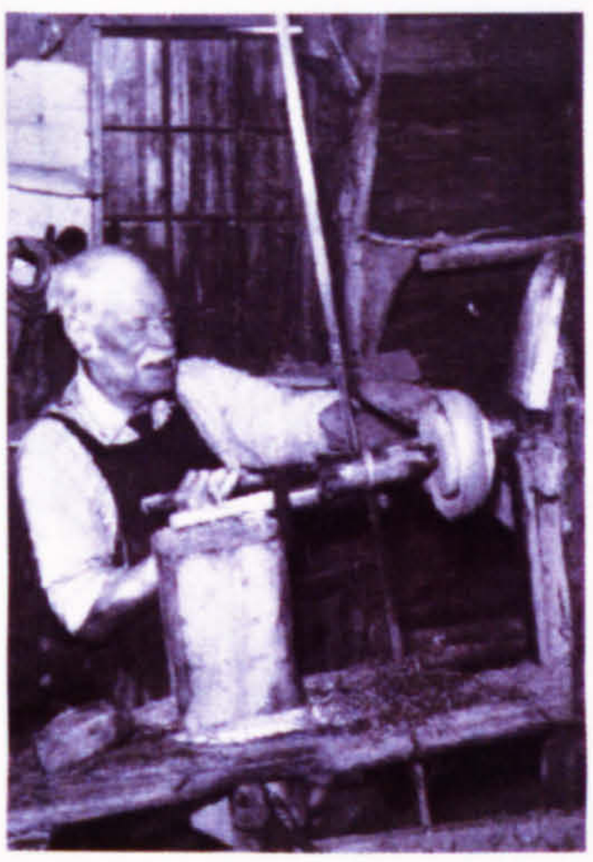


Figure 12: Traditional bowl turner, George Lailey.

The aim of this practical project was to work with an experienced craft practitioner to explore the tacit knowledge within his practice. This involved using a series of video recordings and interviews to promote cycles of reflection and interpretation, allowing the practitioner and designer-researcher to examine techniques and recognise variations. In each cycle of the research a developing prototype learning resource was used as a tool for recording and, with the assistance of a small group of novices, evaluating what had been discovered so far and investigating deeper layers of the problem.

In this chapter I present the findings under three headings: elicitation, representation and application. This is done to reflect my original, systems-orientated approach, which was an iterative process of knowledge elicitation through observation and interviews with an expert, representation through development of a learning resource, and application through testing an exploratory prototype with a group of novices.

During the course of this practical work I increasingly stepped outside these boundaries in response to unfolding events. Whilst primarily unplanned, these judicious interventions show the developing role of designer-researcher as described in the Methodology chapter (see p16). Through the process of video recording and event logging they

were documented and made use of in subsequent appraisal and reflection. Although using these three key concepts as a means of describing the practical work creates some repetition, I feel it provides a clearer picture of the theoretical background to this work than presenting events sequentially.

The systems-orientated approach had its origins mainly in the related fields of cognitive task analysis and knowledge engineering that employ similar methods for accessing 'expert' knowledge, although they can be aimed at different outcomes. Cognitive task analysis is the study of the mental processes that organise and give meaning to observable behaviour and has been developed in the field of cognitive psychology. The aim is to improve performance of a task through understanding and supporting the cognitive activities involved (Potter *et al* 2000) and it is used for a broad range of applications such as developing training resources, assessment criteria or profiling for recruitment purposes, so the outcome is not necessarily computer-based (Militello & Hutton 1998). Knowledge engineering, with its roots in computer science, is specifically focussed on developing computer systems. The development of 'knowledge based' or 'expert' systems has moved on from the rather grandiose aim of creating artificial intelligence and now more simply aims to create machines that are "able to emulate some of the behaviours of a human domain expert" (Diaper 1989 p20).

From this perspective, their main focus is on "the fundamental problem of being able to extract and represent the knowledge of the human domain experts" (Diaper 1989 p11), which is viewed as a bottleneck in the whole process. Whilst the idea that such knowledge could be 'extracted' is alien to me, the methods developed in these disciplines for knowledge elicitation provided a starting point for what I view as stimulating the practitioner to articulate his practical knowledge, as well as promoting reflection both in the practitioner and myself.

A prototype learning resource was used as a means of representing my understanding of the knowledge elicited. This was based on the framework I had developed during my MA research and implicit in this project was a continued test of it. The content was further developed in response to feedback from the novices and informed by literature on

the cognitive processing of graphic representation.

As a means of knowledge application I tested the developing prototype resource with a small group of learners and the account that emerges from this reveals increasing blurring of the boundaries between elicitation, representation and application. It shows the role of the designer-researcher in adapting to circumstances and performing frame experiments to make sense of the problematic situation.

Participants[9]

For this first stage of practical work I recruited a small team of participants from close acquaintances who I considered would be comfortable with the exploratory nature of the research. My aim was to help open up communication between the participants and myself and to make it easier for me to understand their actions through empathic indwelling[10].

Figure 13: Craft practitioner, Robin Wood.

Figure 14: Bowls turned by Robin Wood.

The practitioner whose skills formed the main focus of this project was my husband, Robin Wood who is a full-time professional craftsman turning wooden bowls on a foot-powered pole lathe. He had regular experience of demonstrating his craft to the public and being interviewed by journalists so was comfortable with being filmed and questioned as part of the research. However, he was entirely self-taught and his experience of teaching others was very limited, so communicating his practical skills in a way that would be of assistance to someone wanting to learn them was new to him.

His craft gave a discrete problem to examine because, although the whole process from selection of timber to drying and finishing the bowls is time-consuming and complex, it is possible to learn the turning skills in isolation. Whilst the process is short, the hand-forged hook tools offer sufficient complexity; describing how the curved edge of a tool meets the curved surface of a bowl is not easy, and subtle movements of the tool can greatly affect the cut.

9 I shall largely refer to the participants in this research by their first names as it makes easier reading, particularly in avoiding confusion between 'Wood' the practitioner and 'wood' the material he works with.

10 empathic indwelling is discussed in section 2.2.2, p16

The four bowl turning learners were self-selected friends of both Robin and myself. In addition to helping promote empathic indwelling, this also meant Robin was at ease with them in his workshop and was comfortable with teaching the learners directly when requested.

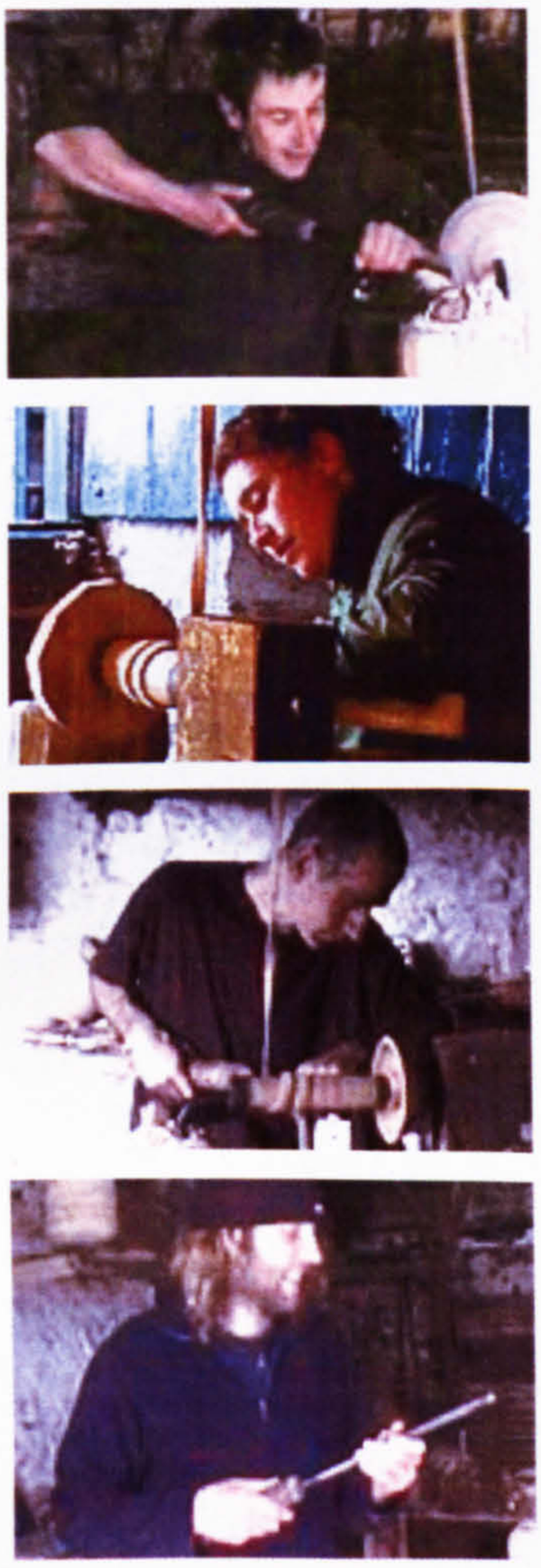


Figure 15: Bowl turning learners (from top) Giles, Helen, Mick & Andy.

Giles [GB] had learned general wood working skills from helping Robin to make outdoor furniture, but had no prior experience of turning. He had volunteered to participate primarily because he was keen to learn how to turn, but he was also interested in the research having undertaken some filming on an earlier project.

Helen [HS] had no prior experience of woodturning but had previously learned the basics of throwing pottery by working for a few days alongside an experienced potter then experimenting on her own. A major issue which I did not discover until we were in the workshop was that Helen was left-handed and it was not possible to adjust the lathe to enable her to hold the tool that way around. She said she was happy to try turning right handed as she had learned to throw pots right-handed[11].

Mick [MK] had experience of turning about fifteen years ago using a treadle lathe on which the turner provides the power in the same way as a pole lathe. However, the treadle is attached to a fly-wheel which gives the work continuous rotation whereas with a pole lathe the work turns back and forth and the turner only cuts when depressing the treadle. Whilst his job and hobbies involve little manual work, he is a keen runner and cyclist so is physically fit.

Andy [AB] had some experience of using a pole lathe but using a spindle turning technique that involves different tools and techniques to bowl turning. He is both physically fit and strong as he works for the local National Park footpath maintenance team.

[11] Robin has studied many hundred Medieval and more recent bowls turned on such a lathe and has not found one that he feels could have been turned left-handed.

Workshop procedure

Figure 16: Robin Wood's house (foreground) and workshop (background).

Figure 17: Video camera on the workshop door.

Robin's workshop is just next door to our house, so I had the opportunity to experiment with using the recording equipment in different conditions, and to set it up to my satisfaction before starting filming each time. The initial observational videos of Robin turning were hand held so I could easily move to capture the action without constraint. I framed shots using the camera's external LCD screen so it could be held relatively unobtrusively at a lower level, rather than in front of my face using the viewfinder.

The sessions with learners were video recorded in their entirety then event logs written to promote immediate reflection and provide a catalogue for future use (see section 2.3.2, p22 for a full discussion). To enable my attention to be focussed on participating, I filmed from a fixed point, attaching the camera to the workshop door with a g-clamp mini tripod, and used a wide-angle lens so most of the workshop was in view. This also enabled the camera to be plugged into an external power supply so I had no concerns about changing batteries. Other than changing the tape every 90 minutes the camera needed no further attention.

After reviewing footage of the first learning session with Giles I had to make several changes to the recording set-up. Firstly, I had used the camera's internal microphone, but found this suffered from wind noise, as the front of the workshop was open to the elements. As there was not an alternative position for the camera that would capture all the action, for subsequent recordings I successfully used an external microphone taped in a sheltered place on the doorjamb.

Secondly, the only light in the workshop came from the open doors, so I initially provided additional lighting with a spotlight that both increased my set-up time and during filming was intrusive from some positions in the workshop. However I could not see a significant improvement in the video quality over the initial observational videos of Robin that were unlit, so did not use additional lighting for subsequent recordings.

Finally, to give access to the learning resource video in the workshop, I had initially placed my laptop on a bench opposite the lathe in full view

of the camera. However, as soon as Giles started turning it became apparent in this position it would get sprayed by wood shavings so I moved it, unfortunately virtually out of the camera's view. Thereafter, I made room for it on the shelf behind the lathe which, whilst not at such a good camera angle, was both safe from the shavings and in a better position for the learners to access it.

Once these issues were overcome I felt able to participate fully with limited intrusion from or interruption by the recording process. The learners rapidly acclimatised to the presence of the camera and showed no sign of self-consciousness in front of it. When at times I left them to work alone in the workshop they readily agreed to manage the camera themselves, switching it off if they left the workshop for a break and back on when they returned.

After each session I processed and reviewed all the tapes, creating event logs both to stimulate immediate reflection and as a catalogue for future access to the recordings.

3.2 Elicitation

3.2.1 Introduction

In this section I describe my initial work with bowl turning practitioner Robin Wood, starting with a review of the formal knowledge elicitation techniques used in such fields as cognitive science and knowledge engineering. I then relate my experiments with several techniques based on the practitioner describing his actions in an attempt to elicit material for the learning resource. The resultant knowledge I felt was too advanced for an absolute beginner, so I used an observation-based technique to form the first tentative prototype learning resource.

Whilst these purposeful interviews and observations provided much useful material, they produced only part of the elicited knowledge. More was revealed through subsequent work with the novices and this is related in the Application section (p59).

3.2.2 Context

The first stage of the practical work aimed to gather sufficient basic knowledge to produce a paper-based prototype of a learning resource. As I was seeking to explore skills that the practitioner would find difficult to articulate, I was looking for specific methods to stimulate that articulation and help the practitioner and myself to reflect on his practice. Cordingley (1989), Cooke (1994) and Edwards (2003) provided overviews of knowledge elicitation techniques from a wide range of fields including psychology, business management, cognitive science and knowledge engineering. Each used different systems of classification to group the vast array of techniques, but those relevant to this research described here fell into three groups: verbal reports, observations and interviews.

Verbal reports aim to access the cognitive processes behind actions and can be carried out either on-line, with the reporter talking as they work, or off-line where the reporter comments retrospectively on their performance, often prompted by an audio or video recording (Cooke 1994). Positive aspects are that the reporter steers the process (Edwards 2003) and that it can be carried out concurrently with the

task being studied, although this in its own right might impair performance (Cooke 1994). However there are many limitations to the processes such as being reliant on how articulate the reporter is (Cordingley 1989), that the reporter might not talk about what seems obvious to them or they might alter their performance because they are aware they will have to describe it (Cooke 1994).

Observation is identified as a powerful tool, particularly in gaining an initial overview of the area of study (Cooke 1994). At one end of the spectrum, with a high level of elicitor involvement, is active participation where the person eliciting the knowledge plays an active role in the practice they are observing, which is deemed useful for gaining insight into social practice, but the results can be difficult to interpret. At the other end of the spectrum, observation can be arranged to have minimal interference with the practice, although the elicitor must remain aware that their very presence might affect the practitioner (Cordingley 1989).

Interviews, whilst being some of the most commonly used methods, have the disadvantage that they are usually retrospective, and reliant on the interviewees' recall of the situation. At the unstructured end of the spectrum they can be useful for establishing rapport and providing a broad view of the domain, although they can "produce copious, unwieldy data" (Cooke 2004). Structured interviews, being more systematic can provide more manageable data, but require a greater knowledge of the domain so can be very time-consuming to prepare (Edwards 2003).

Had I not already been so familiar with the craft, I would have planned to start with an initial period of observation to give myself an overview before starting more formal elicitation. As it was, I decided to go straight into a comparison between on-line and off-line verbal reportage as a stimulus to reflection and then use issues arising from the reportage as a basis for semi-structured interviews with the aim of being able to probe more deeply into the practitioner's practical knowledge. This elicitation yielded what I felt was quite advanced knowledge for a learner and I needed to return to detailed observation to see it anew before being able to make the first tentative representation of the knowledge.

3.2.3 Practical work

Over a period of three weeks I experimented with three different elicitation methods with Robin Wood, each of which was concluded with a semi-structured interview.

Firstly, during the course of a day I undertook two experiments with verbal reportage aimed at providing a comparison between on-line and off-line verbal reportage (Cooke 1994). The task of turning a bowl naturally divided into two parts, shaping the outside and hollowing the inside, involving what the practitioner Robin Wood considered to be related but slightly different skills. So, firstly we used an off-line reportage technique, stimulated recall, concentrating on shaping the outside of the bowl, and then an on-line one, concurrent verbalisation, concentrating on hollowing the inside. Issues arising from each reportage session were used as a basis for semi-structured interviews held immediately afterwards with a view to probing more deeply into the practitioner's practical knowledge.

Whilst the reportage and interviews provided insight into the areas of the practitioner's skill he could easily articulate, I felt the overall focus was probably pitched too high for a complete novice. As background research to the skills needed by a beginner, I filmed the practitioner's normal practice, turning complete bowls from start to finish, over several consecutive days. After consideration of the differences and similarities in these recordings, I used another semi-structured interview to gain direct feedback from the practitioner regarding the initial content to be used in the resultant prototype learning resource.

The work presented here was by no means the end of the elicitation process, but the only discreet part that could be represented as such. The remainder is described in the Application section (see p59) where the boundaries broke down and designer-researcher, practitioner and novice became involved in the process.

3.2.3.1 Stimulated recall

The first part of the task, shaping the outside of the bowl, was examined using an off-line technique, stimulated recall, where the

Figure 18: Still from the 'stimulated recall' video.

practitioner was filmed undertaking his normal practice. Immediately afterwards he reviewed the recording and commented on his performance, and this too was filmed to provide a record of what was said. A semi-structured interview was then conducted, based on issues raised during the elicitation.

I videoed Robin turning the outside of a bowl at his normal production speed with no discussion or comment, which took just over five minutes. Immediately afterwards I transferred the video to a computer so it could be easily reviewed in a non-linear manner without having to spool through the tape. Robin and I then watched this recording together and discussed our observations, which in its own right was videoed to allow later appraisal.

The initial discussion lasted just over twelve minutes, during which time Robin talked in reasonable depth about what he could see happening, but had a tendency to be defensive or dismissive when I asked questions. For example, after the first two minutes I asked if he was still using the same tool that he started with, feeling fairly sure he had changed tools. He dismissed the suggestion and continued with his interpretation. Concerned that he was totally absorbed with trying to keep his pace of interpretation up to the speed of the video, I used the excuse that I could not see the screen clearly to ask him to pause and review the video again. He then suggested that he paused the video when he spoke and we resumed watching the video on this basis. After a further five and a half minutes he independently realised he *had* changed tool and we searched back in the video for when he did so, although at this point he was not very forthcoming as to why.

However, removing the pressure of trying to keep pace with the video did not help with my questioning and attempts to probe deeper were still largely unsuccessful. For example, in the observational video Robin could be seen regularly stopping turning to inspect the surface of the wood and as he did so he always ran his fingertips over the surface too. On four occasions I suggested that the sense of touch played a part in this inspection, but he constantly denied or avoided the issue:

01.02 NW: *You can just see those bumps or can you feel them?*
RW: *You can tell when they've gone because of the noise it makes.*

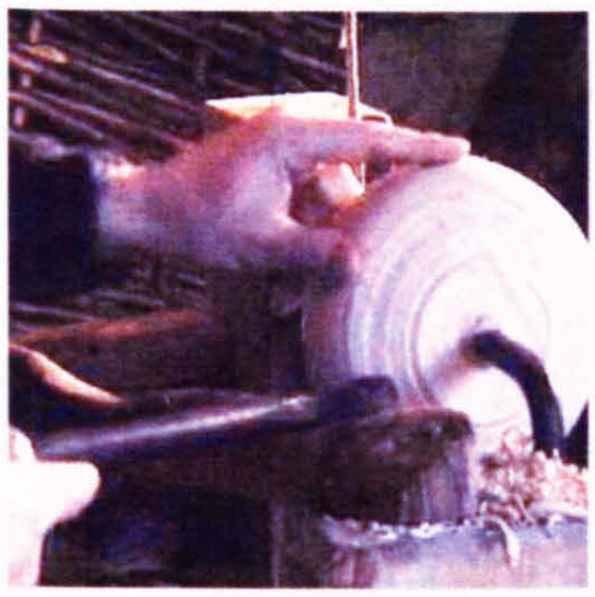


Figure 19: The practitioner "pointing" at the wood.

01.15 NW: *That's what you're feeling with your hand?*

RW: *I was seeing them.*

NW: *Seeing them?*

RW: *Yes I turned it slowly round and I could see them ... and I could see how deep they are so I can see how much to take off in this cut here.*

01.27 NW: *You're also stroking it aren't you?*

RW: *Yes ... a little bit ... yes ... I'm pointing there at ... um ... I'm pointing there at where it needs to be cut off* (see Figure 19).

11.21 NW: *And there you're checking it ... is that visual or feel or both?*

RW: *It's mostly visual: you can see the tear out and I'm making an aesthetic decision on what quantity is OK.*

Robin Wood interview 7.1.04 [event log RW1 clip2]

My feelings about this observation were confirmed about a year later when I was asked if I could contribute material showing craft makers using their sense of touch for an exhibition at the V&A called "Touch me: design and sensation" (V&A 2005). In this context I asked Robin again about his use of his sense of touch and suggested to him he might provide one of his bowls to go with some of the research footage for the exhibition. He then talked quite openly about using his sense of touch to differentiate between the tear-out on the surface of the wood that needed to be removed and natural dark markings in the grain wood, which did not.

To overcome the barrier encountered during the initial interview and instigate a more open discussion I switched off the video camera recording our conversation, diverted attention away from the computer with the observational video and asked more open questions. Once Robin was into the flow of the discussion I found I could ask if he would mind recapping for the camera. He would then comfortably review and elaborate on the discussion, using the video on the computer and bowls he had previously made to illustrate his points.

The result of this session was that I gained a good overview of the part of Robin's skill that he could easily verbalise. This was fairly advanced use of tools and associated techniques: the use of different cuts (roughing, shaping, finishing), the basic feedback he was responding to (sound and sight), and some discussion of his aesthetic judgements.

3.2.3.2 Concurrent verbalisation

The second part of the task was examined using an on-line technique, concurrent verbalisation, where the practitioner was filmed giving a verbal report as he was carrying out his normal practice. Whilst research has identified that the additional cognitive load experienced by practitioners having to talk as they work can impair their performance (Cooke 1994), Robin felt this effect would be minimal as he was familiar with answering questions whilst demonstrating to the public and he was working on a standard bowl using familiar techniques. The issues raised by this elicitation were also used as the basis of a semi-structured interview.

Turning the inside of the bowl took just over nine minutes during which I decided to just listen and not pose questions to avoid the negativity generated in the previous session. Robin talked quite fluently, pausing frequently to re-cap what he had just done and explain what would happen next, rather than talking as he worked. The focus of the dialogue was the advanced use of tools and basic aesthetics, very similar in content to the stimulated recall session where Robin was explaining what he could easily verbalise.

To conclude this session, I again put this video footage onto the computer and we watched it together, video recording the discussion for subsequent appraisal. I was now able to undertake deeper questioning without triggering the defensiveness encountered during the early stage of the previous session.

For example, when asked in the first stimulated recall session why he changed tool at a particular point, the practitioner's initial response was that simply the other tool was sharper. When prompted for more detail, he modified this to the second tool cutting better, but this time did not offer an explanation as to why it was cutting better:

08.31 NW: *So, what's the difference between those two tools?*

RW: *There's no difference between those two tools - the difference is sharpness - this one's been sharpened more recently.*

NW: *So they are both quite big hefty hooks?*

RW: *They're a similar shape, but that one's cutting better ... you can hear it's cutting better.*

Robin Wood interview 7.1.04 [event log RW1 clip2]

In this second session following the concurrent verbalisation, discussion on a similar point revealed that the shape of the tool was also at issue and seemingly identical tools had very subtly different shaped cutting hooks:

> 03.42 NW: *The thing that I notice there is that with this tool ... you're cutting with the back edge with the curl sticking up, whereas with the other tool ... you were the other way up ... weren't you?*
>
> RW: *Um .... er ... it ... er ...yeees ...*
>
> NW: *So if we go back to the beginning* [scrolls back through the video] *here ... then your tool is that way up, isn't it?*
>
> RW: *Yes it is.*
>
> NW: *Why?*
>
> RW: *I think it's probably something to do with the way this particular tool is shaped. The very fine ... um ... that this point, the under ... underside edge is probably more in line with the shaft ... so ... and the result of that, and the very fine angle is that when you use it this way up it just pulls into the wood nicely, whereas if I turn it over then this back edge ... I think you can actually see it ... this line coming straight down here* [pointing with the mouse on the screen]. *The back edge would be more out of line with the centre of the shaft so you get more twisting motion so it doesn't pull itself into the wood in quite the same way.*
>
> Robin Wood interview 7.1.04 appendix [event log RW1 clip 4]

Figure 20: A selection of Robin Wood's hook tools.

The outcome of this session I felt was knowledge at a very similar level to that revealed by the stimulated recall: a relatively advanced description of his techniques and a basic discussion of his aesthetic judgements. Whilst this would be of use to more advanced learners, I felt I needed to return my attention to regular practice with a view to finding assistance for the complete novice.

3.2.3.3 Focused observation

The next experimental elicitation session focussed on observing normal practice to identify basic skills for beginners and concluded with a semi-structured interview based on proposed content for a learning resource. On three successive days the practitioner was filmed undertaking his normal practice, turning a bowl from start to finish, with as little intrusion as possible from the recording process. In addition I explained before recording started that I was not looking for anything in particular and that I required no explanation or interpretation. The video was hand-held so I could change position easily to capture the action without constraint of a tripod, and shots were framed using the camera's screen so I could keep the camera low and relatively unobtrusive, rather than using the view-finder in front of my face.

Figure 21: Pear wood mazers, fine-rimmed drinking vessels.

The three bowls took thirteen, nine and sixteen minutes respectively to turn, with the first two being standard, straightforward eating bowls. As Robin started the third he commented, "It's a very uneven one this: the mandrel didn't go in the centre of the block," and he clearly experienced some difficulty both with the turning and the form. Later he commented that it had become a mazer, a fine-rimmed drinking vessel, so he had to spend more time tidying it up as it would sell for more money.

The three videos were transferred to the computer and compressed so all three could be run simultaneously on the screen to allow comparison. Considering them in the light of the commentary provided in the previous elicitation sessions allowed me to make a first attempt at separating the material into novice and advanced techniques and the drawing up of a preliminary sequence of key skills and critical steps to present to a new learner (see learning resource structure p44).

As a first test of the veracity of the content, I used it as the basis for a semi-structured interview with the practitioner. For speed and to minimise intrusion on the practitioner, I did not video it, but took written notes and then used these to draw up the preliminary resource (see prototype learning resource I, section 8.1). To avoid the problems that arose in the previous session with questioning causing

defensiveness, I kept my own interpretation hidden during the interview and asked the practitioner open questions regarding teaching of a theoretical novice to stimulate him to provide his own suggestions. Where I detected differences between the practitioner's theory and my own, deeper discussion was attempted by my pretending I did not understand, but not pressed if explanations were not forthcoming. I again checked the notes taken during the interview against the video footage previously taken. This clarified the critical steps I had identified with a few minor modifications, but raised a significant issue regarding key skills.

Figure 22: Handgrip with hand as a clamp.

Firstly, the way in which the practitioner described how the tool should be held was considerably different to what could be seen in the videos. Robin made very clear that he felt the tool should be held by using the hand as a clamp over the top of the shaft and also holding onto the tool rest as in Figure 22. Rather than sliding the tool along the rest, the tool should sweep the side of the bowl pivoting from a fixed point, then be moved along the rest a little, clamped by the hand again and another sweep performed.

Figure 23: Handgrip with hand in a fist.

Whilst this process could be observed when Robin was turning the inside of bowls, when turning the outside the tool was rarely held in this manner. Far more commonly Robin held the tool in his fist just behind the tool rest and slid his fist along the rest as in Figure 23. Secondly, even upon reviewing the video again, I could not gain a clear understanding of how to achieve more aggressive or finer cuts. Robin described it in terms of the angle at which the tool met the wood with 30 degrees being aggressive and 15 degrees being a fine cut, but with this being the description of two curved surfaces meeting each other, I found it a difficult concept to grasp. Further complication was added by many of the tools being sharpened on both sides and Robin using them both with the hook tip pointing downwards and upwards:

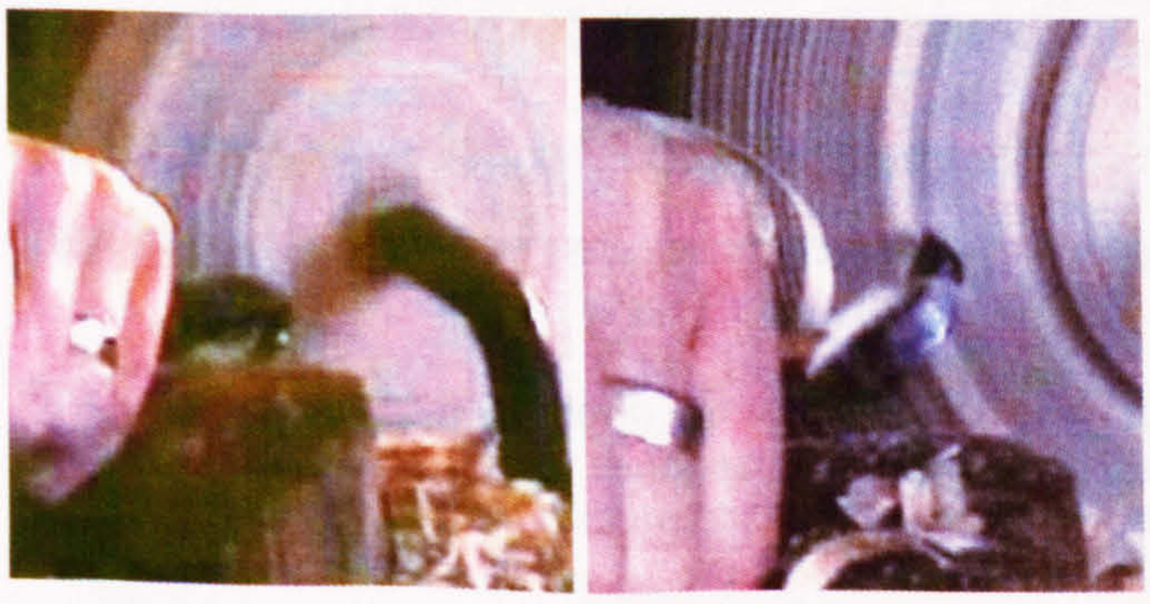


Figure 24: Tool used with the hook tip pointing downwards (right) and upwards (far right).

Whilst this was not an ideal outcome, I felt to have gained a good background to the issues a novice was likely to encounter and that further understanding could only be achieved through working with a novice.

3.2.4 Discussion

My initial response to the experiment comparing on-line and off-line verbal reportage was that they yielded similar results so could be used interchangeably depending on the preference of the craft practitioner. In this context, given the added complexity of stimulated recall: either the necessity of running two cameras or the time taken to import the observational video onto the computer and set the video camera up again to record the discussion, I felt concurrent verbalisation was the better option (Wood 2004).

However, when I attempted to ask more probing questions, the practitioner tended to either rebuffed my questions or respond in a defensive manner. As observed by other researchers in similar situations (Shadbolt & Milton 1999, Edwards 2003), when pressed into talking about elements that he did not have immediate answers for, the practitioner's initial reaction was to give quick responses that gave minimal insight into the situation. In addition, whilst the knowledge yielded during these recordings would be of interest to a more advanced learner, I felt it would be of limited use to a novice. This was later demonstrated by the novices' difficulties with using this video to help them hollow the inside of their bowls.

Overall these attempts at formal elicitation prompted the practitioner to display an instinctive protectiveness towards the complexity of his craft: attempts by myself at interpretation were viewed as over-simplification and instances where the video apparently contradicted the practitioner's interpretation were dismissed[12].

The focussed observation videos provided me with material that was of great importance to the remaining research process. Watching them

[12] This is further discussed in term of Argyris (2003) and practitioners' tendencies to preserve their espoused theories rather than seizing the opportunity to reflect on their theories-in-use, see section 5.3.4, p111.

gave insight into other uncertainties, such as understanding how the tool was held at different stages, stills were taken and used to illustrate an early stage of the prototype learning resource, and the clips themselves were edited and used as 'video sketches' in the resource. However, it was not until both the practitioner and I started to work with a novice that we could focus on what it was that a novice needed.

3.3 Representation

3.3.1 Introduction

In this section I present the context for the representation of the elicited knowledge, starting with a summary of the structure developed in my MA research for an interactive learning resource to support the learning of craft skills that was used as a basis for this project. In addition I provide a review of literature relevant to the representation of the content for this resource starting with a review of notation methods used to record dynamic movement in such fields as dance and choreography.

Whilst such notation was not eventually used, it provided a basis for considering terminology and a means of representation that self-directed novices could pick up quickly. In this context, I provide a review of literature that considers more broadly the use of representation in multimedia learning resources, in particular the use of animated graphics and their observed failure to demonstrate an advantage over static graphics. As an alternative, cognitive design principles are shown as a means that have been used to combine different modes of representation to afford effective learning.

I describe the practical work undertaken showing use of the learning resource structure and the development of the content for it[13]. In particular I describe the development of a 'sketch-and scan' technique to generate static illustrations to interpret video material. I conclude by considering further use of commentaries in future research and reflecting on the learners' responses to animation in the form of video.

3.3.2 Context

Learning resource framework

In my MA research I studied learning in traditional rural crafts to develop a framework for the design of multimedia-based learning in

[13] In this section I focus on learning resource development and a description of the related interactions with learners is provided in section 3.4.

skills with a substantial element of tacit knowledge (Wood 2003). This framework was used to structure the material gathered during the elicitation described in the previous section in order to test its veracity with the group of learners. Whilst this structure was not explicitly tested, the focus of this research being more on the content, implicit in the work was a test of the framework[14]. Its use in the practical work validated the structure, and the framework for understanding practical knowledge described in Chapter 5 provided further insight into its use. The only change I have felt it necessary to make is to alter the descriptive language to less emotive terms that do not have differing meanings in different disciplines as the original did.

The learning resource framework (see Figure 25) consists of three phases: introductory, guidance and development. The introductory phase provides an overview of what is to be done and introduces any key skills or strategies, the guidance phase guides the learner step-by-step through the process and explains any common errors and the development phase offers the learner the opportunity to evaluate the outcome, identify and solve problems, and encourages repetition.

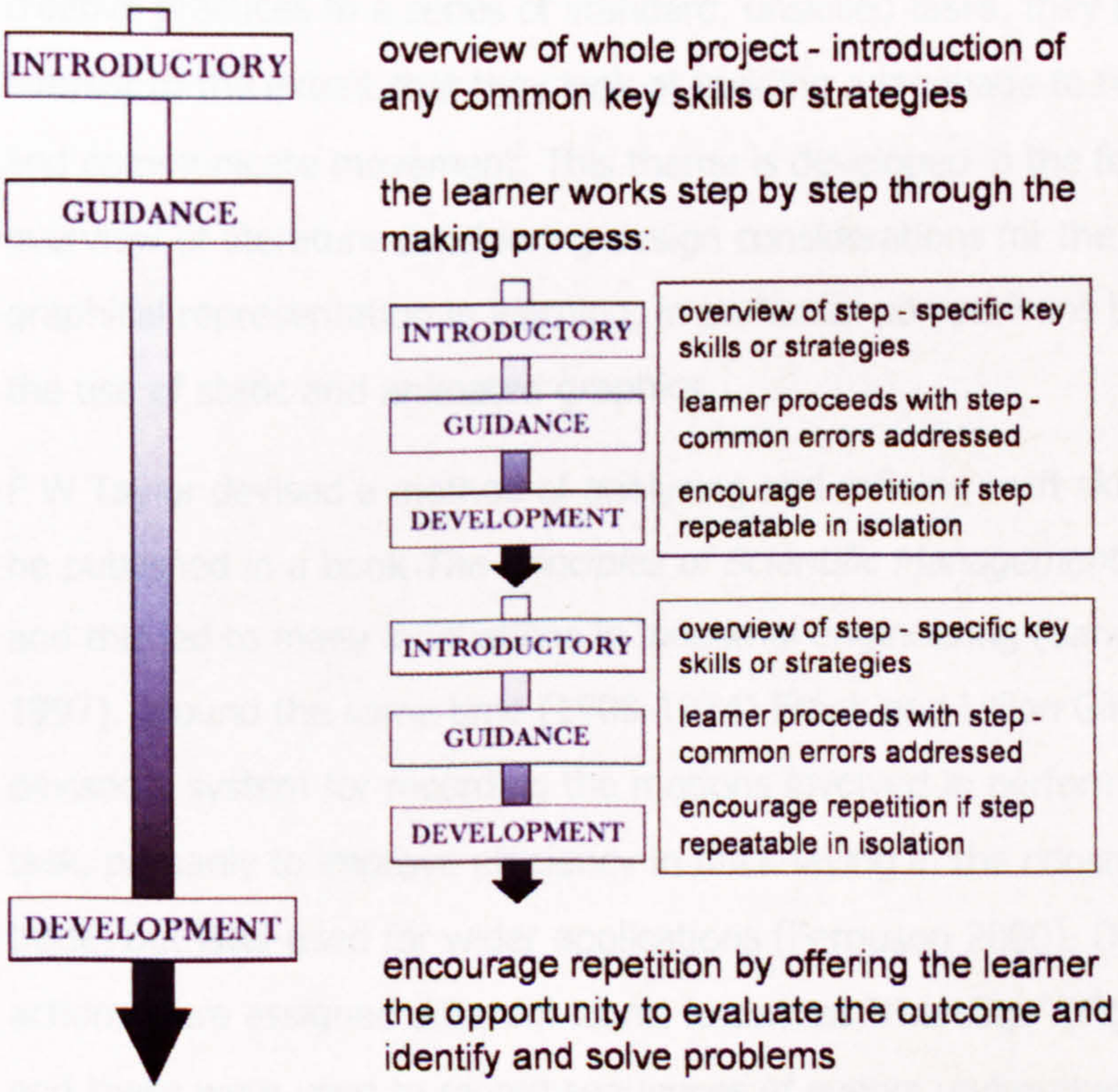


Figure 25: Overview of the learning resource structure.

[14] Gedenryd (1998, p136) describes, "In experimentation the inquiring function is … usually implicit, as part of an action that also has a productive function."

In the practical work section, below (p49) I shall describe how this was used to structure firstly the low-fidelity prototypes, and then the interactive learning resource.

Literature

The literature described here falls into two parts. The first half is a review of notation systems that have been developed to represent dynamic movement. These were considered as a means of representing the dynamic movement of the tool but rejected, as it is not helpful for the self-directed learner to learn to read a new notation system at the same time as learning the practical skill. As an alternative I consider the literature that covers more broadly the use of representation in multimedia learning resources and cognitive design principles to afford effective learning.

The earliest attempts at recording and analysing craft skill probably lie around a hundred years ago in the work of F W Taylor, father of scientific management, and the lesser-known work of Frank and Lillian Gilbreth. Whilst such approaches have been accused of reducing creative practices to a series of standard, unskilled tasks, they are of interest to the extent that they look at building a language to record and communicate movement. This theme is developed in the following overview of literature considering design considerations for the use of graphical representation in learning, in particular comparisons between the use of static and animated graphics.

F W Taylor devised a method of analysing and refining craft skills that he published in a book *The Principles of Scientific Management* (1911) and this led to many innovations in industrial engineering (Sandrone 1997). Around the same time (1908-1924) Frank and Lillian Gilbreth devised a system for recording the motions involved in performing a task, primarily to improve efficiency in brick-laying in the construction trade, but later used for wider applications (Ferguson 2000). Different actions were assigned different icons, known as "therbligs" (Figure 27) and these were used to record sequences of events undertaken by workers with a view to optimising and standardising procedures for all workers.

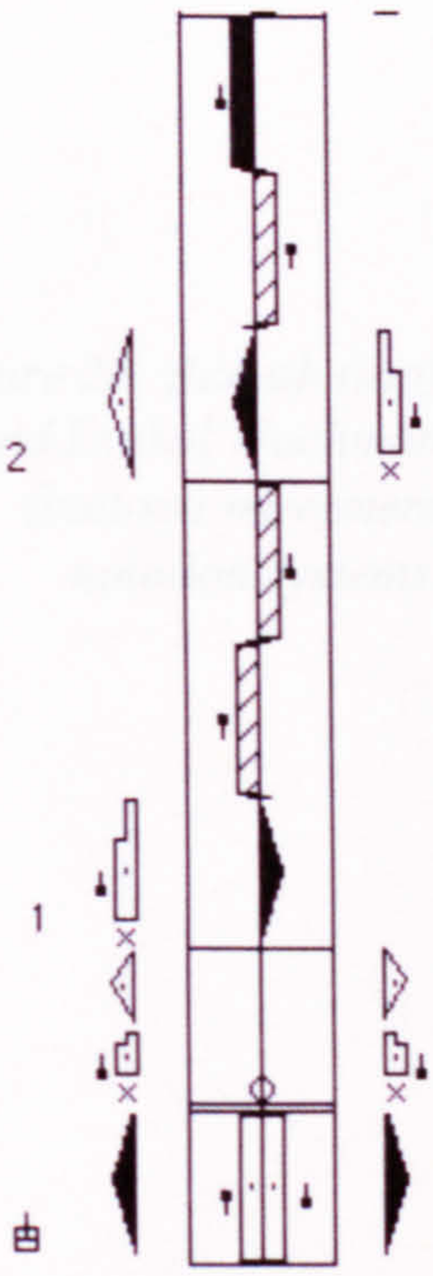


Figure 26 (left): Sample of Labanotation from a ballet score.

Therblig	Color	Symbol/Icon	Therblig	Color	Symbol/Icon
Search	Black		Use	Purple	
Find	Gray		Disassemble	Violet, Light	
Select	Light Gray		Inspect	Burnt Orange	
Grasp	Lake Red		Pre-Position	Sky Blue	
*Hold	Gold Ochre		Release Load	Carmine Red	
Transport Loaded	Green		Unavoidable Delay	Yellow Ochre	
Transport Empty	Olive Green		Avoidable Delay	Lemon Yellow	
Position	Blue		Plan	Brown	
Assemble	Violet, Heavy		Rest for overcoming fatigue	Orange	

Figure 27 (right): Therblig chart showing mnemonic symbols and standard colours used for charting

Whilst such analysis, particularly the use of time and motion studies, greatly improved productivity they have also been criticised for dehumanising the making process by reducing complex skills to a series of sub-tasks that can be preformed by relatively unskilled labourers (Sandrone 1997).

More recently, two prominent notation systems have been developed for use in dance. Labanotation is the most widely used in USA and comprises of a series of symbols, related to music notation, on a vertical body 'staff' (Figure 26). The symbols, written from the bottom upwards, depict the direction, the part of the body, the level and the length of time of the movement (Dance Notation Bureau 2005). Benesh movement notation is more widely used in the UK and is written on a traditional music stave with the stave lines coinciding with features of the body and movement lines describing the paths taken by the limbs (The Benesh Institute 2005). In addition, the Eshkol-Wachman movement notation system was originally developed for use recording dance, but has also been extensively used in research into both animal behaviour and neurological syndromes (Eshkol Wachman Movement Notation 2005).

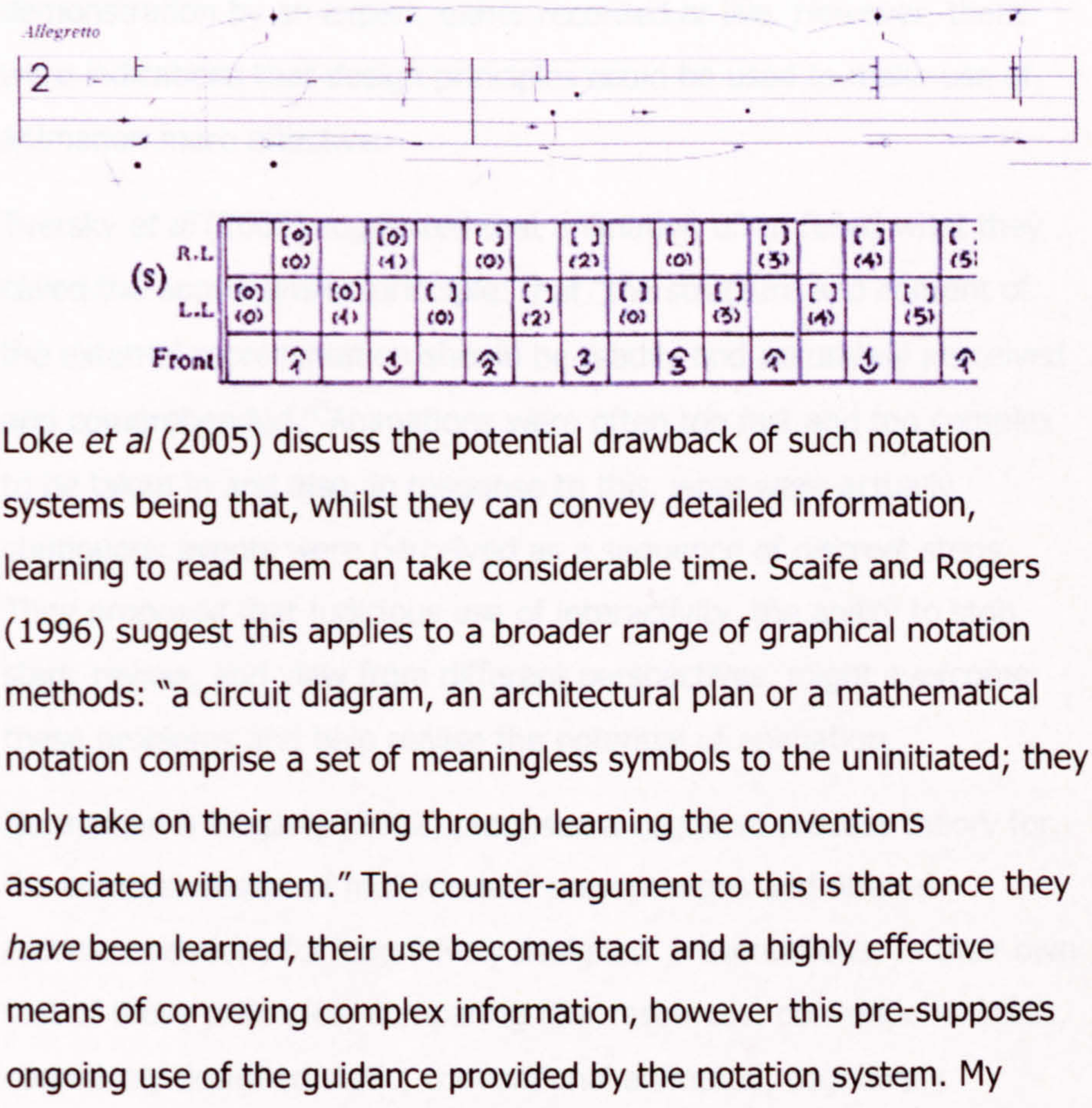


Figure 28: Benesh (top) and Eshkol Wachman (bottom) movement notation systems.

Loke *et al* (2005) discuss the potential drawback of such notation systems being that, whilst they can convey detailed information, learning to read them can take considerable time. Scaife and Rogers (1996) suggest this applies to a broader range of graphical notation methods: "a circuit diagram, an architectural plan or a mathematical notation comprise a set of meaningless symbols to the uninitiated; they only take on their meaning through learning the conventions associated with them." The counter-argument to this is that once they *have* been learned, their use becomes tacit and a highly effective means of conveying complex information, however this pre-supposes ongoing use of the guidance provided by the notation system. My understanding of the craft learning context is that the interpretation will only be used in the 'guidance' phase of learning (see Figure 25, p44) whilst the novices learn the fundamental principles behind how the tools work. Thereafter their knowledge becomes personal and context-specific as they learn how *they* use the tools in specific circumstances so the choreography provided by the notation system would become redundant[15].

A review of literature relating to the use of graphic representation in multimedia learning resources revealed some debate about the benefits of animated over static illustrations, with several widespread reviews concluding that there was little evidence to substantiate claims that animation was superior (Scaife & Rogers 1996, Narayanan & Hegarty 2002, Tversky *et al* 2002). This research considered the learning of knowledge that was largely explicit, for example how a toilet cistern works, so was not necessarily directly comparable to the craft knowledge studied in this research which is based on

[15] The nature of craft knowledge is discussed in full in chapter 5.

demonstration by an expert, either recorded or live. However, there were indications that design principles could be used to make use of animation more effective.

Tversky *et al* (2002) suggested that animation often failed what they called the apprehension principle: that "the structure and content of the external representation should be readily and accurately perceived and comprehended." Animations were often too fast and too complex to be taken in and also, in response to this, what were actually continuous events were perceived as a sequence of discreet steps. They proposed that judicious use of interactivity, the ability to stop, start, review, and view from different perspectives, might overcome these problems and help realise the potential of animation.

Narayanan & Hegarty (2002) proposed a cognitive process theory for the comprehension of multimodal[16] presentations and offered recommendations for 'cognitively designed' presentations. In their own test of these principles, comparing four resources: conventional static, cognitively designed static, conventional animated, cognitively designed animated, they concluded that the cognitively designed presentations were more effective than conventional presentations, but that there was no significant difference in learning outcomes between the animated (computer-based) version and the static (paper-based) one. Mayer & Moreno (2002) summarised these cognitive design principles as:

- multimedia principle: animation + narration rather than narration alone
- spatial contiguity principle: on-screen text near corresponding animation
- temporal contiguity principle: corresponding narration and animation simultaneously rather than successively
- coherence principle: exclude extraneous words, sounds, and video
- modality principle: animation + narration rather than animation + on-screen text

[16] i.e. information presented in multiple modalities e.g. auditory and visual.

- redundancy principle: animation + narration rather than animation + narration + on-screen text
- personalisation principle: words in conversational rather than formal style

In a later test of these principles, Mayer (2003) concluded, "Using different technologies does not change the fundamental nature of how the human mind works; however, to the extent that instructional technologies are intelligently designed, they can serve as powerful aids to human cognition."

3.3.3 Practical work

In this section I describe the development of the learning resource through making and testing a series of simple, low-fidelity prototypes to verify the content before producing a computer-based interactive version. Whilst there was only time for limited testing within the timescale of this research, the early indications were that the structure of the resource and the content developed in this way would effectively support self-directed learners.

The prototype learning resources were based on the structure described above (Figure 25) and the content was focussed on the first two phases, overview and guidance, because the learners were at an early stage in the learning process and did not have the opportunity to develop their skills within the time span of this research. Edited video from the elicitation sessions was provided alongside the paper-based material and the learners proved keen to watch it. Whilst it provided them with an effective overview of tasks to be performed, they consistently struggled to use it to inform their learning and those learners who used the explicit interpretation appeared to gain a better grasp of key skills[17]. During the testing I experimented with several modes of representation for the interpretation, concluding that simple line drawings were most effective and could be easily generated and manipulated using a sketch-and-scan method.

[17] this is further discussed in the 'Craft Knowledge' chapter, p99

3.3.3.1 Resource I

The first prototype learning resource (see appendix I, p163) was largely based on the focussed observation of regular practice and the subsequent semi-structured interview (see p39). The content used is summarised below:

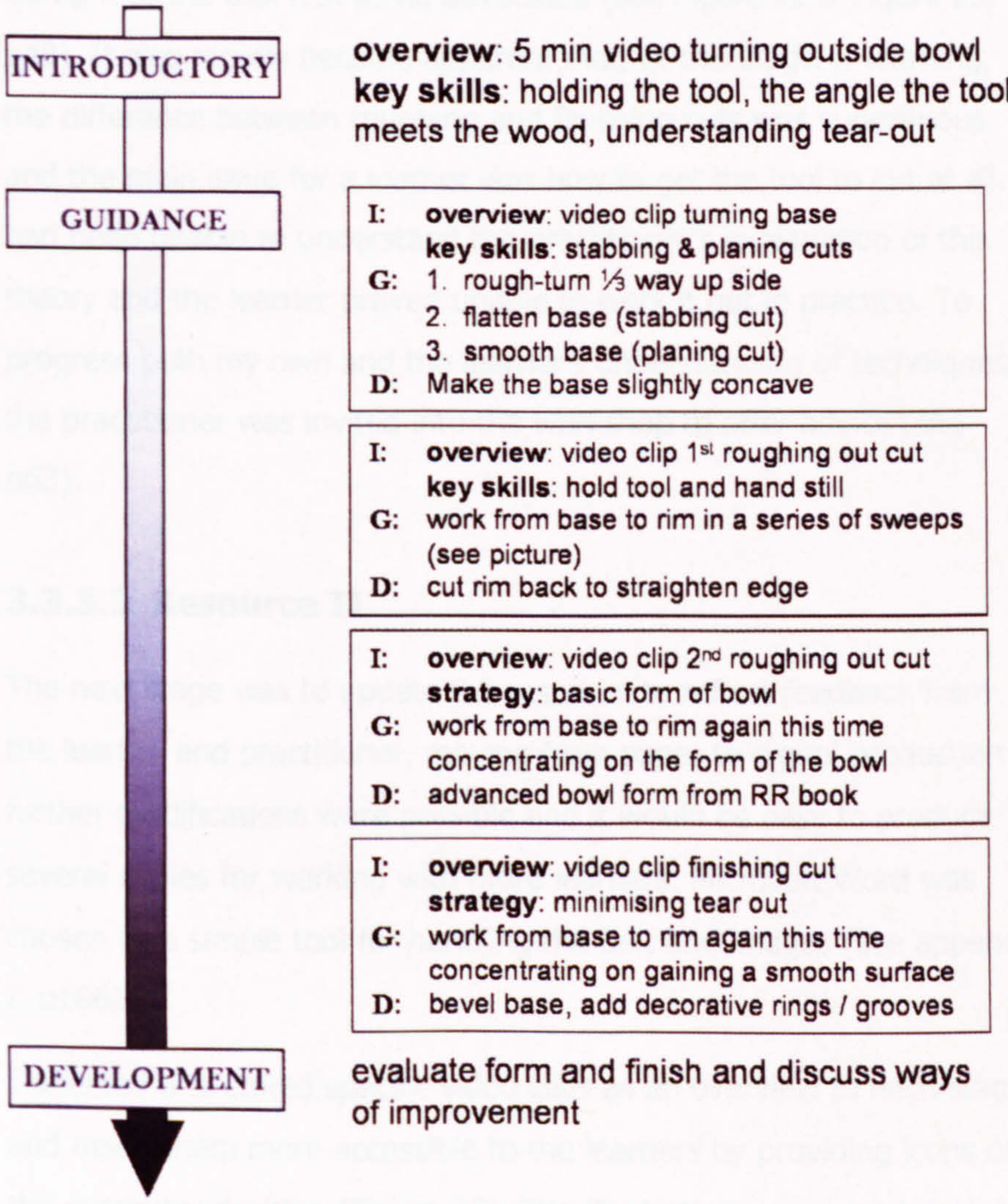


Figure 29: Summary of Resource I.

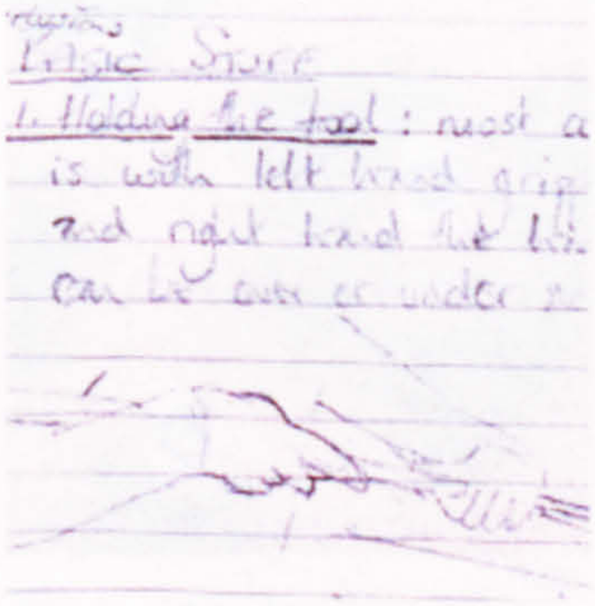


Figure 30: Sample from 'notebook' resource.

This prototype was very simply produced, consisting of several pages of hand-written text and sketches in my notebook that were deliberately presented in an informal manner to indicate to the learner that they were open to interpretation. I wished to make clear to the learner, Giles, that this representation was speculative; there were issues I did not fully understand and I wished to encourage him to explore and experiment. I had also identified some video taken during elicitation with the practitioner that I thought would be useful and made them available on a laptop computer so they could be viewed in the workshop.

The text and illustrations proved a useful starting point for establishing what was of importance to the learner but the use of the video was limited to providing an overview. The drawings of hand-holds on the tool provided a useful point for experimentation and the learner discovered that it was easier to keep the tool still when holding the tool in his fist as the expert could be seen doing, rather than trying to clamp it to the tool rest as he advocated (see Figure 22 & Figure 23, p40). It also rapidly became apparent that, at this stage of learning, the difference between roughing and finishing cuts was superfluous and the main issue for a learner was how to get the tool to cut at all. I had been unable to understand the practitioner's explanation of this theory and the learner proved unable to work it out in practice. To progress both my own and the learner's understanding of techniques, the practitioner was invited into the workshop to offer advice (see p63).

3.3.3.2 Resource II

The next stage was to update the resource to reflect feedback from the learner and practitioner, moving from paper to digital production so further modifications were possible and it would be easy to produce several copies for working with more learners. Microsoft Word was chosen as a simple tool for handling the text and images (see appendix I, p166)

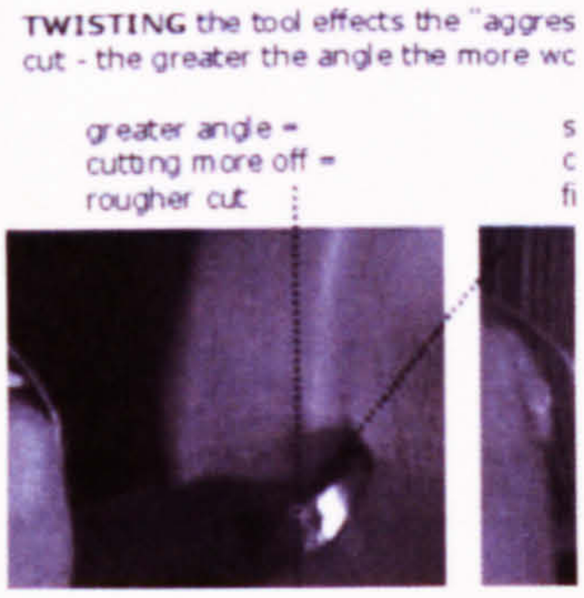
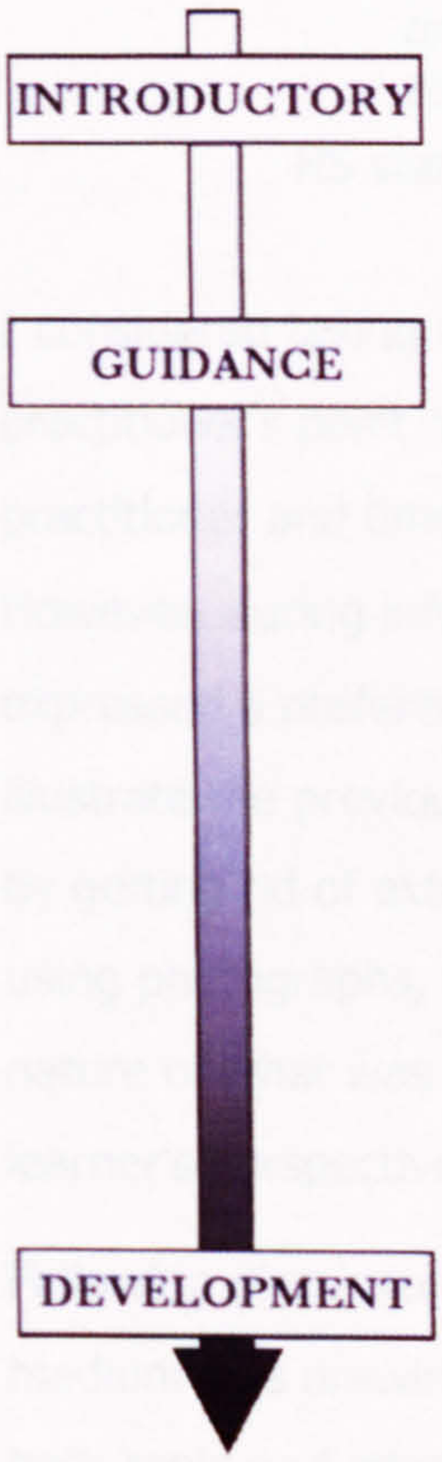


Figure 31: Annotated still from observational video.

Figure 32: Desktop links to video clips.

I selected and edited specific video clips as an overview to each stage and made them more accessible to the learners by providing icons on the computer desktop (Figure 32). The illustrations were made using annotated stills taken from the observational video that were quick and easy to generate by moving the video forward frame by frame until a clear shot was found then extracting the frame as a jpeg. I reduced the number of stages in the guided phase, feeling two roughing-out cuts were unnecessary and their inclusion made the process look more complex. These cuts were shown in three stages to demonstrate the movement of the tool as it progressed from base to rim.



overview: overview video showing lathe working + close up of tool cutting
key skills: holding the tool, the angle the tool meets the wood, understanding tear-out

I:	**overview**: video clip roughing out cut **key skills**: hold tool and hand still
G:	work from base to rim raising tool handle as get closer to rim (photos)
D:	-

I:	**overview**: video clip turning base **key skills**: stabbing cut / planing cut
G:	flatten using stabbing cut, smooth with planing cut
D:	-

I:	**overview**: video clip finishing cut **strategy**: minimising tear out
G:	work from base to rim in finer cut concentrating on gaining a smooth surface
D:	-

evaluate form and finish and discuss ways of improvement

Figure 33: Summary of Resource II.

This resource was tested with two learners: Giles having his second attempt at the craft and Helen as a complete novice. Both learners found the stills taken from the videos difficult to relate to with the main difficulty encountered being the perspective: the images were taken from the observer's point of view and the learners struggled to relate this to what they were actually looking at:

21.30 HS: *"Eek"*

NW: *"Problems?"*

HS: *"Yes"*

NW: *"Do you want me to help?"*

HS: *"Yes, it's the chisel going inwards again ... I think it's because I'm not holding it firmly... how does ... where are the pictures?"*

NW gets the printed sheets showing how RW holds the tool. HS is looking at the one where he's holding the rest because that's what she's been doing. NW says he doesn't do that one so much on the outside and draws attention to the fist on the rest.

HS, screwing up face: *"I can't quite work out how his thumb's ... oh, is it like that?"*

NW: *"His thumb's kind of up there isn't it, so maybe his thumb is back here I think?"*

HS, moving her grip: *"It's on this side ... but it's back to front, isn't it?"* She then manages to get the grip.

NW: *"Yes, like that so then you're not actually holding the*

tool rest but this [points to fist] *should act as a stop some how."*

HS starts turning.

Helen interview 26.3.04 [event log HS1 t21.30]

I considered taking revised photographs or video from the practitioner's point of view, but felt this would be both intrusive on the practitioner and time consuming to capture the shots needed. However, during informal conversation after the session, Giles had expressed a preference for the line drawings that had been used to illustrate the previous prototype resource, feeling they provided clarity by getting rid of extraneous detail. I felt that by sketching rather than using photographs, the illustrations could emphasise the interpretive nature of what was being displayed as well as being able to show the learner's perspective without intrusive photography[18].

Following discussion with a fellow research student whose main medium was drawing cartoons, I developed a technique that became both rapid and adaptable. The individual elements needed for each illustration were hand drawn on paper, scanned and manipulated in Adobe Photoshop to make transparencies, and then complete images were built up using multiple layers. The fixed portions were printed out, movable elements redrawn and then rescanned to generate the sketches needed. These layered images had the additional benefit that they could be used to create animations in the interactive version.

Figure 34: Line drawings generated to demonstrate treadling action.

[18] In a study of the use of sketching in the design process Tversky (1999) says, "drawings differ from images in that they reflect conceptions, not perceptions, of reality."

3.3.3.3 Resource III

A final paper-based prototype was then produced with the aim of focussing the learners' attention on adopting the correct body stance and understanding how different movements of the tool affected the cut (see appendix I, p171). The content was structured as follows:

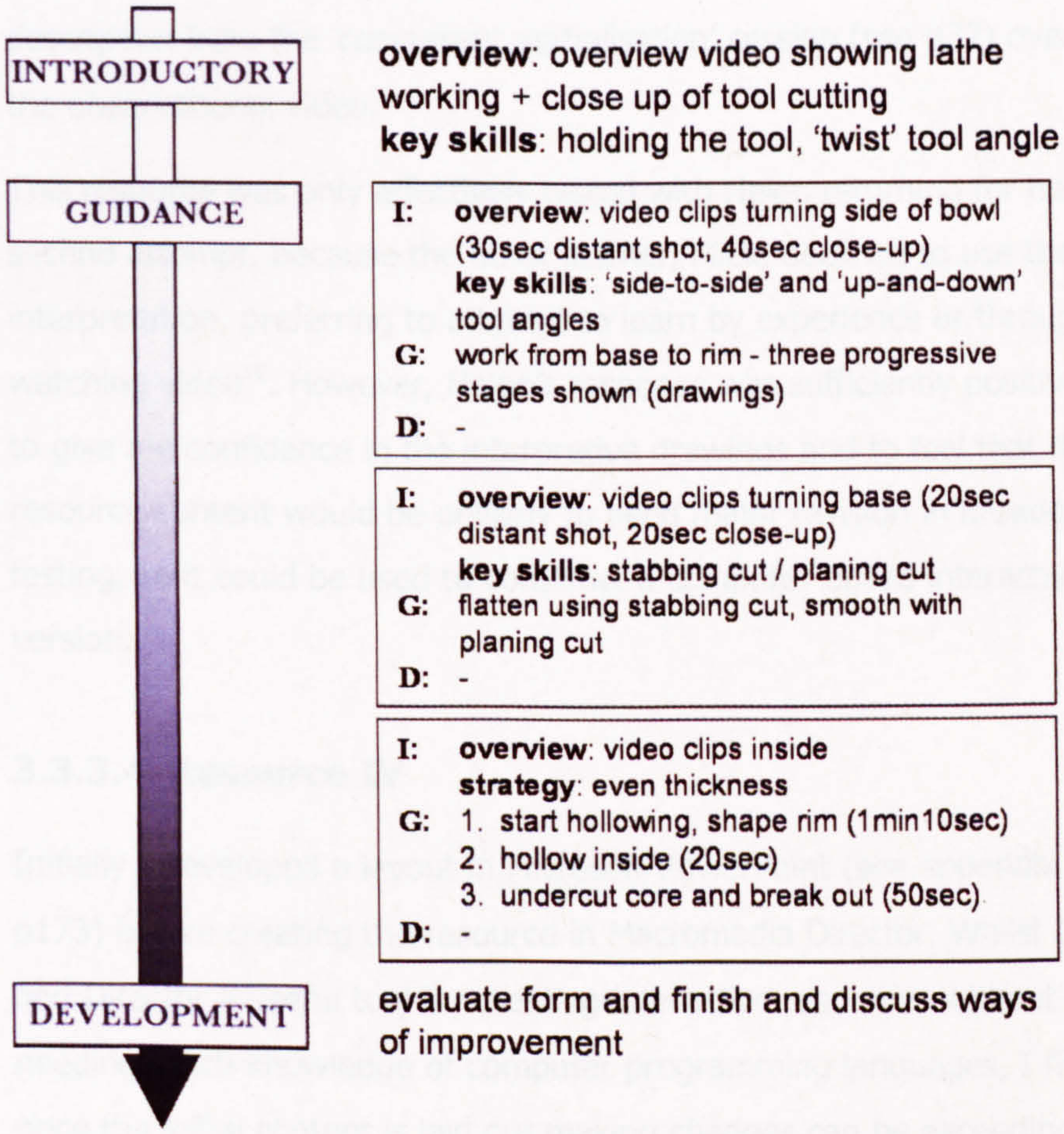


Figure 35: Structure of resource III

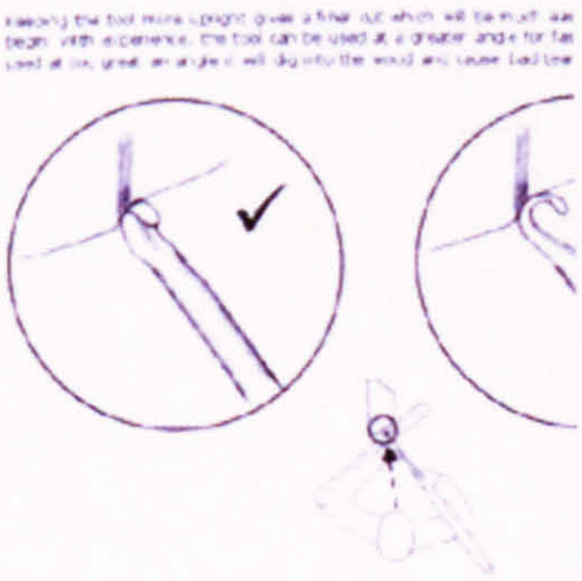


Figure 36: Sample from resource III.

What had been separate photos showing different hand grips on the tool were simplified to show the grip which it was now established Robin used most of the time (Figure 23, p40) with a variation of the handle being either underneath or on top of the arm. The drawings showed two perspectives, one a view from above, and the other from the learner's point of view, to help learners relate the drawings to their own body.

The 'twist' movement was shown using close-up drawings of a tool as it met the bowl, showing what was right and wrong from the learner's perspective (see Figure 36). The side-to-side movement and up-and-down movement were shown on a separate sheet in three stages moving from base to rim, again pictured both from above and from the

observer's perspective.

The differentiation between roughing and finishing cuts was removed because, at this stage, the aim of the learner was just to get the tool to cut. A third stage was now added, providing a series of videos showing in three stages how the inside of the bowl was hollowed. These videos had voice-overs achieved by dubbing the practitioner's description from the 'concurrent verbalisation' session (see p37) over the observational video.

This resource was only effectively tested with Helen returning for her second attempt, because the other learner, Mick, declined to use the interpretation, preferring to attempt to learn by experience or through watching video[19]. However, Helen's response was sufficiently positive to give me confidence in the interpretive drawings and to feel that the resource content would be unlikely to need major revision in broader testing, so it could be used to construct a computer-based interactive version.

3.3.3.4 Resource IV

Initially I developed a layout in Microsoft PowerPoint (see appendix I, p173) before creating the resource in Macromedia Director. Whilst I find Director a useful tool for creating interactive resources without needing much knowledge of computer programming languages, I find once the initial content is laid out making changes can be exceedingly complex. Even the simplest of screens usually contains many overlapping elements and alterations to one part can easily have a much wider impact than planned. For this reason, the graphics and text used in the Word version of the resource were firstly imported into PowerPoint to allow the initial screens to be laid out and a standard structure to be developed that would easily expand to fit more content. This PowerPoint version was retained as a development tool in which new ideas could be sketched out in a 'safe' environment before

[19] A the end of the session, however, he looked through the material and expressed a wish to make another bowl at a later date using the learning resource. When he did return it was about a year later and arranged directly with Robin who reported that Mick seemed disappointed that the learning materials were not available at that time.

deciding whether to implement changes in Director.

The basic content remained the same as resource III but now included plans for content to be added at the development level:

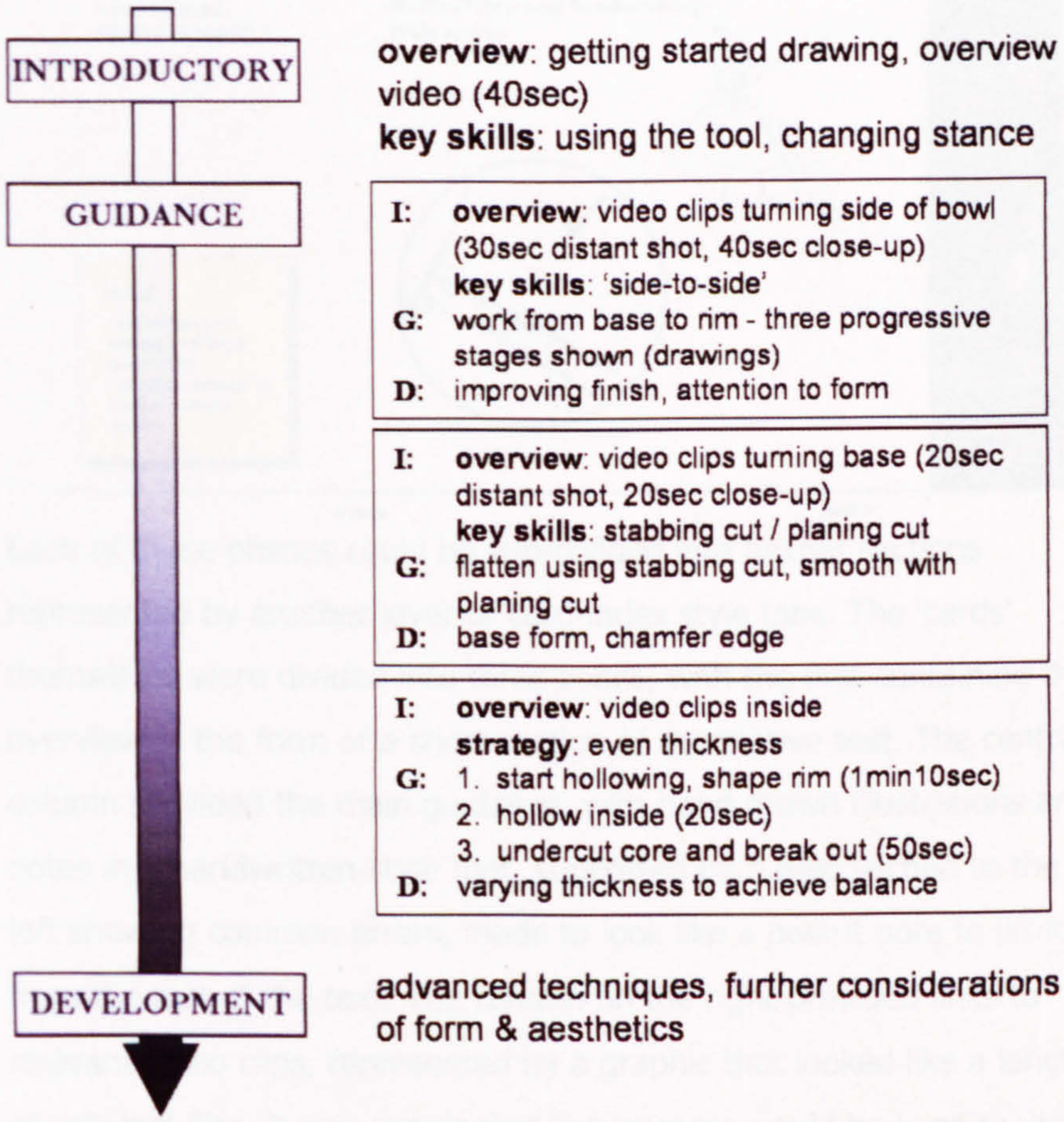


Figure 37: Structure of resource IV

The phases were represented by card-index style tabs with, at a macro level, the overview phase provided by the introduction section, the guidance phase by the step by step and problem solving sections, and the development phase by the advanced section:

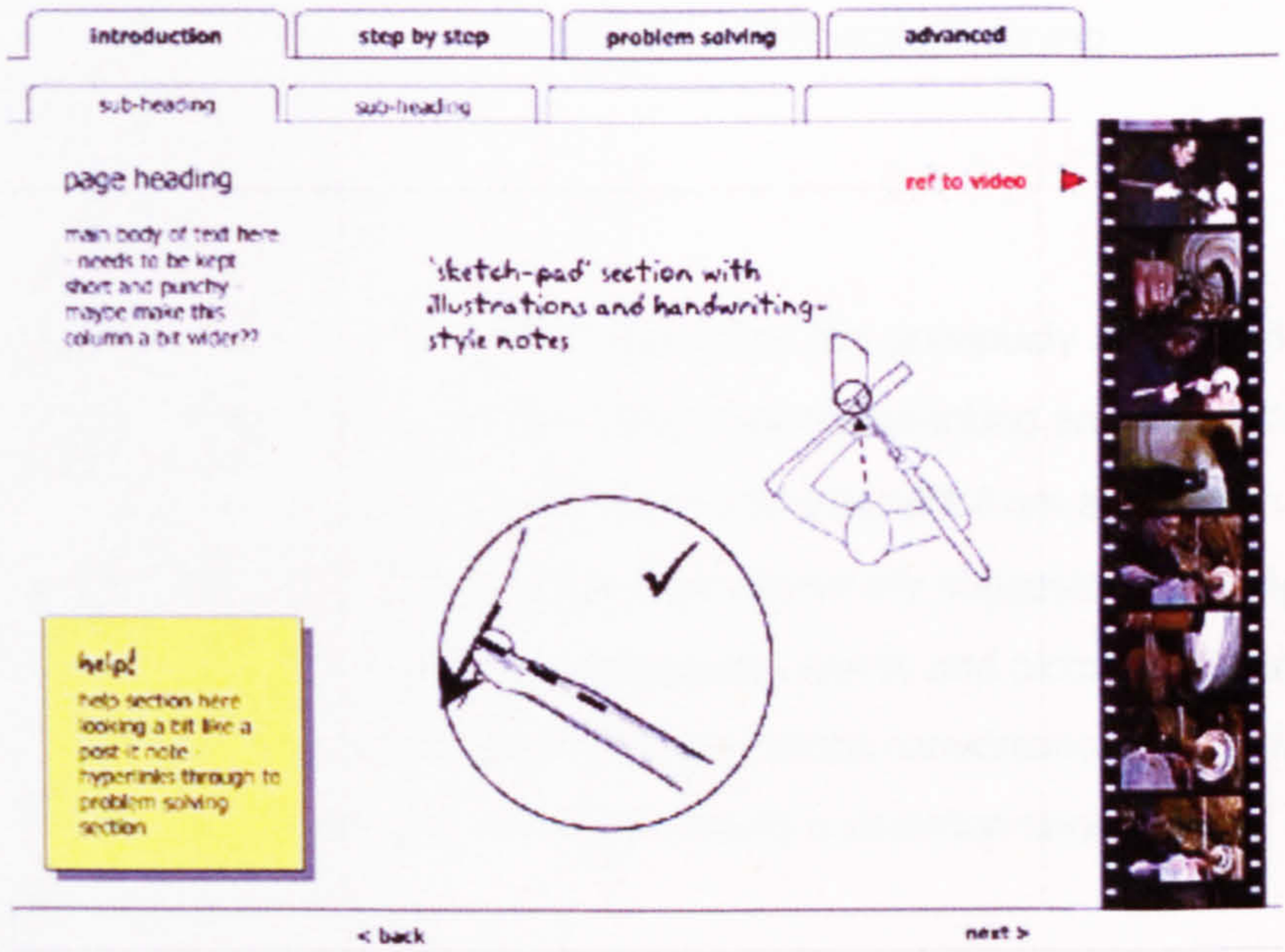


Figure 38: Screen layout developed in PowerPoint.

Each of these phases could be sub-divided into further sections represented by another layer of card-index style tabs. The 'cards' themselves were divided into three zones, with the first containing the overview in the form of a short section of descriptive text. The central column provided the main guidance, with hand drawn illustrations and notes in a handwritten-style font, supported by a help section to the left showing common errors, made to look like a post-it note to lift it from the rest of the text. The column on the right provided links to relevant video clips, represented by a graphic that looked like a length of celluloid film. It was anticipated the learners would be keen to view the video, although initially they would be unable to interpret so it would just provide them with an overview. As their skill advanced they would gain more from watching it, seeking their own interpretation and experimenting with techniques.

The computer-based version was tested with just one new learner, Andy as an exercise in resolving practical design issues raised by this research. Although it is not part of the purpose of this PhD project to evaluate the designed 'product', its use[20] did support the product development process running parallel to the research. Outside the scope of this project, I plan to complete the resource and gain broader feedback on it as the practitioner has now started teaching some short courses and he would like to make the resource available to the

[20] as described in section 3.4.3.4, p72

learners to support their subsequent self-directed learning.

3.3.4 Discussion

The prototype learning resource based on the previously developed structure provided an effective means for representing and evaluating craft knowledge. Whilst I could claim some benefit from application of cognitive design principles, what they essentially suggested: "adding pictures to words, eliminating extraneous words and pictures, placing words near corresponding pictures, and using conversational style for words" (Mayer 2003) proved to be largely a common-sense part of the design process for me.

Of more interest was the use of commentaries, which I only introduced half way through by using the practitioner's voice from the elicitation sessions dubbed over some footage of him turning the inside of a bowl. Whilst the learners struggled to interpret the video themselves, the narrative appeared to have made a more lasting impression as they had a tendency to reference to the words they had heard when working subsequently. In future research I plan to experiment further with using commentaries both with static illustrations and with animations / video.

This observed difficulty the learners encountered using video to teach themselves appeared to uphold the literature into the failure of animation (Scaife and Rogers 1996, Narayanan and Hegarty 2002, Tversky *et al* 2002). As well as encountering difficulties interpreting what they were seeing, they seemed to find it difficult to transfer what they had seen to their own actions. This is discussed further in the 'Craft Knowledge' chapter where I review the learners' experiences in the light of further theory.

3.4 Application

3.4.1 Introduction

In this section I describe how theory was advanced through engagement with learners applying craft knowledge. This process involved a small group of novice practitioners who used the developing prototype resource (described in section 3.3) to support their learning of the craft skill. Whilst describing this separately creates some repetition over the previous chapter which dealt with development of the content of the learning resource, it enables the events to be viewed again specifically from the perspective of how the use of the learning resource informed both its content and supported the theory development described in chapter 5.

I provide the context for this section in the literature relating to use of rapid prototyping techniques, highlighting the different purposes such artefacts can have for exploring the general context of use and experimenting with specific functions. I relate the practical work undertaken describing use of paper-based prototype resources primarily for exploratory purposes and a computer-based interactive resource primarily for experimental purposes. I conclude by considering my role in the research showing how, rather than being a passive computer-operator, I adopted the more involved role of designer-researcher.

3.4.2 Context

Rapid prototyping techniques have become widely used in a range of design practices. Gedenryd (1998 p149) proposed that the artefacts created during prototyping might have more than just a productive purpose, they could also have a second, inquiring purpose: they could be the "means for the inquiry that design is". He made a further divide between experimental and exploratory artefacts, with the former "being concerned with detailed tests - experiments - with the design itself and its internal workings" (ibid p172) and the latter "spanning a

wide range of possibilities without heading in any specific direction or searching for a specific goal" (ibid p152).

Gedenryd suggested an exploratory purpose for what Rettig (1994) described as 'lo-fi' prototypes: produced using hand drawn graphics reproduced on a photocopier, post-it notes, acetates, index cards and so on. Such prototypes could be made rapidly and informal tests carried out frequently with anybody available to quickly develop and evolve ideas. Rettig advocated use of this approach over 'hi-fi' prototypes that would lead to testers tending to comment on 'fit and finish' issues, like the colour scheme or typography, at a stage when the focus needed to be on the bigger picture. These more sophisticated prototypes also took too long to build and alter and, because of this, developers tended to resist changes. Diaper (1989) observed that this often led to the application of 'elastoplast solutions' to the latest issue rather than a reassessment of the overall system to consider whether there was a more efficient method of proceeding. The result could be that the prototyping never ended and the system delivered was merely the final prototype.

Ehn & Kyng (1991) highlighted a different dimension to the paper prototyping concept with their description of 'cardboard computers', mock-ups that encouraged journalists and typographers in newspaper production to role-play using a computer-supported system. Their mock-ups were deliberately unsophisticated: a cardboard box with 'desktop laser printer' written on the side, a matchbox as a mouse, and a sheet of paper as a display. This, they felt, encouraged a 'hands-on' approach, providing an environment which empowered all participants to use and modify the prototype without constraint. Gedenryd (1998 p176) referred to this as a 'situating strategy', a means of contextualising the artefact and enabling the designer to draw inference from its use.

3.4.3 Practical work

In the practical work undertaken with the bowl turners, the first three prototypes[21] were primarily used for what Gedenryd referred to as an

[21] Resources I, II and III, see Appendix I.

exploratory purpose. Whilst the final aim was to produce an interactive learning resource, these prototypes were not mock-ups of that resource; there were no pretend screens, pictures of buttons or imaginary links to other pages. Instead they were used to explore the context and gain insight into the situation of a self-directed learner in the workshop. However, some of the *content* within the prototypes could be seen as experimental in Gedenryd's terms, in particular the drawings and video clips used as illustration, and the final interactive resource [IV] also fulfilled this purpose.

The descriptions of the sessions with the learners below show evidence of the developing dual designer-researcher role. Whilst on each occasion I anticipated leaving the learners to direct their own learning and for my role to be 'computer-operator' to provide learning materials, once the sessions were underway other interventions were frequently deemed appropriate. At times this just involved steering the learner towards material I thought would help although at other times, when neither the learning resource nor myself could provide assistance, the practitioner was invited into the workshop to teach.

3.4.3.1 Resource I

Overview

Figure 39: Giles and myself in the workshop.

This was primarily an exploratory session with my main aim being to explore the context of a self-directed novice learning the craft skill. The resource was very 'lo-fi' consisting merely of some notes and drawings in my notebook along with some unedited video of the practitioner working at normal production speed[22]. I was aware that some of the interpretation I had was incomplete and aware of differences between the practitioner's recommendations and the practice I had observed. Working collaboratively with a novice learner, Giles, this was used to both test my understanding and my representation of the knowledge elicited. Once we had pursued this as far as my understanding could take us, the craft practitioner worked with the learner to try to teach him directly. Whilst this was not entirely sucessful, the act of explaining

22 The content is discussed in the Representation section on p50.

again the principles behind the use of the tools clarified them in his mind and he then initiated a very focussed concurrent verbalisation session in explanation.

It also uncovered a difference between the practitioner's espoused theory and his theory-in-use (Argyris 2003): where his declared method of working was at variance to that observed. The practitioner's response to this was initially complete denial until he had reviewed the observational video which produced a reluctant acceptance. Dealing with this sensitive situation in this manner was made possible by working with close aquantances, but it led to consideration of more generalisable methods suitable for designers working with practitioners who they do not have a close relationship with which is discussed in the 'Craft Knowledge' chapter (p99).

First learner (Resource I: GB1)

Giles firstly watched the video of Robin turning, and then we discussed the key skills using a turning tool and a bowl that Robin had previously turned as props. I was open about the limitations of my knowledge and, in particular, I explained the differences I had perceived between Robin's recommended way of holding the tool and his observed way and suggested to Giles that he experiment in an attempt to throw some light on the differences.

In the workshop Robin had previously mounted a blank on the lathe, selected and sharpened two tools for the learner. Before starting turning, Giles expressed an initial concern about how fast he should treadle and reviewed the first video again until he ascertained that the speed varied and he could turn at any pace he felt comfortable with. For about an hour he experimented in his own way, whilst I stimulated discussion to gain some feedback on what he was trying to achieve and what his understanding of the outcome was. At times I attempted to steer him towards experimenting with some techniques I felt might be helpful and also tried to generate a dialogue about them and to gain some insight into their effectiveness. His major difficulty was finding a position in which he could depress the treadle with sufficient power, hold the tool rigidly and hold it at an angle which would achieve

a good cut, all at the same time.

Whilst this in its own right did not lead to an understanding of the points in question, it allowed both the learner and myself to get a feel for the difficulties of the task and what he needed to learn before having the practitioner explain it directly. In the learner's own words:

> 37.26 NW: *Would you find it intimidating to be doing that in front of [Robin], having him watching you do it badly?*
>
> GB: *To an extent, yes. I think it would actually speed up my learning process, but for that first few times doing something it's actually quite nice to do it and begin to get a feel for it. Whereas if he'd come straight away when I'd first started on it, I'd have been ... stopping and starting more because he'd have been saying, "Well I think you should do this" or, "You've got that the wrong way round."*
>
> Giles interview 5.2.04 [event log GB1]

By this stage we felt we had reached the limitations of the resource so continued by involving the practitioner, firstly with some direct teaching and then with some further elicitation.

Working with the craft practitioner

Figure 40: Practitioner adjusting the learner's tool angle.

Robin's initial focus was on the problematic issue of the angle at which the tool meets the wood, trying to explain directly to the learner the way in which different movements affect the cut. Giles struggled to understand the explanation, confused by Robin's use of "tipping up" to describe twisting the tool and Robin frequently had to move the tool in Giles' hand into the correct position himself.

Next Robin stopped Giles and gave a detailed explanation of how to hold the tool on the tool rest, clamping it with the hand and using the hand as a pivot (Figure 22). It was notable at this point that Robin was unable to explain his theory without a tool in his hand and shortly into his explanation went to fetch one from the tool rack, using the other end of the tool rest to demonstrate the handgrip.

Whilst struggling with keeping the tool still, Giles had experimented with different handgrips, but by this stage had adopted the hold Robin was most frequently observed using (Figure 23) as it kept the tool much more firmly in place, rather than the handgrip Robin was

promoting. When I explained this to Robin, he was exceedingly surprised and could only be persuaded there was some truth in it by watching some of the video on the laptop computer. Even then it was not until he actually stood at the lathe, spinning Giles' bowl and experimenting with holding a tool in different ways that he finally conceded, "Well, there you go, I never knew that!" [event log GB1 t0.48].

Giles then proceeded to finish turning the outside of the bowl under the supervision of Robin, during which time Robin frequently intervened to correct Giles. Whilst the finish of the bowl was considerably better than previously, Giles continued to find it difficult to solve problems on his own as Robin had a tendency to correct him before he was aware he had a problem.

I had originally planned for this to be the end of the session, but Giles was keen to finish his bowl by turning the inside too. As I had not assembled teaching materials for this part of the process, Robin mounted another bowl blank on the lathe to demonstrate instead. He rapidly turned the outside of the bowl without explanation, other than commenting shortly after starting, "I do hold the tool like that, don't I" in reference to the discussion we had previously held about handgrips [event log GB1 t1.09].

Robin then hollowed the inside of the bowl whilst explaining to Giles what he was doing. Subsequently comparing this to the video taken during the previous concurrent verbalisation session (see p37) his explanations were now more focussed on tools and techniques and less on the form of the bowl, showing a shift towards understanding the needs of the novice. He then decided it would be best to leave Giles to experiment for a while on his own, so left the workshop saying, "Not much more I can say. It's not easy, I'll be impressed if you can get that far".

Once Robin had left the workshop both Giles and myself found it difficult to remember what we had been told. Giles managed to hollow a reasonable way into the bowl, but was constantly fighting to get the tool to cut well and was uncertain if this was because he had the wrong tool, the wrong angle, or was just not holding the tool firmly

enough.

Figure 41: Giles with his nearly finished bowl.

When Robin returned to the workshop he was impressed with the progress Giles had made. When he observed Giles turning he felt the problem was again the rotation of the tool making it cut too aggressively and helped him to change it to get a better cut. He then had another go at explaining his concept of the angle at which the tool should meet the wood, still struggling for words, but this time demonstrating what 0° and 90° are first before showing where the 10° angle was that he should be using.

This time Giles seemed to have gained a better grasp of the concept and managed to skim the inside of the bowl without digging in and was able to concentrate on getting a smoother surface. Robin then helped him to complete the bowl by removing the core with a chisel and Giles seemed very pleased with the result.

Further elicitation with the practitioner

At the end of the session with Giles, Robin said that having explained how to get the tool to cut correctly several times both to myself and a learner, he felt he had worked out a way of explaining it succinctly and offered the opportunity to film this explanation in the workshop.

He did this by dividing the movement of the tool into three: up-and-down, side-to-side and twisting:

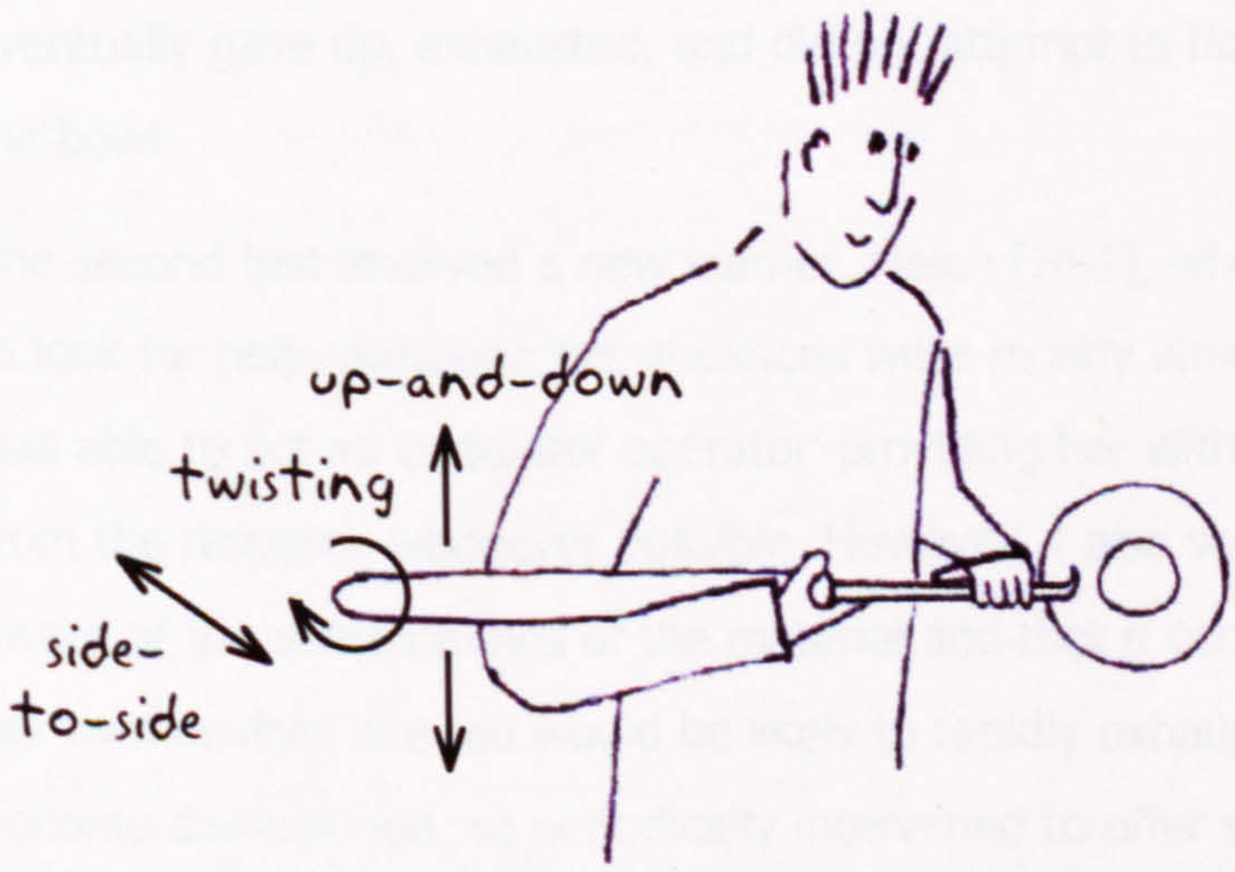


Figure 42: The three movements of the tool.

He described and demonstrated the different effect of each movement: side-to-side affected the shape of the bowl and twisting affected the aggressiveness of the cut. Robin was uncertain about the precise affect of the up-and-down movement, but he felt that normally he held the

tool level, only lifting it up to achieve a fine cut close to the rim. Review of the focussed observation videos confirmed this.

Whilst Robin's narrative as he explained the different actions of the tool was hesitant, with him struggling to find meaningful words, it was sufficient for me to feel I had gained a basic understanding which I had not been able to previously. I also was able to film some close-up footage of the tool cutting to illustrate the results of different actions in the resource.

3.4.3.2 Resource II

Overview

The prototype resource had now taken on a more formal aspect, being produced in Microsoft Word, illustrated with stills from the video, and including shorter, edited video clips to illustrate specific points[23]. I now felt I had an understanding of the key skills the learners needed, so wished to stand back more in these sessions to see if the learners could gain an understanding using my interpretation.

In the first test of this resource however the returning learner, Giles [GB2], was not keen to use the interpretation at all, preferring to try to use the video, which he struggled to interpret, or to experiment on his own. Seeing him struggling, I intervened several times to encourage him to look at the interpretive sheets, but he was not keen. He eventually gave up, exhausted, and did not attempt to hollow inside the bowl.

The second test involved a new learner, Helen [HS1], who was keener to look for help. Although her questions were mostly aimed at myself, I was able to act as 'computer operator' providing her with information from the resource whenever possible. However, I also soon became aware of the shortcomings of the material and that if completely left to her own devices she too would be likely to rapidly exhaust herself and become disillusioned, so periodically intervened to offer suggestions.

[23] An overview of the content is in the Representation section on p52.

First, returning learner (Resource II: GB2)

Approximately six weeks after his first trial, Giles returned to make another bowl and test the new learning materials [GB2]. He was enthusiastic about having another attempt, feeling he had established the principles on the first time and was confident that he could progress with little assistance. On his arrival we started by briefly looking through the sheets and discussing his major problem in the previous session, achieving the correct cutting angle of the tool. We watched a little of the video together and I showed him how to access what was there from icons on the desktop.

After a first tentative attempt at turning and suffering a series of dig-ins he returned to watch the video briefly, had another unsuccessful go on the lathe, then returned to the video again, claiming he was holding his tool at the same angle as Robin in the video. At this stage and again several times later I intervened in an attempt to assist Giles, feeling that his interpretation was different to that which I had intended. He was resistant to most suggestions from myself, seeming to prefer to learn by his own experience, so I otherwise left him to experiment on his own. As related in the 'Representation' section, discussing this with him afterwards, he did not give a specific reason for this, but commented that he had preferred the drawings in my note book [Resource I] to the stills from the video that contained too much extraneous detail.

Working on his own, Giles eventually appeared to get to grips with the twisting movement to avoid dig-ins but not the side-to-side movement necessary to shape the bowl (see Figure 42, p65). As a result the surface of the bowl he made was a series of large steps that he kept re-working until the sides became concave and he finally gave up after about an hour and a half, without attempting to hollow inside.

Second, new learner (Resource II: HS1)

Two days later I tested the same learning materials with a new learner, Helen [HS1]. Throughout the session she was much more keen to seek outside help than Giles, although frequently aimed

questions at me rather than looking at the materials provided. Whenever possible, I referred Helen directly to a relevant drawing or video clip and if she had difficulty interpreting what she was seeing, I assisted with interpretation. As previously discussed, she too had difficulty with the stills from the video, largely due to difficulty in relating their perspective from that of the observer to her view of her own body. Also, in the light of Giles becoming exhausted and disillusioned when left unaided, I occasionally decided to intervene to encourage use of the resource or adaptation of technique to help her maintain momentum.

After around one and three quarter hours, Helen had made a reasonable attempt at turning the outside of the bowl, but was tired and decided not to continue with hollowing inside.

Review with practitioner

Whilst Giles was turning, Robin had commented he felt the major problem was an inefficient use of energy: taking short, stabbing pushes at the treadle rather than maximising the cut by pushing it from its highest to its lowest point. Robin turns with his left foot raised on a block of wood so the treadle can easily rise to its highest point and on the down-stroke he bends his left knee to push the treadle completely to the floor.

Half way through that session Robin had tried to improve Giles' stance by raising the block on which he was standing, but the block was small and had a tendency to wobble on the wood shavings on the floor so it did not help significantly.

Figure 43: Height difference between practitioner (top) and learner (bottom).

Reviewing Helen's video with Robin, he identified the same problem and felt a major contributory factor was the height of both learners (Giles 5'4½" and Helen 5'4") being considerably shorter than his own 5'10". In addition, because they were experimenting with where to stand to achieve a good cut, the block was frequently in the wrong place for them. Before they returned he offered to find a larger block to overcome these problems.

3.4.3.3 Resource III

Overview

This prototype resource was similar in format to the previous one but the sheets were illustrated with line drawings which helped the learners view them from their own perspective and were focussed upon encouraging the learner to adopt the correct body stance and understand how the movement of the tool affected its cut[24]. In addition, Robin had replaced the block he stood on with one which was far larger and more stable, and provided a second large block to raise smaller learners to a height closer to his own.

The new learner recruited to help test this resource, Mick [MK1] declined any assistance other than watching a little video when hollowing the inside of his bowl. Whilst at the time this was frustrating, it ultimately provided useful input to the research, which is discussed in the Craft Knowledge chapter. The result was that this prototype was only tested with Helen [HS2], the returning learner and again, whilst my aim had been to intrude as little as possible other than being 'computer operator', weaknesses in it led me to intervene. This time it was my phraseology rather than the drawings that led the learner to misinterpret the representation.

Second, returning learner (Resource III: HS2)

Approximately three months after her previous attempt Helen returned to make another bowl. From initial discussions she seemed to have a good recall of what she had learned during the previous session so we went directly to the workshop.

Her initial reaction to the printed material with the photos replaced by drawings was positive and throughout the session there were no further problems observed with the way in which she related the drawings to her own body. More of a problem was her understanding of the language I had used in my labelling, thinking they implied she should move the tool sideways on the down-stroke of the tool rather than gradually as she cut around the bowl. This resulted in the outside surface of her bowl initially becoming far from round, a problem that

[24] An overview of the content is in the Representation section on p54.

she was unable to correct on this occasion.

During the session Helen demonstrated she had learned the 'twist' movement, obviously stopping, thinking, twisting the tool and making a comment about it. However, as with Giles during his second attempt, she still failed to understand how to find the correct sideways movement and ended up with large steps in the side of her bowl that she could not remove.

This time Helen progressed to hollowing inside the bowl using the video provided but struggled to find the correct angle to cut cleanly inside, a problem compounded by being physically small, at the limit of her strength, and being quite worn out from having spent two hours turning. Finally, Robin came into the workshop to help her complete her bowl, which she did but was too tired to make much improvement to her technique.

Third learner (Resource III: MK1)

Mick was happy to be filmed but initially did not want to look at any of the learning resource material, wishing to just experiment on his own. He is a similar height to Robin and turning the outside of the bowl was able to adopt a good stance and maintain a firm, regular treadling action. However, he consistently failed to get the tool to cut properly, scraping off thin shavings rather than cleanly cutting the surface of the wood.

Figure 44: Treadle lathe.

This was caused by the side-to-side angle of the tool (see Figure 42, p65) being consistently at around 90° to the ideal position. Mick's previous experience was on a treadle lathe using a turning gouge, which affectivly has the cutting edge at 90° to the cutting edge on a hook tool (see Figure 45). As he was self-taught it seems reasonable to deduce he had learned what angles worked with the gouge without understanding why, so could not work out how to make the hook tool work.

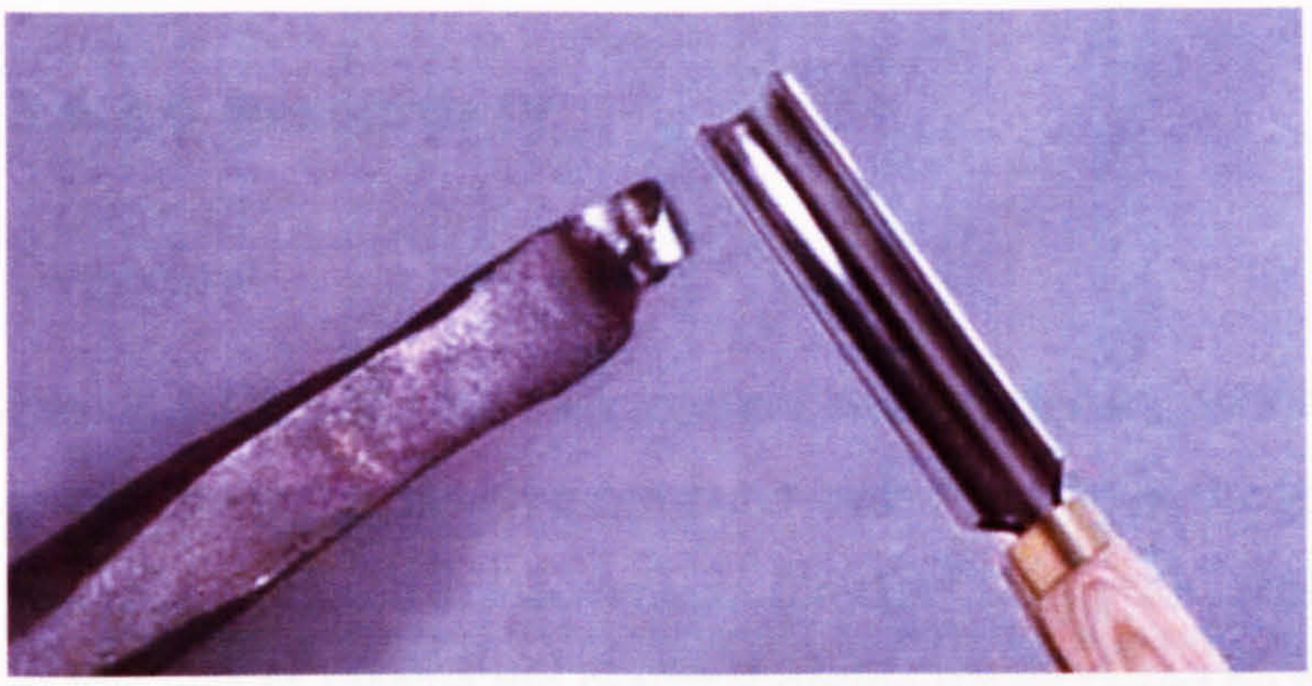


Figure 45: Relative cutting angles of hook tool (left) and gouge (right).

When it came to turning inside the bowl, the difference between his prior knowledge and the task at hand were more apparent. When hollowing inside the bowl on a treadle lathe, it is attached just by its base enabling the turner to completely turn away the wood inside. On a pole lathe the bowl runs between centres, so inside the bowl the turner has to cut a channel around a central core which is snapped out at the end of the process.

Mick started the hollowing process sucessfully, but soon struggled to deepen the channel and finally asked if he could see some video. We watched the video taken during the one of the first elicitation sessions where Robin talked about what he was doing as he turned the inside of a bowl. Mick watched very closely and intently, commenting that what Robin was doing was very different, specifically mentioning that he was using a different angle.

Mick continued to hollow the bowl, regularly changing the angle at which he was holding the tool and trying different tools, but never reliably achieving a good cut. Shortly before finishing he commented that he still had no idea what angle to use the tool at. Through persistence he managed to hollow sufficiently far down, undercut the core and snap it out to finish the bowl.

As we were packing up he commented that he felt he should have watched more video and he would like to come back and have another go, next time using the learning resource.

3.4.3.4 Resource IV

Overview

Having established the basic content and structure, I performed a final test of the material with a computer-based version of the learning resource produced in Macromedia Director[25]. Whilst the main purpose of this was to resolve the practical design issues raised by the research, it additionally provided a preliminary test of the designed 'product'.

Figure 46: Andy using the interactive resource.

A new learner, Andy [AB1], was recruited to provide a completely fresh perspective uncomplicated by issues that had arisen in previous tests. Andy used it successfully when turning the outside of the bowl and at this stage I was largely able to just stand by and observe. He encountered more difficulty when turning the inside, for which there was no explicit interpretation, just a series of video clips. At this stage we worked together trying to understand the video but without success and, as with Giles' first attempt, we progressed by inviting the practitioner into the workshop to teach directly. He then successfully turned a further two bowls unaided.

Forth learner (Resource IV: AB1)

Andy also had some experience of using normal turning gouges but, unlike Mick (see p71), was able to adapt his technique and successfully turned three bowls during the course of an afternoon.

Turning the first one, Andy made extensive use of the learning resource, using the illustrations to understand how to achieve the correct tool angles. Although he frequently commented on how weird it was in comparison to the turning he had previously done, he appeared to gain a good understanding of how to use the tools on the outside of the bowl. He initially encountered more difficulty using them inside the bowl where no explicit interpretation was supplied, just video and Robin's commentary. On his own he was unable to interpret the video, although he persisted for some time, and we called Robin into the

[25] An overview of the content is provided in the Representation section, p56.

workshop to assist. Robin suggested he changed tool, although he would not offer an explanation as to why, and altered the place on the bowl where the tool was cutting to below the centre. Whilst Andy seemed uncertain whether he was achieving a better cut, Robin was very complimentary about his technique. Andy then successfully completed the bowl on his own.

Andy turned two more bowls without further reference to the learning resource. With both he achieved a good, clean cut on the outside of the bowl but continued to struggle when hollowing inside. The final bowl showed a marked deterioration in quality over the previous two, this I felt was probably due to Andy becoming over-tired.

Further development of resource

After working with Andy I felt that to complete the resource it needed the blank areas filling in and some minor modifications. For example, drawings needed producing for turning the base and hollowing inside the bowl. Some of the existing drawings that worked on an A4 sheet could be simplified for screen use using simple animation, but the originals could be retained for use by learners who did not have access to a computer in the workshop. The existing video could be put into an archive in the 'advanced' section and new, high-quality video taken to illustrate the 'guided' section. This would then have made it ready for more rigorous testing with a wider group of learners, but I felt this work would not have added to my research outcomes so I temporarily shelved the project.

Now I have the theoretical understanding of craft knowledge gained through the subsequent research that is described in the rest of this thesis, I feel it would be valuable to complete the project. Robin has recently started teaching some short courses and, given time, I hope to complete the interpretation and make it available to such learners to support their subsequent self-directed learning.

3.4.4 Discussion

The learning resource took several forms, progressing from a 'lo-fi' prototype, whose primary aim was exploratory, to a 'hi-fi' prototype,

whose primary aim was experimental. This enabled me to gain an understanding of both the context and the content of the learning material as I developed the interpretation.

My initial aim when working with the prototype had been to be 'computer operator' in the learning sessions, observing the learner using the resource and, if called upon to do so, providing them with material they could not find for themselves. As discussed in the Methodology Chapter (p16), I had deliberately not learned the skill so the novices would not perceive me as a teacher. The actual role played by myself was more complex than teacher or computer operator: it was the intuitive role of designer-researcher.

Firstly, rather than operating the resource, I was an integral part of it. When the learners asked for assistance I took one of several options. I could select some interpretation to show them and observe their reaction. If this did not help I could look for an alternative or, if it was just that they had difficulty understanding what they were shown, I could add a further explanation. If I did not have what they needed, I could consider if I knew something that I had not yet added to the interpretation that might help and test this out on them.

Secondly, the situation was not entirely driven by the learner. Having observed one learner [GB2] become exhausted and demoralised when left on his own, at times I felt the need to intervene judiciously to steer the learner towards help. The final source of assistance if all else failed was the craft practitioner himself. When he was called upon during the sessions, observing the guidance he gave to learners gave a further source of interpretive material.

3.5 Conclusion

In this first piece of practical work I sought to explore and interpret the practical knowledge of craft practitioner Robin Wood through the development and testing of a prototype learning resource. Initially I adopted a systems-based approach, framing the problem in terms of the three fields of knowledge elicitation, representation and application which provided a starting point for contextual review and preliminary work. However, increasingly the boundaries became less clear as I adapted to unfolding events.

The knowledge uncovered during the formal knowledge elicitation (stimulated recall / concurrent observation) was mostly more advanced than a novice would require and my attempts at getting the practitioner to discuss more fundamental issues were either rebuffed or treated defensively. The combination of focussed observation and semi-structured interview provided a useful starting point to enable engagement with a novice, although the novice proved unable to interpret the video unaided and my initial interventions were also unsuccessful.

Bringing the practitioner into the workshop to teach the learner directly proved to be a more productive frame experiment. It provided the practitioner with experience of explaining his theory to somebody who was trying to apply it and helped him develop an explanation of how to use the turning tools. It also revealed to him a difference between his espoused theory and theory in use regarding how to hold the tool, although he was reluctant to accept it until he resumed his normal practice.

Through further refinement and testing of this material with a small group of novices I developed a prototype resource to support their learning, building on the principles I established through my MA research. Through careful management of the recording process I was able to immerse myself in the sessions with learners in the knowledge that I would be able to subsequently review my actions.

Working in this exploratory manner proved challenging at times for

both the practitioner and the novices, bringing to mind Rittel & Webber's description of town planners undertaking "an argumentative process in the course of which an image of the problem and of the solution emerges gradually among the participants, as a product of incessant judgment, subjected to critical argument" (1984 p136). This process was made possible by working with a group of close acquaintances with whom I had easy communication. In the next chapter I describe my second practical project in which I experimented with a less intrusive, observation-based approach to elicitation, working with participants with whom I was not closely acquainted.

4 Practical work II: clog making

"Bad news goes about in clogs, good news in stockinged feet."

Welsh proverb

4.1 Introduction

Figure 47: Traditional Welsh clogs made by Jeremy Atkinson.

In this chapter I describe the recordings I undertook with clog maker Jeremy Atkinson, during which I refined the knowledge elicitation techniques developed in my practical work with Robin Wood described in chapter 3. Working with Jeremy I developed a less challenging elicitation technique, starting with very general observation and open questions aimed at gaining contextual information, and then gradually increasing the focus of observation and questioning as my understanding grew.

The recordings took place at the Museum of Welsh Life and my official remit was to film archive footage of Jeremy for the museum so I did not have the opportunity to develop and test a learning resource. This led me to consider other ways of validating the knowledge I was eliciting and I describe a subsequent investigation I undertook into an area of knowledge about which I felt uncertain: the seasoning of timber and usage of different timber types. The result of this was to highlight the personal nature of craft knowledge and I describe the resultant implications for representation in learning resources.

Jeremy was teaching a novice whilst working at the museum so I had the additional benefit of being able to observe this process. Although in the circumstances I had to take care not to be seen to be interfering between the two, this led me to consider use of an 'expert learner' as part of the elicitation and validation process. It also led to an

investigation into the skills of the last craftsmen as the craft declined and development of a framework for understanding the learning of craft skills which is described in chapter 5.

Participants

Figure 48: Clog maker, Jeremy Atkinson.

For this second stage of the practical work I aimed to study a craft that I was less familiar with, and work with participants I was not closely acquainted with, as a means of testing the generalisability of the methods I was using. I knew Jeremy Atkinson a little before the project started as he had occasionally demonstrated at craft fairs with my husband Robin Wood but I considered that I had very little knowledge of his craft[26].

Jeremy makes traditional Welsh clogs with a wooden sole and leather upper and is the only craftsman in the UK to hand make the entire clog. There are other clog makers in the country, but they buy in machine-cut soles, machine-made uppers or both and modify them to suit the client. The most specialised part of his skill is cutting the soles from a block of wood using knives unique to the craft. The uppers are hand cut from leather and then nailed onto the soles. Jeremy had first learned to make clogs around 30 years ago, apprenticing himself to an experienced clog maker to learn the skill. Unimpressed by the quality of the clogs he was being taught to make, he proceeded to examine old clogs, extensively research the history of the craft, write a book (Atkinson 1984) and undertake much experimental making to improve the design. He taught a variety of different students over the years, but none has continued into professional practice.

Jeremy had requested that the recordings take place at the Museum of Welsh Life in Cardiff where he was spending approximately twenty days over a two-month period. He was there to train Geraint, one of the museum's staff who had independently learned the basics of the skill and wished to advance his technique so he could demonstrate to the public at the museum. The museum offered support for my recording the project in return for footage of Jeremy for their archive

[26] Although I subsequently revised this opinion, see section 4.3, p92.

and I had the additional benefit of being able to observe what were effectively a craft master and apprentice, with the learner being at a relatively advanced stage.

Workshop Procedure

In contrast to recording the bowl turners, the workshop at the Museum of Welsh Life was two hundred miles from home and I was working to a fixed time scale. As I had been warned I would have to carry my equipment some distance, on my first visit I took just the video camera, g-clamp tripod and external microphone. From my previous experience I was confident this would produce at least an acceptable recording quality.

As it was, the museum workshop had good natural light so additional lighting was not needed, and it was enclosed so an external microphone was not necessary. Unfortunately, it was too large to be covered from a fixed point, so during the first session I overcame this by hand-holding the video, although I found this constrained my movements and either I had to cope with a trailing power lead or keeping an eye on battery levels. Upon review, I also found the resultant constant slight motion of the camera made me feel slightly sea-sick after watching over three hours of film.

For following sessions the majority of the filming was undertaken using a high-quality tripod that remained very stable when extended to head height and could be panned smoothly when I needed to follow action around the room. In addition the tripod had a quick-release lever, so I could easily switch to hand-held mode should I need to change to a different angle. For hand held operation I used the camera's batteries, but I also had a power supply by the tripod that I could plug in at other times.

Figure 49: Filming the clog makers in the museum workshop.

This enabled the camera to be used with minimal attention from myself and, as I spent all day in the workshop both the practitioner and apprentice became familiar with my presence and appeared unconcerned by the recording process. They would regularly laughingly ask to have things removed from the tape when they swore, made a mistake or an indiscreet comment. If I asked for clarification on an issue Jeremy would also comfortably talk directly to camera or ask if I could see what I needed and offer to move.

4.2 Elicitation

4.2.1 Context

In this practical project I aimed to use a more subtle approach to elicitation to avoid the defensiveness and confrontation experienced previously. The bowl turning expert had been very sensitive to questioning of his knowledge during formal elicitation, often being dismissive or defensive. When I uncovered an area of tacit knowledge for which he had constructed theory that was not borne out in practice, he had been reluctant to reconsider his theory. In the circumstances, as he is my partner and aware of the subject of my research I was able to assert my observations and persuade him to re-evaluate his theory by watching video of himself. With most other people, I feel it would be harmful to relationships to be so directly contradictory and there is evidence the video might fail to make an impression. Edwards (2003) related that "it was not uncommon for a worker to deny vigorously that they ever carried out a task in a certain way, even after they had seen themselves doing it on the video!"

My planned strategy for elicitation was a hybrid of the focused observation, concurrent verbalisation and semi-structured interview techniques that had been used with the previous practitioner. Initially the focus was on general observation, with open questioning aimed at contextualising the observations, and then gradually both observation and interviews became more focussed as I gained understanding. To help with the contextualisation, the interviews were nearly all based in the workshop whilst the practitioner was undertaking his regular practice.

An important principle identified by Bell & Hardiman (1989) was that it must be a co-operative process. They had observed the protectiveness displayed by experts towards their knowledge when they learned that potential users of the system being designed had been interviewed first. Similarly, if users did not feel sufficiently involved in the process they would feel that the experts were imposing the system on them

and reject it. They described it as a major diplomatic role to keep all participants actively involved and advocated interviewing expert and user independently. Whilst I had both expert (the practitioner) and user (the novice) at my disposal, I had limited access to them individually and had to take care not to harm their relationship with each other although it became increasingly evident that the novice's perception of the expert's knowledge could be very informative. I felt that in this particular part of the research I could not make use of the novice in this way, but conclude by proposing that greater use might be made of an 'expert learner'.

4.2.2 Practical work

Before starting the recordings I asked Jeremy for background reading and he recommended his own book (Atkinson 1984) plus chapters from five other books: Edlin 1949, Fitzrandolph & Hay 1926, Hartley 1939, Jenkins 1965, Jones 1927 which provided a historical perspective.

During each recording session, I would watch the clog makers, take notes, and talk to them both whilst also continuously filming proceedings. Afterwards, I would watch the video, compare with my notes and decide upon areas requiring further clarification to be used as the basis for discussion during the next session. So, each session built upon the proceeding one with any gaps filled in by the semi-structured interviewing. Only the final session was more formal in nature, where I asked direct questions to fill in specific areas of uncertainty. By that stage the practitioner was completely at ease with the recording equipment and myself and readily talked directly to the camera in answer to the questions.

Whilst I was able to undertake some quite deep questioning without triggering defensiveness in the practitioner, there still remained some issues where the practitioner's stated theory was at variance with my understanding and this is discussed further in section 4.3.

4.2.2.1 First visit: observation and rapport-building

During this first visit to the museum the focus of the observation was on regular practice as I had not previously seen clog making knives being used. Jeremy was keen to explain what he was doing and had started making a pair of soles from the very beginning, sawing a piece off a log, so I could see the process all the way through.

In particular I was interested in understanding the main tools used to shape the soles: specialised stock knives with a hook at one end to fit in a ring on the workbench and a long handle to act as a lever. These come with three different blades for different parts of the process; see Figure 50 and Figure 51.

Figure 50: Using a stock knife.

Figure 51: Stock knives for clog making.

Geraint was completing the first pair of clogs he had made under Jeremy's supervision, providing the opportunity to observe interaction between the two. Geraint appeared very dependent on Jeremy, frequently asking him for help. Similarly Jeremy would frequently break from his own work to see what Geraint was doing and would issue instructions in an assertive manner. He could also be observed telling Geraint what to do, but then actually doing it himself.

My questioning was mostly very general, such as asking about themselves and how they became interested in the craft, with the aim of getting to know Jeremy and Geraint and building a rapport. When I asked Jeremy occasional, directly craft-related questions about what he was doing or thinking, I found him to be open and keen to explain his work to me.

4.2.2.2 Second visit: materials and tools.

During the second visit to the museum I gained a greater insight into Jeremy's understanding of his materials and tools. He and Geraint had just returned from working with the museum's blacksmith to correct Geraint's knives and they jointly gave a detailed description of hardening and bevel angles. Jeremy was of the opinion Geraint was so proficient with his tools now because he had learned with blunt tools, so found them relatively easy to handle now they were correctly tempered and sharpened.

In addition Jeremy explained use of the last, which is the foot-shaped piece of wood used to form the shape of the leather when it is nailed onto the sole. He had a variety of different lasts and explained their advantages and disadvantages, how they differed from shoe making lasts and general differences between shoe making and clog making.

Figure 52: A selection of clog lasts.

Figure 53: Geraint and his first clogs made with Jeremy.

Jeremy also described the use of timber for clog making, both from his own experience and from his understanding of the historical perspective. Geraint brought out a photo album he had assembled of old clog makers and I used this to stimulate further discussion about the history of the craft. Again, Jeremy appeared open to direct questions and would bring work over to talk about what he was doing directly in front of the video camera [JA2.2 t0.32/0.40].

Geraint was completing his second pair of clogs, providing an opportunity to see how the uppers were made. He was clearly proud of the progress he had made under Jeremy's tutorage and showed the clogs he had previously made on his own for comparison with those he had recently completed. He was still frequently asking for advice from

Jeremy who remained assertive in his responses, but was also full of praise for the progress Geraint had made. [JA2.1 t0.54/1.04]

4.2.2.3 Third visit: form and function

By the third visit to the museum I had gained a good understanding of the process and how the tools were used to cut the soles. I had established a good rapport with Jeremy and Geraint and was in the position of actually asking them not to chat as they worked so I could take clean footage for the museum's archive. My focus was now on understanding the form of the sole and how the pattern that was produced by drawing around the foot was made into a pattern for a sole and subsequently used to shape the clog. I also commissioned Jeremy to make a pair of clogs for me and recorded him adapting my foot drawing into a clog pattern.

Figure 54: Soles cut as patterns to guide the learner.

Jeremy spent much of his time making soles in different sizes for Geraint to use as patterns when working on his own. Geraint appeared to have gained hugely in confidence and was now working with much less assistance. Jeremy would leave him far more to his own devices, for example looking over at Geraint and asking if he needed help rather than going straight over and giving advice.

4.2.2.4 Fourth visit: craft context

As my understanding of Jeremy's knowledge of timber had been pieced together from diverse conversations during the previous three visits, I had arranged to meet Jeremy where he normally cut his wood near his own workshop so he could give a more detailed explanation in the context of where the work was undertaken. This enabled me to adopt a more direct style of questioning and Jeremy to talk more fluently without distractions of his own work or interventions from Geraint.

We visited two different locations that Jeremy used as sources of timber and he explained how he selected trees for clog making and how their working properties were affected by the way in which the trees had grown. He also talked extensively about use of different timbers both from a historical perspective and from discussions with

foreign clog makers.

This visit also provided useful contextual information, offering the opportunity to see Jeremy in his own workshop, an old shop just off the main high street in the small market town of Kington. In the past it had been open to the public, but at the time of my visit it was virtually empty. As well as having moved many of his tools to Geraint's workshop in the museum for the summer, he was undertaking most of his work whilst demonstrating his craft to the public at craft fairs where he also took most of his orders.

Figure 55: Jeremy's workshop window.

4.2.2.5 Fifth visit: historical context

As part of this visit to the museum I had arranged to view some film from the museum's archives of Thomas James who Jeremy considered to be the last really good Welsh clog maker. Jeremy and Geraint came to watch the film as well although both had seen it before, but not recently. At the time the film was shot (1963) James would have been around 70 years old and Jeremy was of the opinion that by this stage he was not regularly making clogs and had especially made this pair for the film crew.

Figure 56: Thomas James.

The film was very short, about 5 minutes, and we watched it through twice to glean what we could from it. Jeremy and Geraint had particularly wanted to see use of the hollowing knife because, after James' death, Jeremy had bought one from his son but had not been able to get it to work satisfactorily. In the film he was not seen using one at all, the only hollowing seen was done with a *twca cam,* a curved spoon carving knife (Figure 57):

Figure 57: Twca cam: spoon carving knife.

Jeremy and Geraint decided this was because the wood being used was alder that cuts more easily than the sycamore they use, which in its own right presented a conundrum because Jeremy was convinced James used sycamore too. My feeling, based on my own spoon carving experience, was that whatever timber he was using he had a very sharp tool and was able to use it with great efficiency. However, by subsequently reviewing the film and looking closely at the log as he started, I was convinced that the wood was actually alder by the texture of the bark.

Jeremy was also surprised to see James cutting the basic shape of the sole with an axe rather than a stock knife and apparently cutting the rebate around the edge of the sole before hollowing the surface. In addition he remarked upon seeing James nailing the upper to the last because Jeremy had noticed the lasts in James' workshop did not have nail holes although, when using waxed kip leather and solid lasts, it was usual to nail to the last[27]. Jeremy had previously concluded that James drew the leather in with a thread to shape it so he did not damage the last.

For the crafts practitioners, the film had raised more questions than it answered. They were left uncertain about what James had done to perform for the camera rather than being his usual practice, what had been lost during the editing process, and what had been misrepresented by tasks being edited into a different order from that actually performed. From my point of view it was useful to observe

27 The upper was traditionally nailed to the last then the wax-impregnated leather was heated to mould it to shape. Once cool, the last could be removed and the upper nailed to the sole. Jeremy uses a more modern, high quality 'veg tanned' leather that is thick and supple. The upper is nailed directly onto the sole over a last that is made from two jointed pieces so is sufficiently flexible to be removed once the clog is complete.

their reaction to evidence which potentially contradicted their espoused theory and this is discussed in Chapter 5.

In the workshop Jeremy and Geraint had established much closer communication and, whilst their understanding was not always perfect, they needed few words to communicate often leaving me with a limited understanding of the issue under discussion:

GP*: Right what did I need to do with these now?*
JA*: You've got one thick on one side which is the same foot you did with ... um ...*
GP*: Oh, with the ...*
JA*: Yes.*
GP compares the soles.
JA*: You seen it? It's on the inside. No, no, bring it here.*
GP brings them over to JA, saying: *That one's ... that one looks actually ... there ... it looks thicker,* pointing to where he thinks the problem is.
JA: *I'm not so worried about that, but it is thicker there ... but I'm more worried about that.* He draws on the sole and holds the pair out for GP to compare. *You've got a curve on that.*
GP: *Oh, and I haven't on that, I can see what you mean now... I was looking at that side.*

Jeremy Atkinson interview 17.8.05 [event log JA5.2 t0.07]

On the whole Jeremy now left Geraint to work on his own. Geraint was using the sole patterns as his main guidance (Figure 54) and only consulting Jeremy when he was aware of a problem.

To explore the use of timber in clog making further, I had recruited bowl turner Robin Wood as a related expert to talk about timber with Jeremy. Whilst Robin asked different and slightly more challenging questions than I had previously, Jeremy remained forthright in his answers, maintaining that use of unseasoned sycamore was unique to the South of Wales, and I remained unable to reconcile this to my own understanding[28].

[28] For a full discussion, see section 4.3

4.2.2.6 Sixth visit: tidying up

I had arranged the final visit to the museum to fill in some gaps in my understanding and in my archive material as some of my previous footage had poor audio due to workmen demolishing scaffolding outside the workshop during two of the recordings. It was also the last working day Jeremy had planned at the museum. He had largely packed his tools away, but Geraint now had a full set so he could continue working after Jeremy returned to his own workshop.

Firstly I wished to check the order in which Jeremy performed the processes I had recorded as I had filmed parts of several clogs being made but had not observed one straight through. The need for this had been highlighted when watching the Thomas James film (see 4.2.2.5) and the uncertainty the heavy editing had produced.

I was also still uncertain about how a clog sole pattern was made from drawing around the foot. In explanation Jeremy firstly drew around my foot and then superimposed in red the pattern he had used to cut my clog sole, adding a couple of cross-sections to illustrate the reason for the differences (Figure 58). Upon completion he felt this was a good explanation and would also be valuable for Geraint to have, so took it to the office to photocopy.

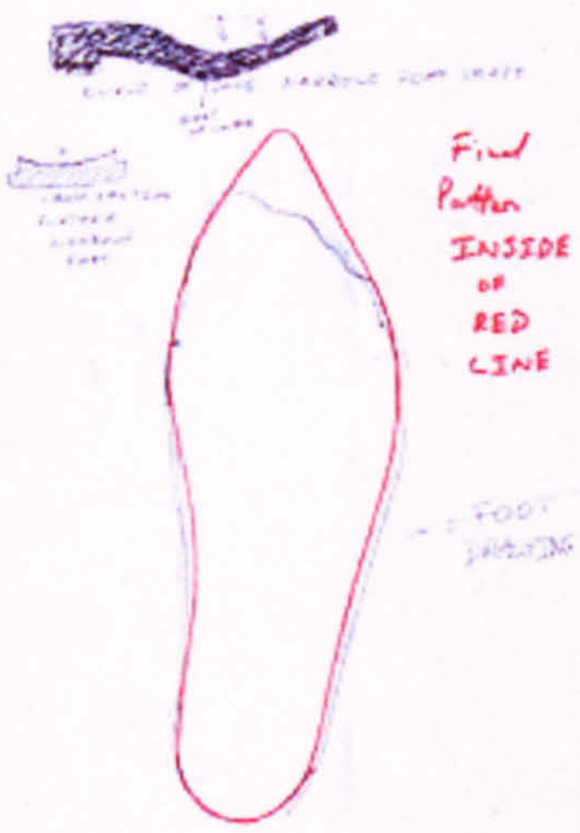


Figure 58: Atkinson's drawing of how to make a clog pattern.

By now Jeremy appeared completely relaxed in front of the camera and would voluntarily talk directly to it rather than myself if I asked for an explanation. Geraint now seemed quite self-confident in his work, but was still keen to maintain contact with Jeremy in case he encountered problems when working on his own.

4.2.2.7 Conclusion

The process of gradual immersion, prolonged observation and increasingly focused interviewing, enabled me to come to a wide-ranging understanding of the craft: tools, materials, form and function. This was achieved without the difficulties encountered in the first, tentative stage of practical work, showing that this stage of practical work was effective in refining and developing elicitation methods.

In addition, observation of interaction between the practitioner and

learner gave insight into the learning process that in this case was accelerated because Geraint had existing experience and Jeremy was teaching him a more refined way of working. Jeremy started by frequently intervening and often undertaking tasks for Geraint, he then increasingly just asked Geraint if he needed assistance, and finally progressed to waiting for Geraint to ask for help. Finally, Jeremy made a set of soles to serve as patterns for Geraint when he was working on his own and offered email backup to give support on an ongoing basis.

By taking time to get to know Jeremy and his craft I was able to ask increasingly probing questions without triggering defensiveness, but still did not find a way of dealing with the problem when his stated theory was at variance to my own understanding. This led to consideration of what 'the truth' was in this context. If I doubted one element of what I was being told, should I not doubt it all? Whilst I could 'test' a certain amount of knowledge with learners, the appeal of the multimedia resource was the quantity of rich, contextual material it could contain and I would not be in a position to verify it all.

4.2.3 Validation of elicited knowledge

During the first three visits to the Museum of Welsh Life, during the unstructured, open interviews Jeremy had related his experiences of using different timbers for clog making and his interpretation of their working properties. This description did not seem to match my own understanding and I was aware that, had I been assembling it into a learning resource it would have presented a dilemma. It was of too great an importance to completely omit, but I was not confident enough about its accuracy to include it. I also did not feel I could directly challenge it in the way I had been able to on the previous project with my partner Robin Wood and the tool handgrip (see p63). Firstly the knowledge was more subjective, and secondly I did not wish to damage the rapport we had built up.

I was aware that my understanding of Jeremy's knowledge had been pieced together from disparate comments made whilst he was undertaking other work. So, during subsequent elicitation I took the opportunity to explore this knowledge more deeply, firstly by

conducting a focussed interview situated in the context of the problem area. I interviewed him specifically about timber use in the woods near his workshop where he obtained his timber. I used more direct questioning than in previous interviews and Jeremy talked directly to me rather than chatting as he worked in the museum workshop. However, the outcome of this interview was simply to verify the knowledge I had previously pieced together, but it did not bring it any closer to my own understanding.

My next line of enquiry was whether Jeremy was being outspoken in his views when talking to me because in his eyes I was a relative novice. To test this theory I recruited an expert in a related area to undertake similar questioning: my partner, craftsman Robin Wood whose knowledge of timber was developed both from working as a woodsman for the National Trust and from his own craft skill.

Jeremy and Robin knew each other as craft practitioners and usually demonstrated considerable respect for each other's craft skills. Out of deference to Robin's knowledge of timber, I anticipated Jeremy would be less forthright and would demonstrate some differentiation between knowledge of which he was assured and that which he considered speculative. I had also hoped to see some display of tacit understanding during the discussion in a similar manner to Robin and Martel (see section 5.4.4, p126).

However, during this interview I observed no sign of respect for each other's different beliefs or any tacit communication. Jeremy remained outspoken in his explanations and Robin was relatively quiet in a style I took to mean he did not believe Jeremy but wished to avoid conflict. Afterwards Robin confirmed that this was so. I was now no further forwards in understanding our differences, so proceeded by looking more deeply at a specific problem area, the roots of my understanding of it and the broader literature on clog making.

4.3 Boundaries of knowledge

In this section I present an investigation of the differences that emerged from the practical work between my understanding and that of the practitioner based on re-evaluation of the event logs, reappraisal of the video and wider contextual research. I uncover the basis of my unease with the practitioner's understanding of the historical usage of timber described in the previous section in two more discreet issues: the use of unseasoned timber and the choice of timber species, and speculate on the reasons for Jeremy's interpretation.

I conclude by examining the role my own specialised knowledge played in making sense of the situation and propose working methods for designers working outside their own area of knowledge by making use of expert learners. I also reflect on the importance of choice of media in representing and interpreting elicited knowledge.

4.3.1 The problem area

Originally Jeremy was taught how to make clogs using seasoned alder which had become the most common method when industrialisation caused high demand (Fitzrandolph & Hay 1926, p64). He was told, by an old traditional clog maker whose craftsmanship he respected, that unseasoned sycamore was traditionally used for clog making in that area of SW Wales and, through experimentation, Jeremy taught himself how to use it.

Jeremy asserted these clog makers had learned to use unseasoned sycamore from the local bowl turners who made dairy bowls:

> *"I think that because they used sycamore for quite a lot of things ... they knew how to work it. They used it for bowls mainly, I'm sure they were working green. You see all the other woods that you use for clog making you work dry. You don't work them the same way as sycamore at all ... I think they cut green sycamore for that [bowls] and as craftsmen always talked to each other and always have I think that's how they [clog makers] came to use sycamore."*
>
> Jeremy Atkinson interview 23.7.05 [event log JA2.1 t0.22]

Whilst the crossover of skills was feasible, what I found most difficult

was his understanding of the way in which the bowl turners used the wood. Jeremy implied that it was usual to work dry timber and that working unseasoned sycamore was unique to this area because the bowls were used in the dairy trade and never dried:

> *"All the nests of bowls I think were down in West Wales and I think a lot of them were with dairy equipment. ... My theory is that they cut the stuff green, they went off to market, they went back into a dairy again, they got washed down twice a day, the water content is probably the same as they were green. So, what's the point of doing it dry? I mean if you're doing it dry and it gets full of milk and cream and then it gets washed out and its in a cool scullery then probably its water content is very much the same as it was as a tree."*
>
> Jeremy Atkinson interview 23.7.05 [event log JA2.1 t0.18]

This provided two issues to seek a deeper understanding of: the use of seasoned and unseasoned wood, and the choice of timber species.

4.3.1.1 Seasoning timber

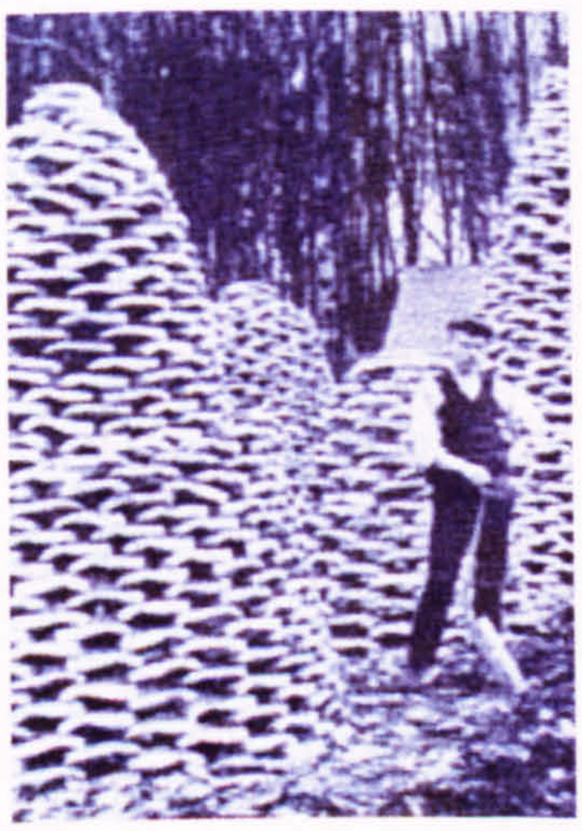


Figure 59: Clog blocker with rough-cut soles 1910.

Firstly, considering the use of unseasoned wood in bowl turning, Robin Wood's research showed this was the way nearly all old bowls were made, confirmed by their characteristic oval shape caused by uneven shrinkage during the subsequent drying process (see below). In his experience unseasoned wood was used because it cut much more easily with hand tools before it was fully seasoned.

In the documented history of clog making, alder and birch were the most commonly used clog timbers. Itinerant labourers would fell the trees and rough-cut them into clog-blocks which would be sold to clog makers who would refine the shape and nail on the uppers. Jones (1927, p46) states, "the blocks must be left to dry for some months before they can be shaped into soles."

Jeremy was of the opinion this was because otherwise it would split. His experience of working alder dated to the 1970s when he was originally taught the craft:

> *"... what we used to do was we'd go out, we'd cut a tree down, we'd come back, we'd rough cut it and ... we'd leave it on the north side of a stream, under cover against a wall. I mean you couldn't get a damper place. It would be left there in the air to circulate on a rack for six weeks, maybe, at least five. If you didn't do that it would crack on you."*
>
> Jeremy Atkinson interview 23.7.05 [event log JA2.1 t0.28]

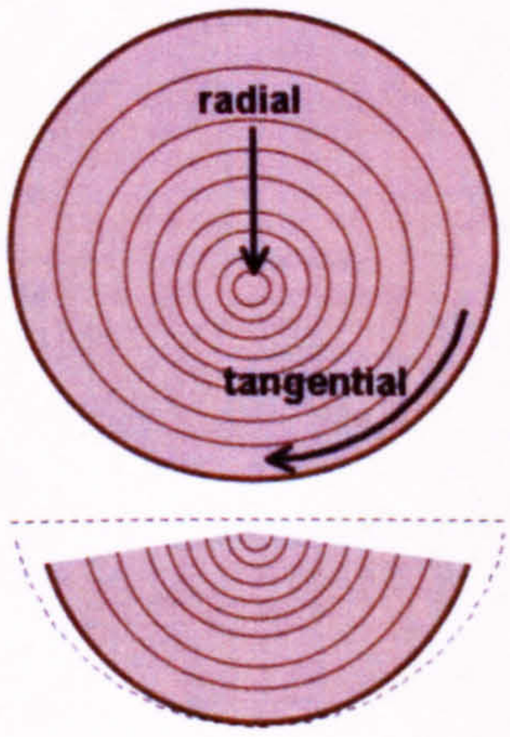


Figure 60: Timber shrinkage.

Robin's experience of working green alder was that it suffered from a large amount of shrinkage as it dried. As this shrinkage was not even; tangential shrinkage can be as much as twice radial shrinkage (Figure 60) the wood will definitely warp and could split. To stop the splitting, his method of working any green wood, but particularly alder with its high rate of shrinkage, was to remove the pith and central few growth rings where the tension was at its greatest.

Jeremy's experience of the problems of cracking might have been caused by his teacher's inexperience, as at that time he too was quite new to the craft. Thirty years later when teaching Geraint, this teacher appeared to have overcome the problem in the same way as Robin describes:

> JA, splitting the remaining log in two: *"When you cut alder you are supposed to get rid of the centre anyway."*
> NW & GP: *"Mmm."*
> JA: *"So Rob [Robin Wood] told me"*
> GP: *"Trevor [the teacher] told me that as well."*
> JA (sounding surprised): *"Did he? ... Must be true then, must be."*
>
> Jeremy Atkinson interview 1.8.05 [event log JA3.4 t0.19]

As the itinerant block-cutters were able to cut and dry whole blocks presumably without many of them splitting, this must have been common knowledge at the time and it should have been equally feasible to cut and dry complete soles without them splitting. I feel a more likely reason for this not being done was because the sole would shrink and warp as it was drying making it uncomfortable and uneven to walk in.

4.3.1.2 Timber type

With regard to the unique suitability of sycamore, archaeological remains demonstrate that a large range of different timbers were regularly used to make bowls and Robin successfully turns using many British hardwoods (Wood 2005 p35). Traditional bowl turners however demonstrated local preferences. In 1936 traditional Irish turner, Joseph Hughes claimed the only woods suitable for turning bowls were sycamore or horse chestnut, "other trees, such as ash, beech etc. would not make dishes satisfactorily because after a short time they would crack" (ibid p165). Similarly, George Lailey (1869-1958) who

lived near Reading used only elm (ibid p153).

In a review of the literature on historical clog making I found evidence for a wide range of timbers being used for the soles, but that there were clear regional preferences. During an extensive survey of rural crafts when there were still a good number of practitioners, Jones (1927) observed that most clog makers used only one type of timber and "are convinced that no other kind is suitable".

4.3.2 Understanding the knowledge

It could be deduced that the traditional craft practitioners described above had adapted their techniques to using timber that was accessible in their locality and suitable for their purpose. As they were not familiar with the working properties of other timbers they asserted that this was the only way to work and as people did not travel far there was little reason to question this knowledge.

Jeremy, having had a bad experience with alder, put his energy into learning to use sycamore. Having solved his problem through switching tracks he was disinclined to re-examine why he had struggled with alder, preferring to believe it was the fault of the wood. In his case, I feel it was not the limitations of travel but lack of other craft masters that left these assumptions unchallenged.

Accepting such local knowledge as universal does not appear to have harmed any of their practices, although it would be interesting to consider what might have happened had the virulent form of Dutch elm disease that struck England in the mid-1960s arrived earlier. Lailey would have been forced to either re-asses his understanding and discover another timber he could make bowls from, or find a new profession.

The outcome of this for the learning resource design is to highlight the importance of the mode of representation used and the learners' response to it. Material presented in the 'guidance' section extracted from its context is liable to be interpreted by novices as fact, so it needs to be verifiable. In reality the facts are not necessarily *the* way of undertaking the task, but *a* way that is recommended as a starting point. The remainder of the material must be maintained in its original

context so, as the novices develop their skills they can form their own opinions and make their own judgements. The original video therefore needs to be retained as shot and in its entirety.

This is discussed further in the Craft Knowledge chapter (p99) when I consider the role of reflection in craft learning and what leads practitioners to expand their skills or become entrenched in their existing knowledge.

4.4 Conclusion

The underlying elicitation method of conducting increasingly focused observations and interviews in the workshop produced valuable material without triggering the defensiveness encountered during formal elicitation sessions in the previous practical work. In the context of this research the amount of time I spent recording the clog makers was useful, but in terms of elicitation for the learning resource it did produce unwieldy quantities of material that taxed even my usually efficient event logging process. In future work I would plan a more streamlined series of recordings allowing myself greater time in between each to process and reflect on them.

I felt the presence of the learner in the workshop was extremely beneficial in providing the expert with the context in which the material would be presented. The expert was already interpreting his practice for a novice and this offered the opportunity for him to rehearse his interpretation of his skills with meaningful feedback from a person who was attempting to apply it. Whilst it was not possible during this project, I felt it would have been beneficial to have made greater use of the learner in a similar manner to the learners recruited during the bowl turning project. In future research I plan to work with an 'expert learner' who can provide feedback on their learning, act as an active elicitor and assist with interpretation for a learning resource.

Unpicking the possible origins of the clog maker's beliefs alongside my own and the bowl turner's provided insight into the context-specific nature of such knowledge. The concepts of 'true' and 'false' do not apply in this context and that 'helpful' and 'unhelpful' are more applicable although this may depend on the individual receiving the knowledge. The interpretation at the 'guidance' phase of learning is therefore not 'the way to do it' but 'the recommended way of starting'. This highlights the importance of also retaining the original video so the learners can see the context in which the material was elicited and draw their own evaluation when they are able.

This is considered in more detail in the next chapter in which I consider

the nature of craft knowledge and speculate on the process of craft learning.

5 Craft knowledge

"... in all things that we see or do we are to desire perfection and strive for it, we are nevertheless not to set the meaner thing in its narrow accomplishment above the nobler thing in its mighty progress ... not to prefer mean victory to honourable defeat; not to lower the level of our aim, that we may the more surely enjoy the complacency of success."

John Ruskin *The Nature of Gothic* (1853 p84)

5.1 Introduction

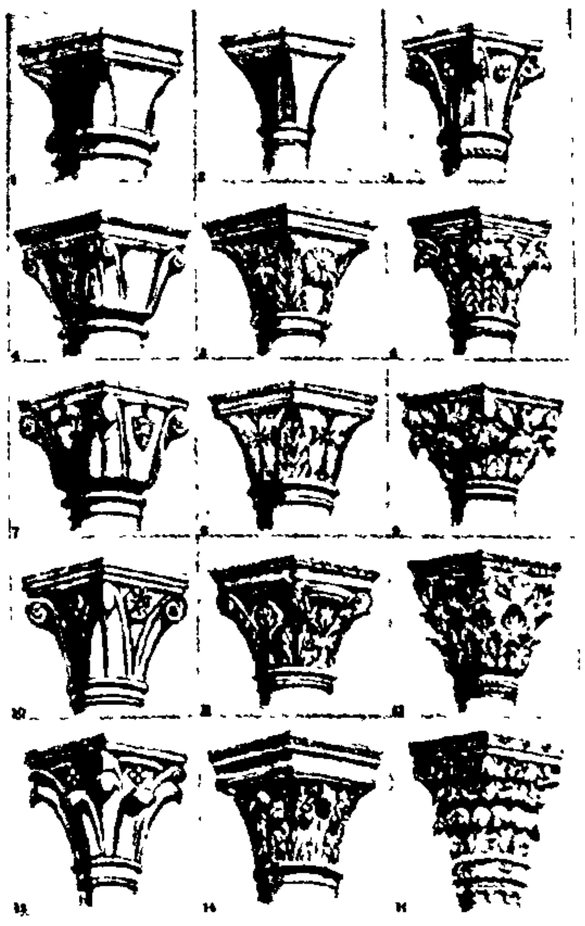


Figure 61: Ruskin's Gothic capitals.

In this chapter I describe the development of a framework for understanding the learning of craft skills drawing on the theories of John Dewey, Michael Polanyi and Donald Schön and validated through reappraisal of the practical work described in chapters 3 and 4.

I start by describing the decline and revival of clog making skills, a story that was initially related during the elicitation described in the previous chapter and then validated through further investigation into the literature on the craft. This demonstrated the difficulty in resurrecting such crafts without the critical appraisal of the wider community of practice.

I then provide a contextual review of literature, firstly setting the historical background for the revival of interest in traditional crafts and then considering literature on the tacit nature of craft knowledge and its means of transmission. I use this to reappraise the practical work undertaken with the bowl turners and clog makers and gain a deeper understanding of the ways in which craft skills can be learnt.

I conclude with a speculative framework for understanding craft skills learning, based on explicit concepts being used to bridge the gap in personal knowledge between a novice and an expert, and on reciprocal reflection as the means by which novice and expert refine their

communication. I also consider in greater depth the role of reflection for the self-directed learner and its influence on the path their learning might take.

5.2 Clog making skills

5.2.1 Introduction

In this section I plot the decline and revival of clog making skills. A by-product of the recordings described in the previous chapter were biographies of two other Welsh clog makers and implied differences in relative skill levels. As this material was largely anecdotal, I undertook some wider research into the history of clog making to gain a better understanding of how these people learned their skills.

Whilst the industrial revolution led to a high demand for clogs, the resultant increasing mechanisation of the process led to a gradual erosion of both the design of the product and the hand craft skills which only remained in isolated areas. The influx of 'hippies' into rural Wales in the 1970's stimulated a new demand for clogs and through research and experimentation Jeremy Atkinson was able to trace the original skill back and revive it.

The resultant picture this created of the last remnants of this once-ubiquitous craft resulted in my speculating on the nature of such learning which creates the remainder of this chapter.

5.2.2 Biographies

5.2.2.1 Thomas James

Figure 62: Thomas James.

Thomas James was born in the early 1890s and learned the skill by becoming apprenticed to a local clog maker in his early teens. He was well into his 70s before he fully retired and into his 90s when he died. A series of photos taken in 1961 are held in the archive at the Museum of Welsh Life and also appear in *Traditional Country Craftsmen* (Jenkins 1965). The museum also has a short film of him working produced by HTV in 1963.

Atkinson thought he was the last traditional Welsh clog maker: the last to both hand carve the soles from unseasoned sycamore and make the uppers from waxed kip leather. He had first visited James' workshop in 1980 at which time James apologised for no longer being fit enough to

show Atkinson what he did but allowed him to look around his workshop. Atkinson visited again after James' death and bought some tools from his son who had not continued the tradition.

5.2.2.2 Trevor Edwards

The history of how Trevor Edwards learned clog making was not entirely clear, but Atkinson thought he was in his 20s when he learned, having found a retired craftsman who was prepared to teach him. He had not served a traditional apprenticeship, only learning to hand carve the soles from alder and buying in ready-stitched uppers to complete the clogs. Edwards taught Atkinson to make clog soles in the late 1970s, firstly informally, then for 6 months on a government-funded scheme. After he retired he continued to demonstrate his craft occasionally and also provided some tuition to Parfitt (see below).

Figure 63: Jeremy Atkinson.

5.2.2.3 Jeremy Atkinson

Jeremy Atkinson described his early training as "ten months faffing about and six months training" at Edwards' workshop in the late 1970s. He had previously been undertaking teacher training, but had dropped out and wanted to "do something with his hands". He claimed to have chosen clog making as a craft because Edwards was the first craft practitioner he found who would take him on as an apprentice [JA4 t1.09].

He produces finely finished clogs with hand carved sycamore soles and hand made leather uppers. At the time of interview, he was undertaking most of his clog making whilst demonstrating at craft fairs during the spring and summer months, spending the autumn and winter months undertaking freelance footpath survey work.

He had attempted to teach his craft to several different people over the last 20 years, but had not felt any showed the talent or perseverance to succeed. None followed him into professional practice. Parfitt was the first novice he felt demonstrated the potential to make a successful clog maker and Atkinson provided him with tuition at the Museum of Welsh Life for a total of three weeks in 2/3-day periods during July/August 2005.

Figure 64: Geraint Parfitt.

5.2.2.4 Geraint Parfitt

Geraint Parfitt had been employed as a room steward at the Museum of Welsh Life, Cardiff, when he became interested in clogs after exploring the archive material held there. In his spare time he started to learn the craft from Edwards who had retired from full-time making, spending a total of about two months with Edwards over a four year period, supported by practicing on his own when he had spare time.

Edwards put him in touch with Atkinson, perhaps prompted by incidents such as the one described below, and Parfitt started spending his free time with Atkinson instead. He then persuaded the museum's management to find funding for Atkinson to help him advance his skills during summer 2005. The museum subsequently promoted Parfitt to craft demonstrator at the beginning of 2006 and he had set up a workshop at the museum which was open to the public.

5.2.3 Considering the evidence

Emerging from these profiles was an implied difference in skill levels of the three 'master craftsmen': James, Edwards and Atkinson. Atkinson was of the opinion that Edwards had degraded the craft and his own work had both restored it to James' level and additionally progressed beyond that.

Whilst this was Atkinson's subjective opinion it was partially substantiated by Parfitt who, prior to meeting Atkinson, was also not impressed by the quality of Edwards' work or his teaching, as illustrated by his relation of the following incident:

> *I was working over at Tannoy ... in the workshop there and [Edwards] was training me. He went off for lunch and I'd started a sole and he said, "Finish it by the time I come back." ... So I went rummaging around and found one of the soles that he'd finished and I gave it to him and I said, "What do you think of this?" "Aye," he said. "It's not very good see, 'cos ..." this, that and the other. However it was one of his own soles he'd cut. He couldn't tell and I said, "That's one of yours mate." I don't think he ever forgave me for that!*
>
> Geraint interview 1.8.05 [event log JA3.2 t1.13]

These judgements of the relative skills of James and Edwards were verified by further research into the major criticism they had of Edwards' clogs, the shape of the sole. A wooden sole will not bend as the wearer walks so it must be curved to roll with the foot. This curve is known as the spring and the point at which it starts is critical. If it is too far behind the ball of the foot the wearer will not be able to stand still, or as an old clogger commented "a chap would be always rocking like" (Hartley 1939). If the spring is too far in front of the ball of the foot, the wearer will have to lever the clogs forwards as they walk causing their heels to ride up and down in the back of the clogs causing discomfort.

Figure 65: My own clogs made by Atkinson.

Atkinson recommended starting the spring just behind the ball of the foot, as illustrated in Parfitt's notebook below, and my experience of walking in the clogs he made for me was that this did enable my heels to remain in contact with the soles of the clogs for most of my stride. The clogs I was shown that had been made by Edwards, and those made by Parfitt under Edwards' tutorage, were quite flat in profile and the spring started after the ball of the foot. Whilst none of James' clogs were available to view, Atkinson had some photographs of soles cut by him and I found several more in books. Close inspection revealed that, whilst they were much less curved than Atkinson's, the start of the spring was clearly behind the ball of the foot (see Figure 66).

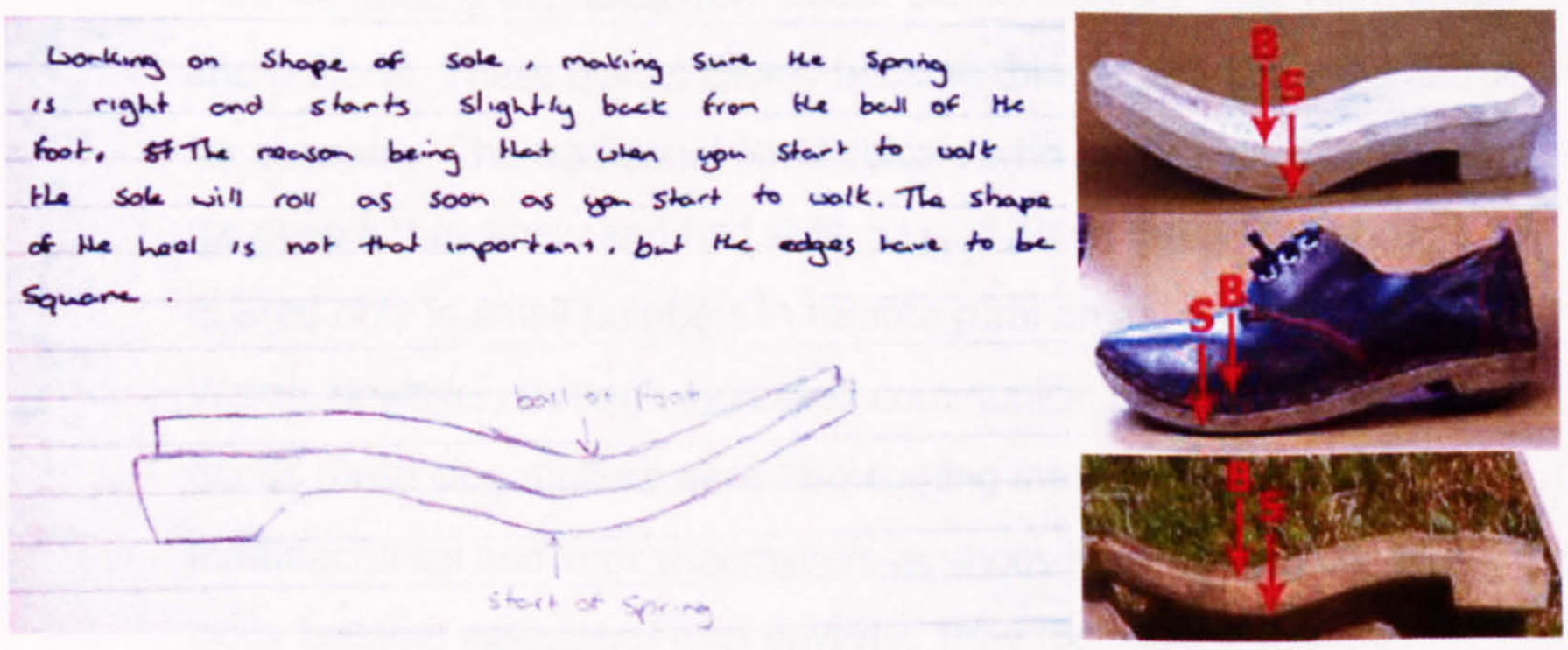


Figure 66 Above: clog sole drawing from Parfitt's notebook. Right: soles made by (from top) Atkinson, Edwards and James showing start of spring (S) and ball of foot (B).

An additional internet search for images of old, hand carved clogs produced five more examples, all of which appeared to confirm Atkinson's rule of starting the spring just behind the ball of the foot:

Figure 67: Clogs with hand cut soles from Hawes C20th (top l), Wrexham C19th (top r), Scotland C19th (centre), Dumfries 1943 (bottom l), Scotland 1936 (bottom r).

5.2.4 Conclusion

In the 1927 government survey of rural 'industries', Jones plotted the start of the decline of clog making skills (Jones 1927). The industrial revolution had generated a huge demand for clogs and a gradual mechanisation of their production. Firstly came the blockers who rough cut alder or birch soles in the woods and transported them to urban areas where the final shaping was undertaken in large workshops employing huge numbers of makers. Then the factories took over, machine cutting the soles from beech planks because they were cheap and uniform. These planks clearly became thinner and the soles flatter for economy. The traditional hand cutters who made individual clogs for people they knew and had skills passed down the generations existed only in small numbers in remote rural areas, particularly West Wales. However, through increased communication and transport of goods these clog makers were also coming into competition with clog manufacturers and with shoemakers as shoes became cheaper and clogs become associated with poverty. They too were starting to economise and buy in ready-made soles, uppers or both and put the two together.

I would speculate that James represented the end of the hand carving tradition: one of the last of the makers who had learned through informal apprenticeship and followed the profession all his life.

Following the decline described above, Edwards appears to have learned to manipulate the tools but not the importance of the form of the clog to its function. Ten years later Atkinson was able to revive the craft through contact with the last remaining skilled craftsmen who remained in rural areas of Wales and Northern England and much experimentation. Perpetuation of the craft is still uncertain with Atkinson having only passed his skills onto Parfitt although, with the Museum of Welsh Life's support, he should have a good chance of continued practice and possible the opportunity in time to teach.

Figure 68, below, provides a representation of the development of clog makers' skills over time. This is not intended as a measurable graph, but more as a visual aid to perceiving the relative skills of craftsmen described above.

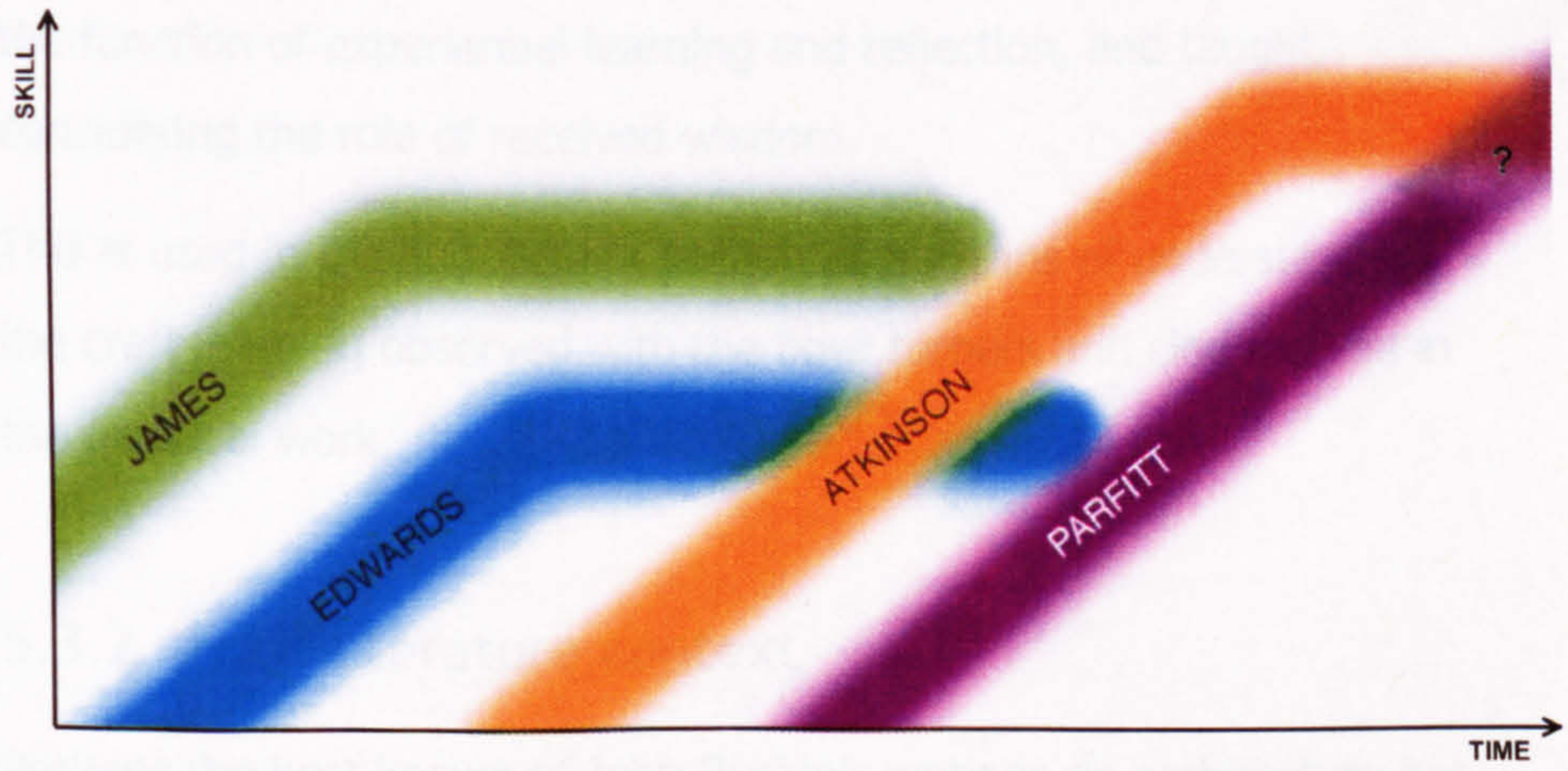


Figure 68: Representation of clog makers' skill levels.

In the next section I shall speculate on factors influencing the growth of a practitioner's skill, reasons for skills levelling off and likely causes of novice practitioners 'breaking through' the skill levels of their masters.

5.3 Contextualising craft knowledge

5.3.1 Introduction

In this section I present a brief historical context to the revival of interest in traditional craft skills starting with John Ruskin and the resultant arts and crafts movement. Whilst this degenerated into an argument that hand-made was good and machine-made bad, David Pye returned the focus to Ruskin's original concept, the mind-set of craftsman.

I then consider the theories of Michael Polanyi, John Dewey and Donald Schön, providing insight into the personal nature of craft knowledge. I discuss the ways in which it can be learned, considering the function of experiential learning and reflection, and taught, considering the role of received wisdom.

This is used in the subsequent section as a means of understanding the craft learning observed with the bowl turners and clog makers in the practical work.

5.3.2 Craft literature context

Perhaps the best known of John Ruskin's writings on architecture has the full title "On the nature of Gothic Architecture: and herein of the true functions of the workman in art" (1853). His argument was that the true beauty of Gothic architecture could only be understood through understanding the mindset of the craftsmen who produced it. What made Gothic architecture stand out from more modern architecture to Ruskin was its freedom of form which he felt came about through the freedom of thought and action allowed to the workmen. This freedom enabled Medieval craftsmen to take risks which might generate imperfections, but also allowed a speed and fluidity of work which created what he considered to be spiritually uplifting architecture. He called upon craftsmen to "do what you can, and confess frankly what you are unable to do; neither let your effort be shortened for fear of failure, nor your confession silenced for fear of

shame" (Ruskin 1853 p83).

Ruskin's writings inspired the Arts and Crafts Movement and in particular William Morris who did much to promote craft skills and products, seeking to restore the life of working men and women through reviving an interest in traditional crafts. He condemned the increasing separation of 'art' and 'craft', with the latter becoming mere manual labour to the detriment of the craftsmen whose "working lives have been one long tragedy of hope and fear, joy and trouble" (Morris 1877 p238)[29]. At that time, Morris's utopia of the working classes employed hand making beautiful domestic objects that they could also beautify their homes with was unreasonably idealistic: in the social conditions of the period only the affluent classes bought such hand made goods.

Nearly 100 years later in *The Nature and Art of Workmanship,* David Pye reflected on the increasing degradation of the argument into a promotion of hand-made over machine-made work and argued for a return to Ruskin's original concept: "The intrinsic importance of these ideas is not diminished by the fact that so much rubbish has derived from illegitimate extensions of them" (Pye 1968 p70). He sought to establish an understanding of craft skill based on the likelihood of actions undertaken by the workmen having a negative impact on the quality of what was being produced. At one end of the spectrum was the workmanship of risk that was "using any kind of technique or apparatus, in which the quality of the result is not predetermined, but depends on the judgement, dexterity and care with which the maker exercises as he works." At the other end was the workmanship of certainty where "the quality of the result is exactly predetermined before a single saleable thing is made" (ibid p4). Pye promoted modernisation of the craft process by moving the focus of attention away from the hands of the craft practitioner towards the head. The use of machines became 'permitted' in Pye's definition providing it was intelligent use involving personal management of the inherent risks.

[29] The debate regarding the divide between art and craft continues to this day, for example on the Craft Research blog [on-line], and whilst of interest to me I feel it is not directly relevant to this research which is focussed on skills rather than the resultant artefacts.

5.3.3 Tacit knowledge

Both William Morris and Christopher Alexander suggested that the risk management associated with craft skill was not necessarily a conscious process. Morris, in a lecture on the 'lesser arts' (1877 p241), referred to traditional craft skill as "the art of unconscious intelligence" and Alexander referred to such work as "the products of an unselfconscious culture" (1964 p33). However, Michael Polanyi provided the greatest insight into the nature of the knowledge that governed such craft practices.

Polanyi sought to challenge the perception of scientific knowledge as an exact, impersonal entity through drawing parallels with more creative professions and seeking an understanding of the knowledge that governed them. In the book *Personal Knowledge* (1958), he proposed that any expression of knowledge was greatly influenced by a complex range of knowledge possessed by the person in the act of knowing. He suggested that, whilst explicit rules or formulae might influence a skilful performance, it was actually the performer's wider personal knowledge that played the largest role in guiding the performance. He observed that much of this knowledge was so internalised and interwoven it was not possible to express: "we can know more than we can tell" (Polanyi 1966 p4) and such knowledge became widely known as tacit knowledge.

On a purely functional level, tacit knowledge could be seen as offering advantage to the craft practitioner by reducing cognitive load, freeing the mind from one level of a task to enable thought to be directed at another. Polanyi (1958 p55) referred to this as "two kinds of awareness": focal awareness and subsidiary awareness. On a simplistic level he illustrated the point with the example of hitting a nail into a piece of wood. The actor's hand is in direct contact with the tool handle, but there is only a subsidiary awareness of this and the focal awareness is on the impact between the end of the hammer and the nail. The person hammering is able to tacitly adjust the speed and direction of the hammer blows whilst concentrating attention on the nail entering the wood.

In *The Tacit Dimension,* Polanyi advanced this concept to two terms of

tacit knowing, the proximal and the distal. He described the functional relationship between these terms as knowing the proximal only by relying on our awareness of it for attending to the distal (Polanyi 1966 p10). We only know the whole of the theory that governs how we adjust the blows of the hammer by relying on it whilst in the act of driving the nail into the wood. This is why craft practitioners have difficulty describing the theory that governs their actions, they only know it through attending to their practice. He further described the phenomenal structure of tacit knowing as that we attend from the proximal to the distal: we attend *from* the theory *to* things seen in its light, hence theory could only be learned through practising its use, a process he called interiorisation (ibid p17).

Polanyi also considered the reverse of this process, where the focus of the practitioner's attention was returned to the theory. The immediate result of the action becoming proximal and the theory distal was often a complete loss of meaning; "By concentrating attention on his fingers, a pianist can temporarily paralyse his movement" (ibid p18). However, Polanyi believed the long-term effect need not be negative, destructive analysis of such knowledge followed by re-interiorisation could result in a more secure and accurate basis for practice (ibid p19).

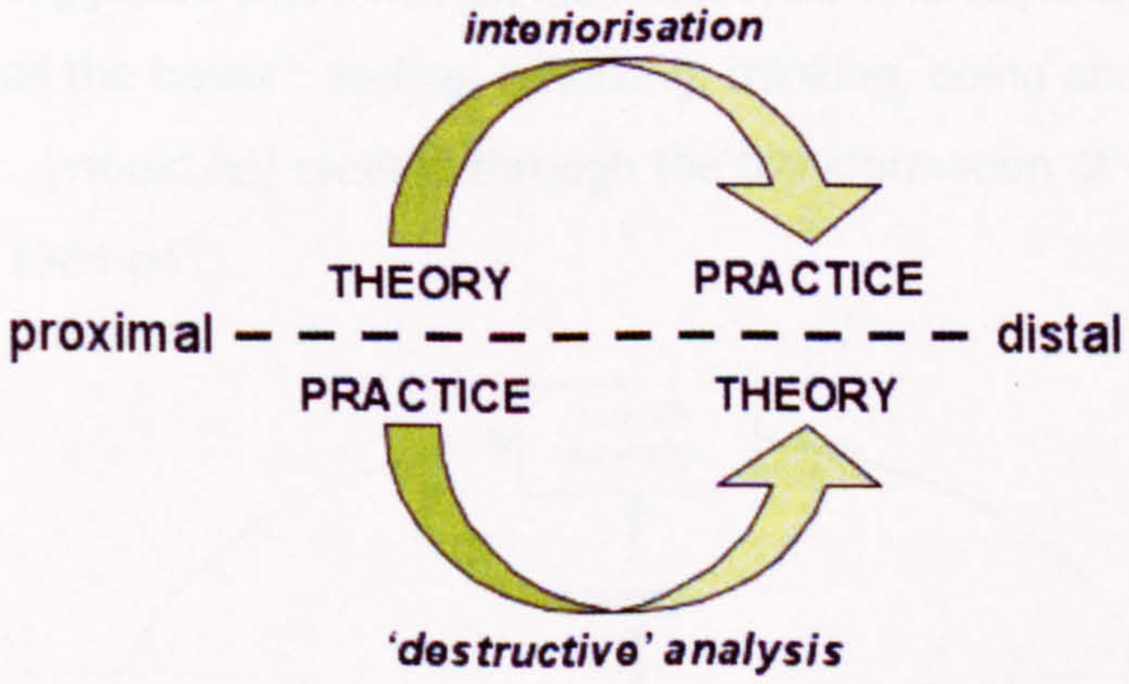


Figure 69: My interpretation of Polanyi's theory[30].

This was described prosaically by John Ruskin:

> *You can teach a man to draw a straight line ... and to copy and carve any number of given lines or forms, with admirable speed and perfect precision; and you find his work perfect of its kind: but if you ask him to think about any of those forms, to consider if he cannot find any better in his own head, he stops; his*

30 This is purposefully represented as two separate processes above and below the dotted line as I do *not* wish this to be interpreted as a cyclical process.

execution becomes hesitating; he thinks, and ten to one he thinks wrong; ten to one he makes a mistake in the first touch he gives to his work as a thinking being. But you have made a man of him for all that. He was only a machine before, an animated tool."

John Ruskin 1853 p84

5.3.4 Experiential learning and reflection

Whilst Polanyi and Ruskin suggested that attending from practice to theory could be destructive until turned back into action, there also exists a body of thought that in the right circumstances it could be entirely constructive.

A major strand of John Dewey's educational philosophy was that an experiential continuum was essential to a practitioner's performance, leading to a development of both emotional and intellectual attitudes to practice that influenced their further action (Dewey 1938 p250). From this, David Kolb developed a model of experiential learning consisting of two opposing modes of gaining experience of the world: concrete experience (feeling) and abstract conceptualisation (thinking); and two opposing modes of transforming that experience: reflective observation (reflecting) and active experimentation (doing). He suggested there was an idealised cycle whereby a learner would "touch all the bases": feeling, reflecting, thinking, doing and "knowledge ...[would be] created through the transformation of experience" (Kolb 1984 p41).

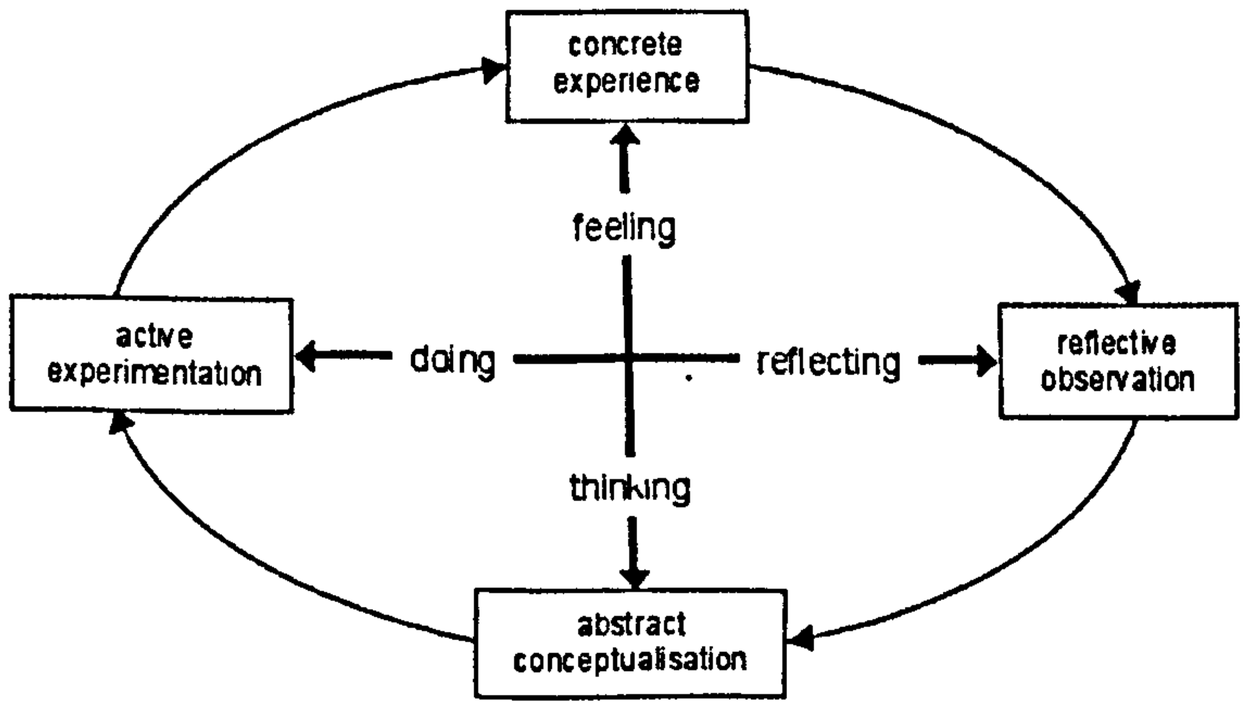


Figure 70: Kolb's experiential learning model.

The problem with this representation, as discussed with regard to action research, is that it appears to represent a sequential process and this is rarely borne out in practice (see Methodology p16). However, viewed in the light of Polanyi's concepts: to the left, practice

(concrete experience) is being attended to from theory (abstract conceptualisation) with the interiorisation taking place through a process of active experimentation. To the right is the converse with theory being attended to from practice through a process of reflective observation, however this is now viewed as a constructive process, rather than Polanyi's destructive analysis.

Donald Schön gave insight into the reflective process through studying the nature of professional practice with a view to understanding what made those at the top of their profession exceptional. He described a concept similar to Polanyi's 'personal knowledge' that he called 'knowing in action': "When we go about ... spontaneous, intuitive performance ... we show ourselves to be knowledgeable in a special way. Often we cannot say what it is we know. ... It seems right to say our knowing is in our action" (Schön 1983 p49). Prior to describing in detail his modes of reflection, I shall clarify my understanding of three of his key concepts:

- action-present: the period of time in which action could still make a difference to the situation, depending on the practice this could be anything from a matter of seconds to hours or even days (ibid p62).
- knowing in action: the knowledge that guides skilful performance but does not depend on the practitioner being able to describe what he is doing or even being consciously aware of the knowledge behind his actions (Schön 1987 p22)
- knowing in practice: a practitioner's professional knowledge, encompassing both the professional context of the practice and the activity involved in undertaking and developing the practice (Schön 1983 p60).

The first, and simplest, mode of reflection identified by Schön is reflection *on* action (1987 p26). In this situation an unexpected event caused the practitioner to stop and reflect upon the likely causes outside the action present. Having thus identified a likely solution the practitioner would undertake new action to test the explanation, revising their knowing in practice.

Whilst Schön was slightly dismissive of such reflection as it was not a

sign of a mature professional, from an educational perspective John Dewey sought to promote a similar course of action: "To be intelligent we must 'stop, look, listen' in making the plan of an activity" (Dewey 1916 p235), a three stage process of observing the current situation, considering alternative solutions then forming a plan for progressing. This clearly relates to Polanyi's 'destructive analysis' where actions are initially frozen but a clearer understanding is achieved through re-interiorisation of the theory through further action (Polanyi 1958 p50).

Dewey (1933 p5) considered the wider educational goal however to be a more fluid thought process. Key to this was a successive chain of thoughts building upon each other and moving towards some sort of a solution, although that solution may not be a final conclusion, merely a stepping-stone on the way. Schön echoes this in his description of reflection occurring entirely in the action present. In such an instance, rather than 'stop, look, listen', the practitioner remained absorbed in the task. The 'surprise' caused him to consider more closely and critically his current understanding of the procedure he had tacitly been carrying out, use his understanding of the 'surprise' to construct a new understanding, then test this with an on-the-spot experiment, thus revising his knowing-in-action (Schön 1983 p62).

Schön also described a more advanced stage of reflection in action where primary consideration of the 'surprise' did not lead the practitioner to a new understanding, so instead he found a new way of framing the problem, to see if this would bring about an alternative understanding of the situation (Schön 1983 p62). This required the skilled practitioner to assume one set of values to be constant to enable a test to be carried out on others and a conclusion reached before considering a further re-framing and re-testing of the question. "Constancy of appreciative system is an essential condition for reflection-in-action. It is what makes possible the initial framing of the problematic situation, and it is also what permits the inquirer to reappreciate the situation in the light of its back-talk" (ibid p272).

This concept was advanced by Chris Argyris who worked extensively with Schön studying the behaviour of individuals within business organisations and observed that individuals had two distinct theories of action: espoused theories and theories in use. Their espoused theories

consisted of the beliefs, values and attitudes which they advocated employing. Their theories in use were those they actually employed, of which they were not always aware and these were not always consistent with their espoused theories. When an individual discovered a gap between their espoused theory and their theory-in-use their natural tendency was to preserve their espoused theory, or at least minimise damage to it , by seeking an easy explanation for the difference: this was what he referred to as 'single-loop' learning (Argyris 1995).

More unusual, but from his observations by far a better strategy, was for the individual to use the perceived difference between the theory in use and the espoused theory as a means of re-assessing the governing values behind the espoused theories: what he called 'double-loop' learning. The key issue was that double-loop learning was far more than just reflecting on the actions taken in single-loop learning. It required the individual to undertake actions to challenge their established view of their whole practice (Argyris 2003).

This took professional development away from the narrow, problem-solving perspective, towards a more holistic concept of the practitioner being able to re-assess and move forward knowledge within their craft practice generally. Polanyi (1958 p196) referred to "the essential restlessness of the human mind", where practitioners exhibited a natural desire to make discoveries by setting themselves new problems. In the process they established new theoretical frameworks, tested them, potentially destroyed all or part of them, but in the process established some form of new knowledge. He suggested that it was only through complete immersion in the field of study, a state he refers to as indwelling, that the existing limits to knowledge be broken down:

> *Scientific discovery ... bursts the bounds of disciplined thought in an intense if transient moment of heuristic vision. And while it is thus breaking out, the mind is for the moment directly experiencing its content rather than controlling it by the use of any pre-established modes of interpretation: it is overwhelmed by its own passionate activity.*
>
> Polanyi 1958 p196

The next consideration is what makes a practitioner behave reflectively? John Dewey highlighted the importance of the attitude of

the practitioner towards their practice, particularly their response to an unexpected event: something that interrupted usual routine or the discovery that the usual solution to a problem was not working, and this needed to generate doubt to stir the practitioner into seeking a solution (Dewey 1933 p14). Polanyi referred to it as "a first stage of perplexity" (1958 p120) and Donald Schön described the practitioner being "stuck in a problematic situation which he cannot readily convert to a manageable problem" (1983 p63). The practitioner must move from a state of certainty, where actions are instinctive and even mechanical, to a state of uncertainty where an indeterminate action is needed to restore the situation.

However, the practitioner might look for an easy solution, jumping at the first answer that occurred to him out of laziness or impatience (Dewey 1933 p16), or they might side step the problem in an effort to preserve their current knowing-in-action (Schön 1987 p26). This is the process referred to as "single loop" learning by Argyris (2005) where action was taken to preserve rather than question the theory in use. Alternatively, Dewey suggested the practitioner may be prepared to prolong the state of doubt and embrace the problem as something of interest in its own right, using it as a "stimulus to thorough enquiry" (1933 p16), providing they were prepared to be:

- open-minded: open to alternatives in an active, positive way
- whole-hearted: taking absorbed interest in the subject at hand
- intellectually responsible: ensure the train of thought is consistent and followed through to the end (1933 pp30-32)

5.3.5 Received wisdom

So far the consideration of developing craft skills has been focussed on self-development by the practitioner, but I feel it is important not to neglect the importance of the accumulated knowledge of previous generations of practitioners. Given that much of this knowledge is tacit, Polanyi observed that it could be "assimilated only by a person who surrenders himself to that extent uncritically to the imitation of another. A society which wants to preserve a fund of personal

knowledge must submit to tradition." (1958 p53)

In her study of the great Japanese ceramicist Shoji Hamada, Peterson (1974) described the relationship between deshi (apprentice) and master: "To learn as a deshi means to submit one's self to the master, to leave one's own self, to become 'in' the master. This 'surrender' to the master does not mean just blind imitation, but gives a spiritual discipline and the opportunity to absorb a skill into one's bones."

However, in current English language usage 'received wisdom' has strikingly negative connotations: whilst the dictionary definition is "widely accepted as authoritative or true"[31], in common usage this is understood as "knowledge that people generally believe is true, although in fact it is often false" [32].This fits with Schön's comment that our current culture espouses independence of thought and action and this generates negativity towards *any* sort of imitation (1987 p120), which would explain the negativity towards the traditional apprenticeship situation where the novice must initially imitate without understanding.

According to Polanyi, the difference between the skill of the novice and that of the expert is "a gap to be bridged by an intelligent effort". He unfortunately only views this from the perspective of the expert, explaining "Our message had left something behind that we could not tell, and its reception must rely on it that the person addressed will discover that which we have not been able to communicate" (1966 p6). The onus in his terms is on the novice to understand through intelligent effort. As discussed in the Methodology chapter (p16), Polanyi viewed this as a kind of indwelling that I refer to as empathic indwelling, where the novice attempts to interiorise the master's skill. To use Polanyi's example (1966 p30) a chess player might re-enact a master's game to gain a feeling for his skill.

Schön similarly referred to "an apparently unbridgeable communication gap" (1987 p101) between novice and expert however he suggested the solution was in "reciprocal reflection-in-action" implying that the

31 definition from Concise Oxford English Dictionary (2002)

32 meaning from The Free Dictionary, [http://idioms.thefreedictionary.com/conventional%2Freceived+wisdom] accessed 11/06

expert needed to make as much effort as the novice in the process of bridging it. Whilst retaining the necessity for the novice to initially suspend any disbelief, put their trust in the expert and imitate the expert's practice, Schön softened the process by calling it reflective imitation, where the novice copied the expert but also reflected on what they were doing (1987 p120).

Schön also described the difficulty that could arise when the expert did not respond reflectively, simply seeking to correct 'mistakes' at face value rather than trying to understand the reasoning behind them, creating a defensive attitude in the learner (1987 p136). Instead, the expert needed to view the novice's actions in response to instruction as revealing the meaning they had constructed for that instruction. They needed to observe the novice's actions reflectively and respond back until they felt there was a convergence in meaning (1987 p104).

Nonaka & Takeuchi (1995) did much to popularise the work of Polanyi and the concept of tacit knowledge within the field of knowledge management. Their description of how individuals share tacit knowledge within large organisations led to a widespread belief that tacit knowledge could be transmitted from one person to the next by making it explicit which I feel to be in need of closer examination.

Their description of knowledge creation within an organisation involves a spiral with a tacit to explicit process, 'externalization', then an explicit to explicit process, 'combination', an explicit to tacit process, 'internalisation' and a tacit to tacit process, 'socialization', and so on as shown by the illustration below:

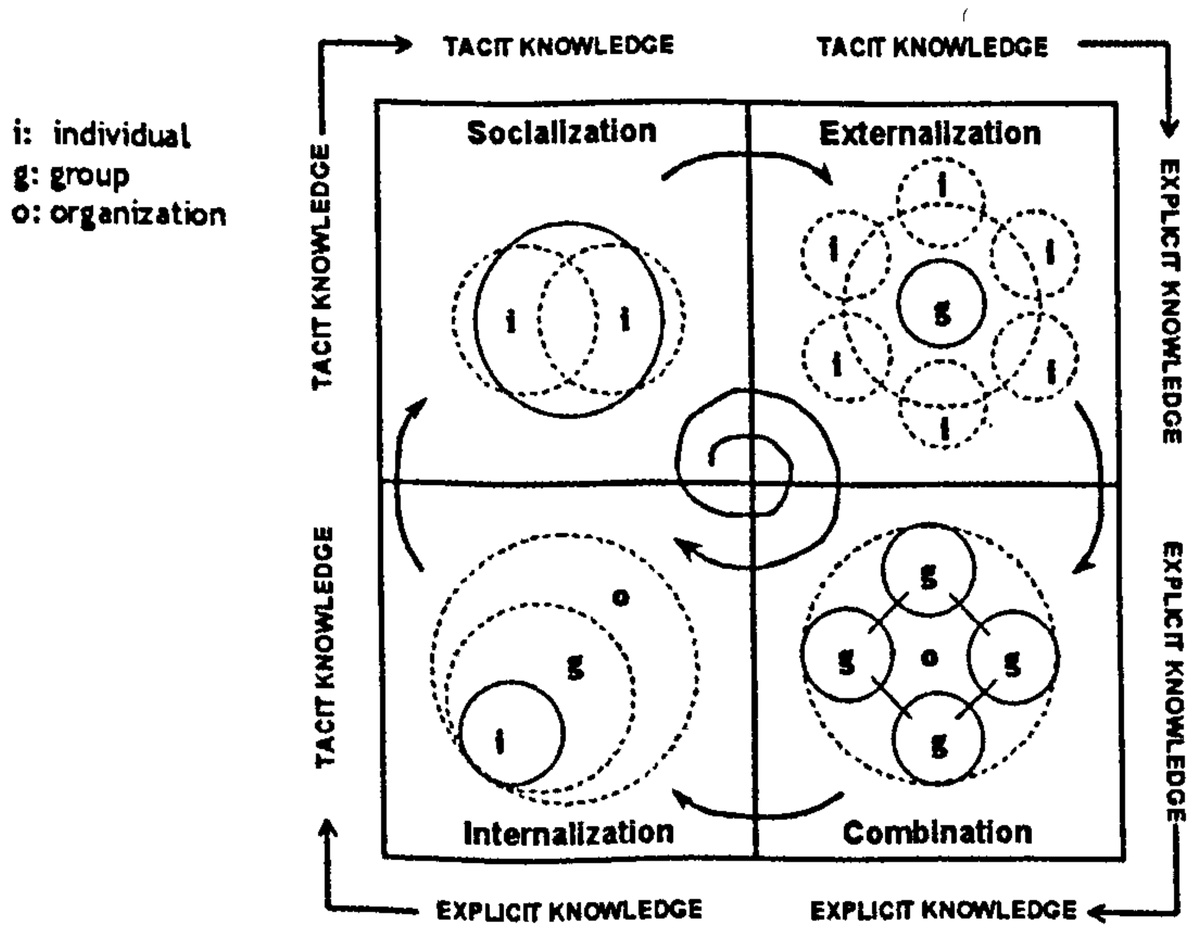


Figure 71: 'Knowledge Creation Spiral' (from Nonaka & Konno 1998)

Firstly, to look more closely at their explanation of tacit to explicit knowledge, they say, "externalisation is a process of articulating tacit knowledge into explicit concepts. It is a quintessential knowledge-creation process in that tacit knowledge becomes explicit, taking the shapes of metaphors, analogies, concepts, hypothesis or models" (1995 p64). This may be the origination of the concept that "tacit knowledge becomes explicit", having lifted the phrase from the context in which it was written, although the broader concept is that explicit knowledge is used to articulate the tacit. As Rust (2004) says "the idea that people's tacit knowledge can be somehow extracted and made explicit in the form of rules for all to employ ... is fundamentally misguided". The implication is that tacit knowledge could be articulated verbally through metaphors, analogies etc. or, as frequently observed in the craft context, visually through demonstration, sketching or modelling. Gamble (2002) gives a vivid description of such an interaction from her observation of cabinet-making apprentices at a trade school in South Africa: "When asked in an interview about the propensity to draw everything, an apprentice called drawing his 'third language' (in addition to two spoken languages)."

Nonaka and Takeuchi illustrated their understanding of the tacit to tacit process by describing a manufacturer who was developing a bread-making machine and struggling to replicate the kneading process. Although the dough made by the machine looked the same as that made by a master baker, when baked it tasted nowhere near as good. The problem was solved by one of the manufacturer's employees who 'apprenticed' herself to a master baker (p64): "One day ... she noticed that the baker was not only stretching but also 'twisting' the dough, which turned out to be the secret for making tasty bread".

At face value this again implies that a simple piece of explicit knowledge could be used to explain the baker's tacit knowledge, reinforcing the "making tacit explicit" concept. On closer examination it could be argued that, whilst the master baker was an expert in manual bread making, he probably had little knowledge of bread making machines, and for the researcher it was probably the opposite. It was only through the researcher gaining personal experience of manual bread making to build her personal knowledge of the subject that she

was able to interpret the actions of the master baker in comparison to that of the bread-making machine. By dwelling in the craft she was able to combine her personal knowledge of manual bread making with her personal knowledge of how the bread-making machine worked and produce the explicit concept of the machine twisting the dough to more closely replicate the action of the master baker. This could be seen as finding an explicit concept to articulate tacit knowledge rather than a process of making tacit knowledge explicit.

Further to this it could be proposed that in a craft context what Nonaka & Takeuchi called "socialisation", the pure tacit to tacit process, occurred only between people with skills or experiences in common, who were able to dwell in the other's thoughts or actions without needing explicit interpretation. This ability would be more likely to manifest itself in a more advanced learner who had shared experience and developed a shared language with other practitioners. "By such exploratory indwelling the pupil gets the feel of a master's skill and may learn to rival him" (Polanyi 1966 p30).

Lev Vygotsky (1934) in his classic study of how language is learned discussed the use of abbreviated language between people with a close familiarity. "If the thoughts of two people coincide, perfect understanding can be achieved through the use of mere predicates, but if they are thinking about different things they are bound to misunderstand each other" (p236). He illustrated this with a passage from *The Diary of a Writer* (1873) where Dostoevsky described walking home behind a group of drunken workmen and overhearing a conversation between them that entirely consisted of one (unprintable) word. He concludes, "So, without uttering a single other word, they repeated that one beloved word six times in a row, one after another, and understood one another completely."

5.3.6 Conclusion

The literature considered in relation to craft knowledge shows that such knowledge is considered to be highly personalised, context-specific and tacit. Craft skills are learned through experience and various forms of reflection can be of positive influence to this learning.

Received wisdom from experts can also be influential to the learning process, but initially this will require the learner to demonstrate trust and belief in the expert. The expert may use explicit concepts to articulate their personal knowledge and must reflect on the response of the novice to ensure a convergence of meaning.

In the next section the practical work previously undertaken, particularly that of the bowl turning novices, is reviewed in the light of this theory and used to form the speculative framework for understanding craft learning proposed in section 5.5.

5.4 Practical Work

5.4.1 Introduction

In this section I review the practical work undertaken with experienced and novice craft practitioners described in chapters 3 and 4 in the light of the above theory[33]. This provides greater insight into the nature of craft knowledge and learning from both the novices' and the experts' perspective and provides a basis for the framework described in the following section.

5.4.2 Tacit craft knowledge

Figure 72: Espoused theory for holding tool.

Figure 73: Theory in use for holding tool.

The tacit nature of craft knowledge was revealed during the initial work with Robin Wood when exploring the issue of the way the turning tool should be held (see p40). The interview in which this knowledge was initially elicited was conducted away from the workshop and he advocated his espoused theory: that the hand should clamp the tool to the rest. This differed from the observed theory in use: that the hand frequently gripped the tool in a fist behind the rest.

On observing a novice using the latter technique [GB1 t45.25], the tacit nature of this knowledge was evident in the inability of Robin to explain his theory without demonstrating with a tool in his hand. This explanation was again his espoused theory and, when shown the video footage of his practice revealing the difference to his theory in use, his instinct was to find reasons to preserve his espoused theory by attempting to construct alternative reasons for the different handhold.

Upon returning to the lathe and offering the tool up to the learner's bowl, Robin reluctantly accepted the observed hand grip might be valid, but at this point still declared his espoused theory was equally applicable. It was only later when turning a bowl himself that Robin was able to truly acknowledge his theory in use: "I do hold the tool like

[33] references in the text to specific instances in event logs take the form [HS2.3 t0.32]: HS = participant's initials; 2.3 = session 2, tape 3; t0.32 = time code 32 minutes

that, don't I!" [GB1 t1.09].

Considering this in the light of Polanyi's theory, Robin could be seen to only know the theory of how to hold the tool through his practice, when theory was the proximal term and practice the distal. When trying to access this theory during elicitation he came up with a plausible explanation, which was how he often held the tool when hollowing inside the bowl, but not one that worked universally or in the circumstance under discussion. Even having observed himself on video, he was only able to really acknowledge his theory in use through re-interiorisation, returning to his normal practice, then shifting the focus of his attention from the practice to the theory and seeing how he was holding the tool.

Experienced clog maker Jeremy Atkinson highlighted the value to the craft practitioner of tacit knowledge during an interview. He observed that Parfitt, a relative novice, had a tendency to concentrate so hard on each individual part of the process that he lost sight of his overall aim.

> *"Geraint's got to the point where he can manage everything but he's concentrating so much on each individual task he doesn't look at the whole. Which is easy to do. It's just a sort of transitional thing. He can do all the individual things but because he's concentrating so hard on it he's not always stepping back."*
>
> Interview Jeremy Atkinson 17.8.05 [event log JA5.1 t0.45]

It could be argued that at Parfitt's early stage of learning his focal awareness was on the cutting edge of the tool and not on the form he was producing. In contrast, Atkinson's usė of tools was tacit and hence of subsidiary awareness, so his focal awareness was on the form of the sole he was carving.

5.4.3 Experiential learning

There were three sessions with wood turning learners where the focus was on the novices working experimentally, relying largely on reflecting on their own experience rather than any given interpretation. The first was the initial session [GB1] where the learner and I were establishing what interpretation was required, the second was the next session with this learner [GB2] where interpretation was supplied but

he proved reluctant to use it, and the third was the session with a new learner [MK1] who also declined help from any interpretive materials.

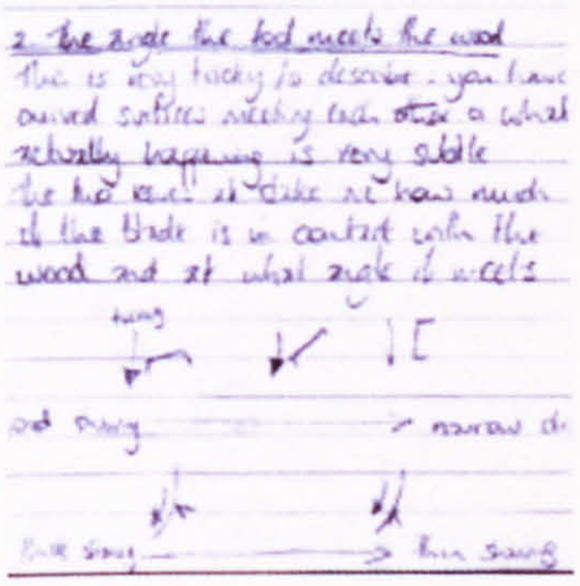


Figure 74: Preliminary tool angle interpretation.

On his first visit, the only assistance Giles had was some video clips of the expert and the theory I had constructed through interviewing and observing him, which was very limited. I was aware that I had failed to understand the theory behind the angle at which the tool should meet the wood, but was uncertain of its relative importance and interested to see if the novice could work it out for himself. Giles was keen to experiment with different tool angles, but struggled to find a workable solution [GB1 t0.14, 0.18, 0.20]. When he finally did find an angle that worked [GB1 t0.25] it only worked for part of the side of the bowl because he did not have enough understanding to move the tool to follow the contours of the bowl.

Figure 75: Giles experimenting with tool angles

By his second visit I had produced some drawings as explicit interpretation of the tool angles but, after an initial look, Giles was very reluctant to use them and instead was highly experimental, performing some extraordinary manoeuvres in an attempt to overcome problems. He showed signs of having remembered the 'twist' angle which he had gained an understanding of on the previous session, but still could not adapt it to follow the contours of the bowl so he became exhausted and demoralised [GB2 t0.17-0.54].

Mick already had a little experience of turning and was adamant he did not want any help or to view any interpretation. Turning the outside of the bowl unaided he consistently used an incorrect angle but, being tall and strong, was able to hold the tool steadily when it was not cutting correctly so appeared more successful. Upon viewing video of the expert he was able to identify that the hook tools he was now using worked differently to the gouges he was used to[34], but after further experimentation he admitted he had no idea at which angle the tool should be held [MK1 t1.17].

I would speculate that the novices' lack of personal knowledge of the skills meant they had difficulty interpreting their own experiences and were unable to act reflectively. This is possibly because they were

[34] An explanation of the difference between gouges and hook tools is provided on p71.

trying at a too early stage to work with practice as the proximal term and theory as the distal term. There was also little evidence of reflection *on* action, possibly because at this early stage they only knew their theory through their actions.

In nearly all the sessions, the learners used some explicit interpretation in the form of drawings as a learning aid that appeared to produce more sign of reflective thought. In the first session [GB1], the only explicit interpretation available was the drawings of the handgrip on the tool. Giles twice showed signs of reflection, firstly saying that he had found altering his grip helped him control the tool and he would not have thought to do that without having seen the drawings [GB1 t0.33]. He also commented that taking a break had proved beneficial in giving him time to think about the material he had seen and now he could think much more as he was working [GB1 t0.34].

Helen was keen to ask for help and engage with the explicit interpretation available to her during her first session [HS1]. She rapidly showed signs of experimenting with two of the three tool movements from the interpretation, but when I mentioned the third she admitted to having forgotten about it [HS1 t0.25]. However, upon reminding she was able to make the correction, although for the first few times she asked me what was wrong and I turned the question back on her, before she was able to spot the problem and correct it herself [HS1, t0.31, 0.33, 0.37].

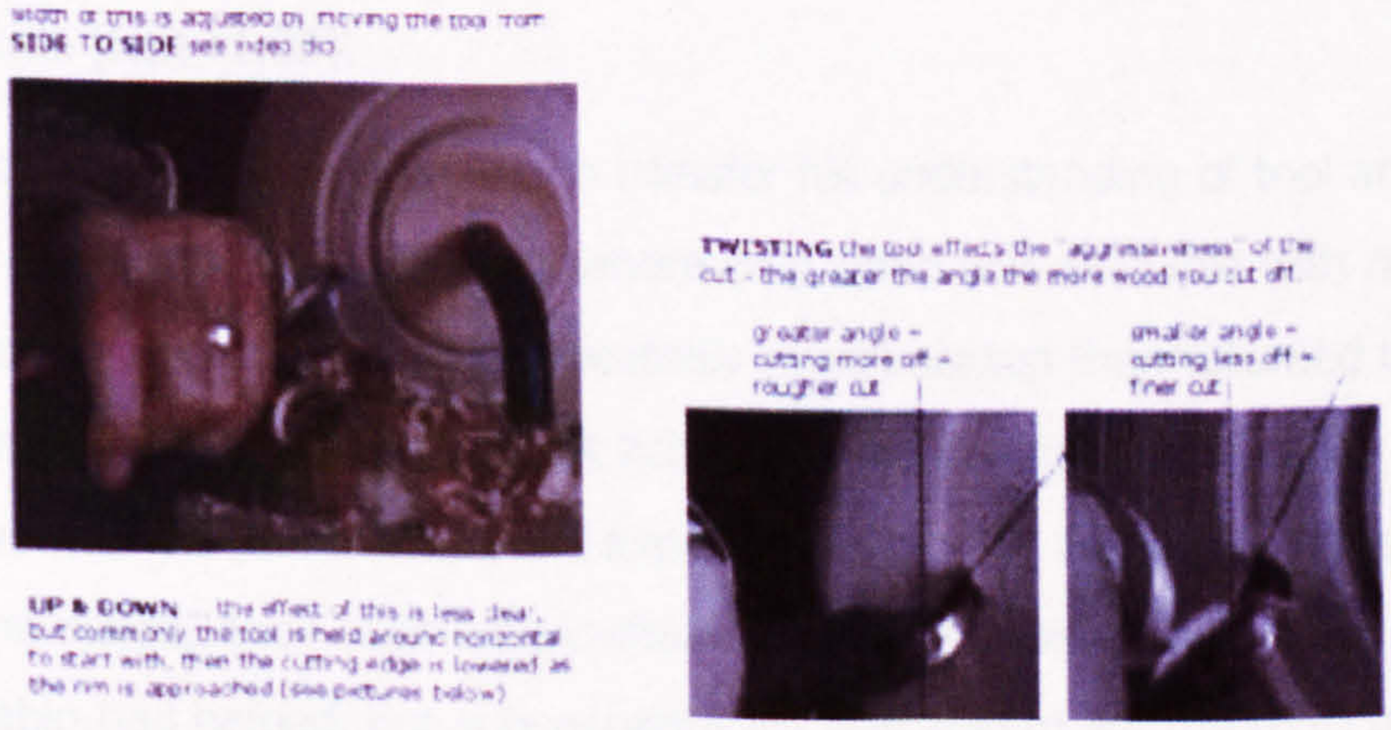


Figure 76: Tool angles from Resource II / HS1.

On her return visit, Helen showed signs of remembering about the tool angles she had used previously [HS2.1 t0.00] but when she actually started turning she struggled to achieve a good cutting angle. Instead she started to drag the tool across the surface of the wood as she was cutting, creating a very irregular surface that became increasingly

difficult to manage. Subsequent discussion revealed she was acting in response to her understanding of the interpretive sheets [HS2.1 t1.35] that were subsequently revised to avoid this confusion.

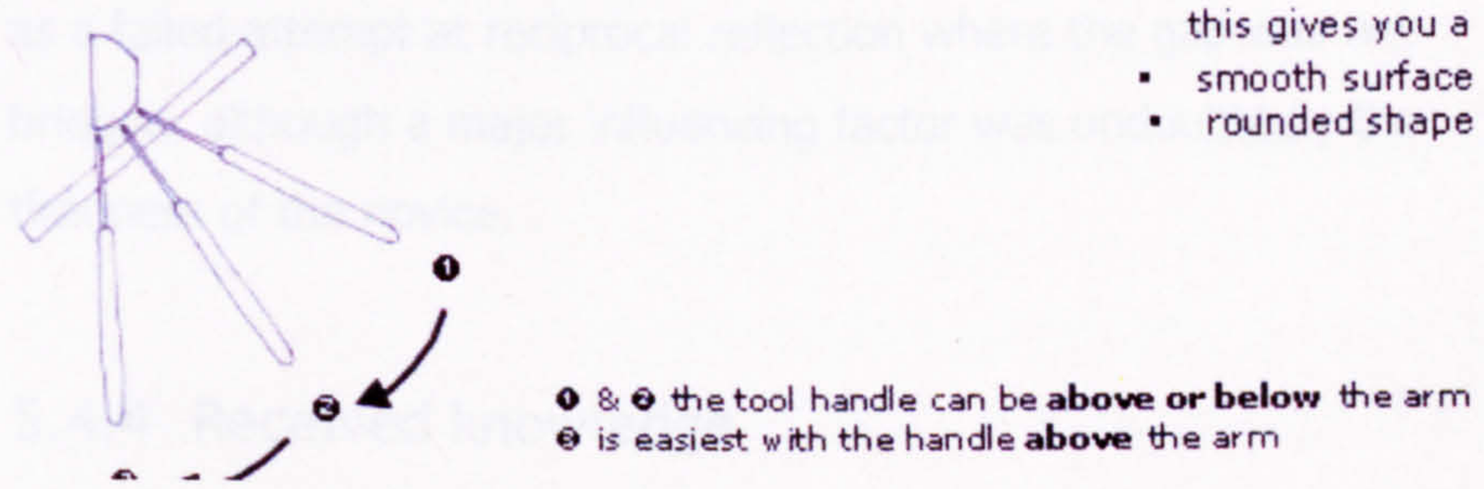


Figure 77: Tool angles from Resource III / HS2

Andy was also familiar with turning using gouges rather than hook tools, but studied the explicit interpretation closely and was able to immediately adapt his technique and gain a correct cutting angle on the outside of the bowl [AB1.1 t0.00, 0.11] and later returned to look at the diagrams again to refine the technique [AB1.1 t0.13].

It appears that given a 'bridge' in the form of some explicit interpretation, these learners showed signs of being able to interpret their own experiences. They could attend from this given theory to their practice and thus appeared to be able to reflect on the theory. In GB1 and initially in HS1 reflection on action can be seen: they both have a tendency to stop, go and look at something, come back and experiment with their interpretation of what they have seen. In HS1 this can be seen to develop into reflection in action as the tool snags and Helen corrects it, commenting "the same" without breaking her stride [HS1 t1.06].

However, Andy was unable to transfer his understanding of tool angles to hollowing inside the bowl where only video was available with no explicit interpretation. He repeatedly experimented then returned to watch the video but could not achieve a good cutting angle and eventually I called Robin, the expert, in to provide assistance. When first asked, Andy seemed uncertain whether the explanation from Robin had helped, but subsequently he was able to get the tool cutting well [AB1 t0.46, 0.48]. I would interpret this as the novice being unable to construct a bridge to the video on his own, but once the expert provided the start of one, the novice was able to grasp and apply it, a demonstration of effective reciprocal reflection.

Robin also attempted an explanation of hollowing inside the bowl to Helen when she was in difficulties, but she continued to struggle to achieve the correct cut and Robin had to physically correct the tool angle to help her [HS2.2 t1.26, 1.30, 1.32, 1.33]. This could be seen as a failed attempt at reciprocal reflection where the gap was not bridged, although a major influencing factor was undoubtedly the tiredness of the novice.

5.4.4 Received knowledge

As previously discussed, the wood turning learners were keen to watch video of the expert turning but they frequently struggled to relate what they had seen to their own work [GB1 t0.15-20; GB2 t0.01-0.04, 0.05-0.06, 1.06-1.10; HS2.1 t1.47, HS2.2 t0.23-0.28, 0.30-0.35, MK1 t1.07-1.17, AB1 t0.21, 0.28, 0.33, 0.35, 0.37]. Similarly, after watching the expert demonstrating, they tended to have difficulty replicating the action they had seen when they returned to the lathe themselves [GB1 t1.27-1.33; HS2.2 t1.30]. It was only Helen who had a few successes at following the video on its own, the first was a video clip that actually had a little commentary from the expert [HS1 t1.01] and the other three without [HS1 t1.29-1.32; HS2.2 t0.02-0.04, 0.44].

I would interpret this as the learners not having sufficient knowledge of what they were observing to be able to interpret it themselves: there was too large a gap between their knowledge and that of the expert for them to be able to construct their own bridges across this gap unaided.

The expert's first attempts at teaching directly were also largely unsuccessful. When first attempting an explanation of the cutting angle on the outside of the bowl to Giles there were clear communication difficulties with misunderstandings about the meaning of such words as twisting and pivoting [GB1 t0.43, 0.44, 1.01, 1.02 1.05]. On each occasion Robin had to physically move the tool in Giles' hands to show him the correct angle. By the time Giles was turning inside the bowl, he could understand what Robin meant when told to twist the tool but could not identify the problem himself [GB1 t1.46, 1.49]. Finally Robin attempted a fuller explanation using angles, showing him where 90°

and 0° were then telling him to aim for 10° which proved more successful at that time [GB1 t1.53] although on his subsequent visit he did not appear to have retained this knowledge.

This could be seen as the start of reciprocal reflection; the experienced practitioner was also starting to reflect in an attempt to bridge the gap between his knowledge and that of the learner. It was following this that Robin thought out the alternative explanation which he performed direct to camera and formed the explicit interpretation provided for turning the outside of the bowl which was successfully used by the learners.

The final point of interest arising from this interaction between Robin and Giles in the first session, showed Giles having tested and found wanting received knowledge, so developed his own theory:

> *GB: One thing that's quite difficult. You're saying that I'm to put it in at this angle, at times anyway, but you're also saying to turn it this way, whereas if it's flat onto that and I turn it this way then obviously it comes out. So I've just been inching my hand along.*
>
> *RW: So you've been listening to what I say then working out the actual way to do it, obviously!*
>
> event log GB1 t1.03

Whilst Giles' meaning is not exactly clear, Robin seems quite happy to accept Giles' interpretation without needing to defend his own. Possibly this was as a result of finding his explanation of how the tool should be held was incorrect, or possibly because it did not seem an important-enough issue to debate and it was more important for Giles to build his confidence in his own abilities.

Whilst I did not have the chance to observe any wood turning learners at a more advanced stage, the clog makers did offer this opportunity. I noticed that during the two months I followed the progress of novice clog maker Parfitt, although I became increasingly familiar with the craft, I found it progressively more difficult to follow exchanges between him and expert clog maker Atkinson. It appeared that, through shared experiences, Parfitt and Atkinson were developing a communication that was increasingly tacit and inaccessible to myself.

Robin Wood described a pure tacit to tacit transmission when watching another turner, André Martel, who uses the same sort of hook tools

but on an electric lathe, making a bowl on Wood's foot-powered lathe:

> *"He just naturally turned the tool over and cut back at it from that side, which I'd never done before and I said, "oh no, you don't use it that way" and then I stopped and thought, "ah, that's actually quite helpful" and so I do that quite often myself if I've not got a flat rim. So I'd been a full time professional turner for 5 years before I started doing that."*
>
> Robin Wood interview 7.1.04 [event log RW1 clip2 t29.50]

As one of few experts in his field, Wood was used to being the authority on the subject, so his instinct was to correct the other turner and preserve his espoused theory. His rapid re-assessment of the situation might have been influenced by knowing Martel was also highly experienced in making and using the tools they have in common, although they use radically different lathes. Once he had acknowledged the authority with which Martel was speaking, he was able to reflect and see the value in what was being done. As an experienced practitioner he was able to make sense of what he was observing without the need of interpretation or action.

5.4.5 Conclusion

Consideration of the wood turning novices leads me to conclude that as a main starting point both Helen and Andy could be seen attending from the received theory in the interpretation to their practice. They both initially used reflection on action, frequently stopping, looking for help then returning to their practice, and then showed signs of progressing to reflection in action, being able to problem solve as they worked.

Whilst Helen on the face of it struggled, this could be seen as being largely due to the experimental nature of the process: not having the lathe set up for her diminutive size, having some experimental resources for her received knowledge which were not always helpful or open to misinterpretation, and having to work right-handed when she was left-handed. However, when considering her actions, it could be seen that she was responding reflectively, both taking received theory then attempting to test it and trying to develop her own theory.

Andy had the added advantages of being more physically adept and having some much more resolved interpretation to work with. His

reflection on action was easily observable, frequently swapping between the computer and the lathe. As he verbalised less than Helen, it was not possible to definitely identify any deeper reflection, but the experimentation he undertook and the steady improvement that could be seen to his technique as he turned his second bowl implied that he was successfully reflecting in action.

Giles and Mick were both disinclined to use any interpretation and, when they did look for help, turned to watching video and attempting to interpret it themselves. As neither was naturally communicative, the degree of reflection they achieved could only be assumed from their actions. As their experimentation often did not follow any perceptible pattern and there was little sign of consistent improvement, this implied frequent rather random experimentation without much consistent reflection. Both appeared to have practice as the proximal term of their tacit knowledge and theory as the distal for their main starting point: they were trying to construct theory from interpreting their own actions and finding it a complex process. Not that it is unachievable, it is the way Robin learned because at that stage there was nobody else practising the craft, but there must be a greater chance of becoming exhausted and demoralised in the process as Giles found on his second attempt.

More recently and outside the scope of this research project, Mick arranged with Robin to come back to turn another bowl. On arrival he expressed disappointment that the interpretive sheets he had seen previously that had been left in the workshop by Helen were no longer there. Instead Robin gave a short demonstration, then stood with him for a little to help him understand the tool angles before leaving him to experiment. Robin was of the opinion he made better progress on this attempt, achieving a better cutting angle with the tool.

These differences of approach by the learners could be seen as a demonstration of what Kolb (1984 p61) identified as learning styles. I could have tested them to prove it, but with only four learners I did not feel this would prove anything or help progress this study. What can be deduced is that self-directed learners are likely to approach their learning in different ways and find some parts of the process

easier than others.

This is considered in the next section where I discuss the probable outcome of different forms of reflection and speculate on the potential learning paths different novices might take.

5.5 Discussion

5.5.1 Introduction

In this section I draw some speculative conclusions about the observations of wood turning novices described above and the different skill levels emerging from the study of the clog makers described in section 5.2. I illustrate this with a series of drawings that I have developed to assist my thought process however, whilst they may look like graphs, they need to be viewed as maps of concepts rather than mathematical representations.

My hypothesis is that there are two people, a novice who wishes to learn a craft skill and an expert, a master craft practitioner. The novice's aim is to bring his practical craft skill at least up to the level of the expert and potentially above it. Assuming she wishes to benefit from the accumulated experience of previous practitioners, she will need to make use of received knowledge from the expert, but there is a 'knowledge gap' between the two which needs bridging:

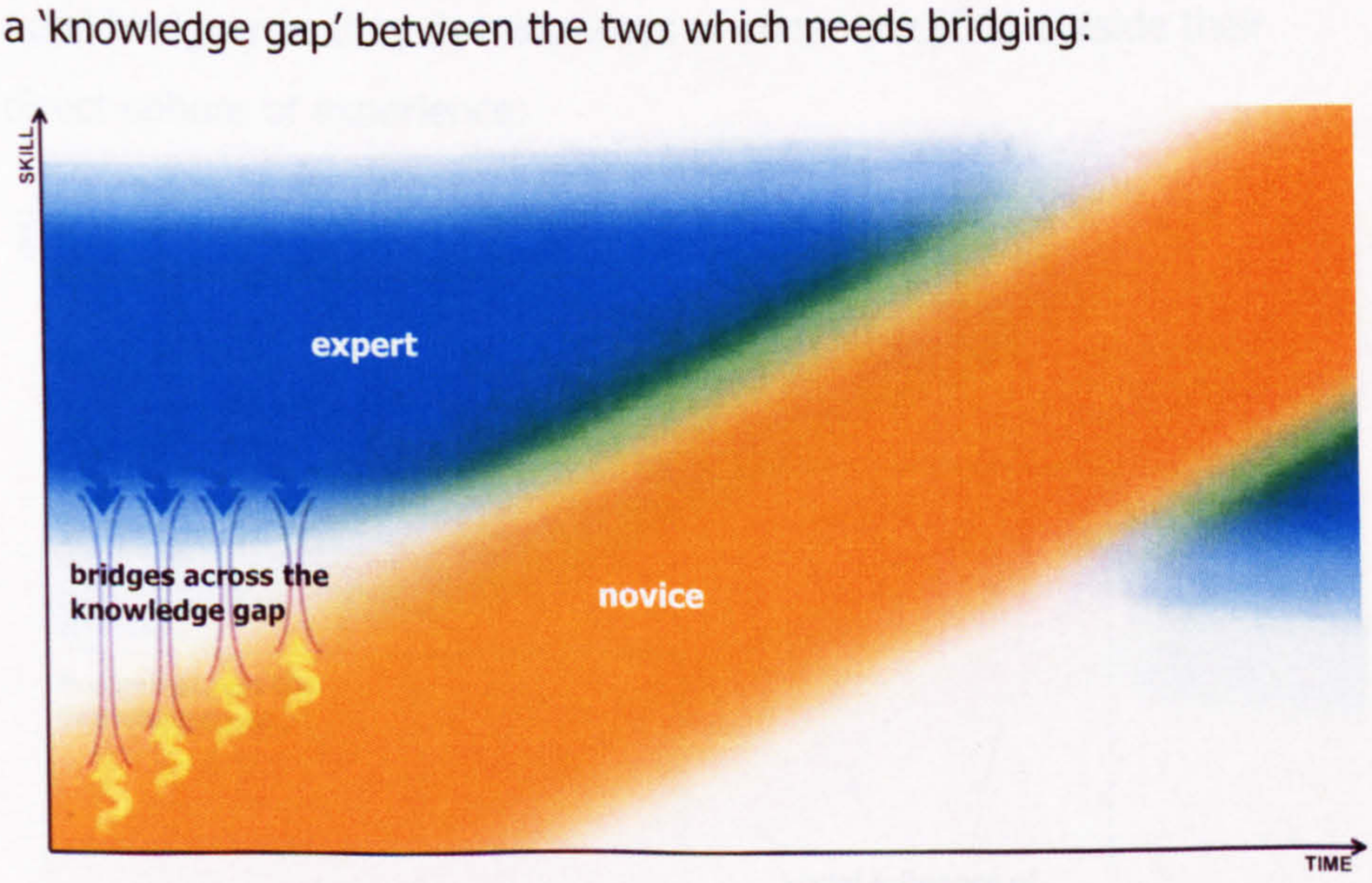


Figure 78: The knowledge gap between craft novice and expert.

The expert might start by demonstrating but, rather than leaving the novice to try and interpret what they see, the expert might provide a commentary, thus attending from his practice to his theory. The expert's commentary will use explicit concepts in an attempt to bridge the gap, and the novice will need to undertake some form of action in response to this received knowledge, primarily imitating the expert, but in a reflective manner. The expert in turn should observe and reflect on the novice's response, considering revising his interpretation until a

consensus of understanding is reached and the gap is bridged.

As the skill of the novice progresses, they will need less help directly from the expert, instead being able to observe, form their own interpretation and take action to test it. The novice will also increasingly rely on their own experience to develop their skill, constructing their own theory and performing experiments to test it. Finally the novice may be able to learn from the expert through observation alone: tacit to tacit communication will be more likely to occur when the novice is able to understand simply through observation without need for action, just through indwelling.

The novice is also increasingly likely to be influenced by other practitioners, both within their own craft and potentially other related crafts. This was traditionally called the journeyman phase where, upon completeing their apprenticeship, they travelled to work away from the area where they had learned their skill, both gaining the benefit of other craftsmen's skills and spreading their own knowledge (Epstein 2004). Here too they might experience a knowledge gap that might need bridging as they develop ways of communicating outside their direct sphere of experience:

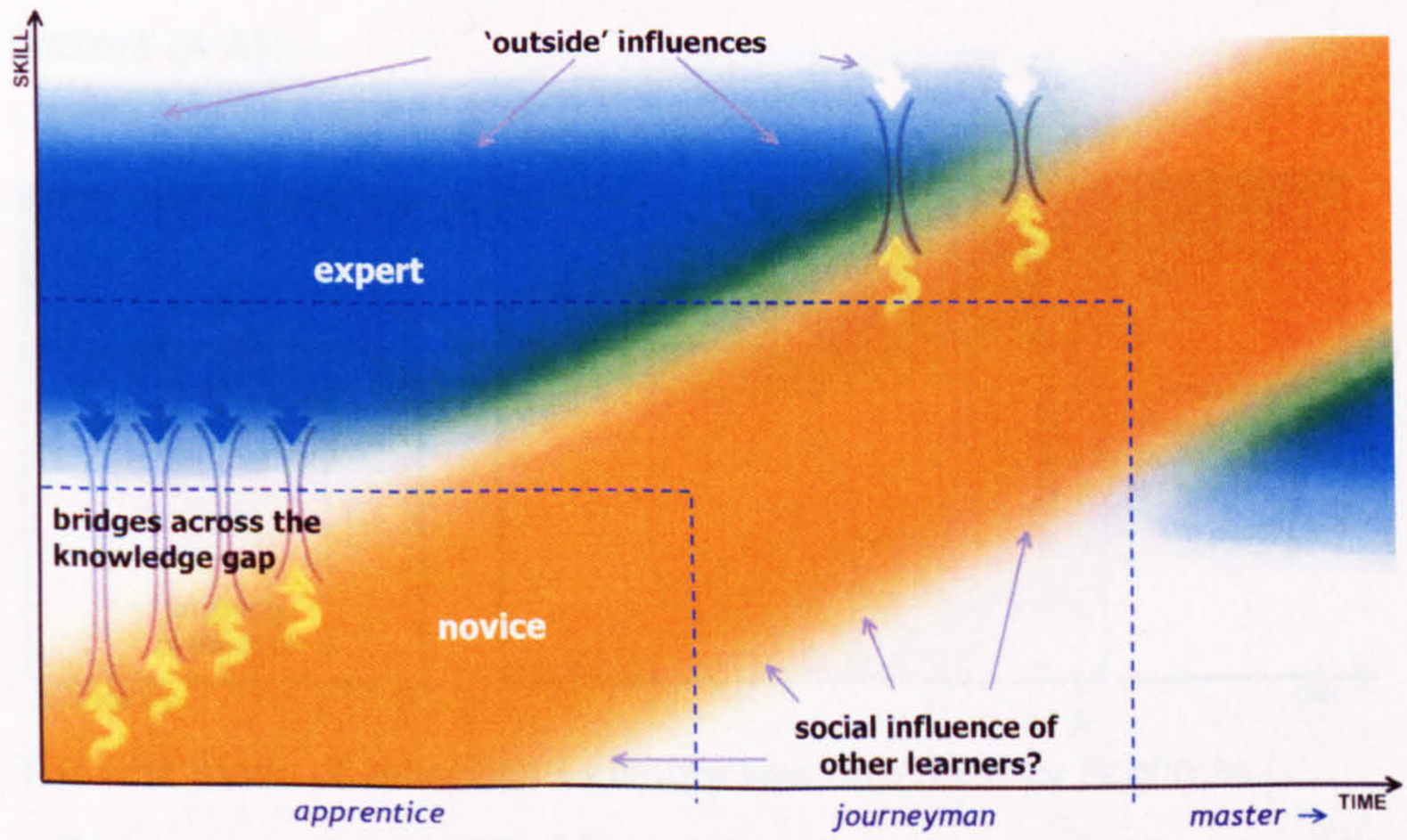


Figure 79: Phases of a novice's learning and possible routes of received knowledge.

The final element that is included on the above diagram, but not discussed is the social element, the influence of other learners. There was not the time to explore this aspect of learning durring the current research, but I plan to do so in my post-doctoral research.

In the above diagrams the 'knowledge paths' have been drawn straight and parallel sided and the novice's rises steadily to meet the expert's.

The wood turning learners described above appeared to make different starts to their learning and the biographies of the clog makers concluded with an implication that the different practitioners peaked at different levels. To speculate on how these different paths might be formed, I shall consider in detail the different forms of reflection described in section 5.3.4.

5.5.2 Modes of reflection

In reviewing the literature relevant to learning craft knowledge[35], I identified reflection as an important element that enabled a craft practitioner's thought to be turned back on action in a constructive manner. In this section I aim to consider the possible effects on the practitioner of different modes of reflection, developing further the illustrations used above as a representation of my understanding.

Schön defines the action present, the period of time in which the actions of the practitioner could make a difference to the situation, as forming the boundaries of the practitioner's knowing in action. If the figure on the right is thought of as being three-dimensional, the figure on the left can be seen as a slice through it at the point of the action present (A-A):

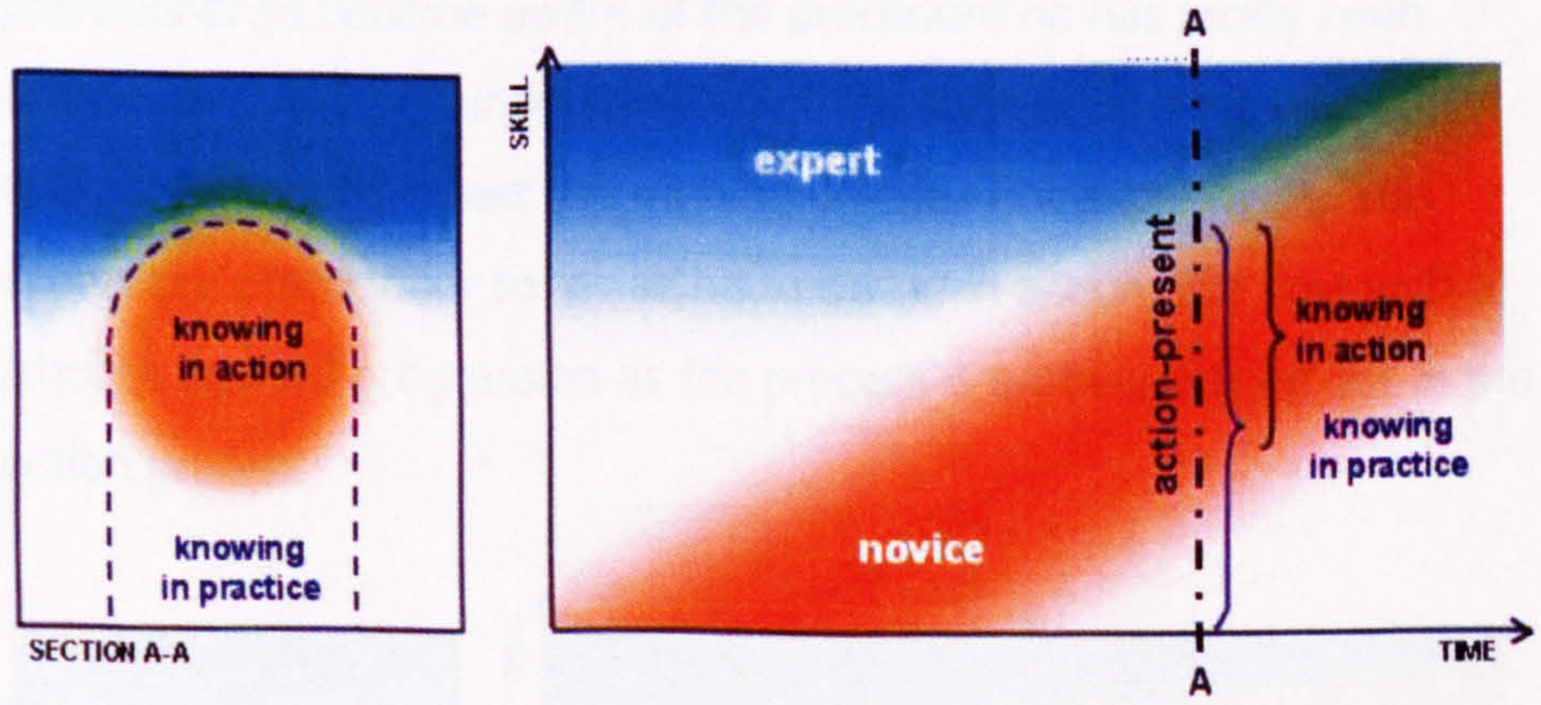


Figure 80: The relationship between knowing-in-practice and knowing-in-action.

The first mode of reflection I identify was described by Schön as reflection *on* action (1987 p26) and this closely relates to the approach described by Dewey as 'stop, look, listen' (1916 p235) and Polanyi as 'destructive analysis' (1958, p50).

Reflection on action occurs when an unexpected event causes the

[35] see section 5.3.4, p111.

practitioner to stop, look at what they are doing and think about what has happened and how to proceed. During this process the practitioner reconsiders their knowing in action, identifies a possible solution and returns to the action-present to test the solution. The result of this will be an overall increase in the practitioner's knowing in practice although, with the thought process occurring outside the action present, the portion of this which is knowing in action will tend to remain the same:

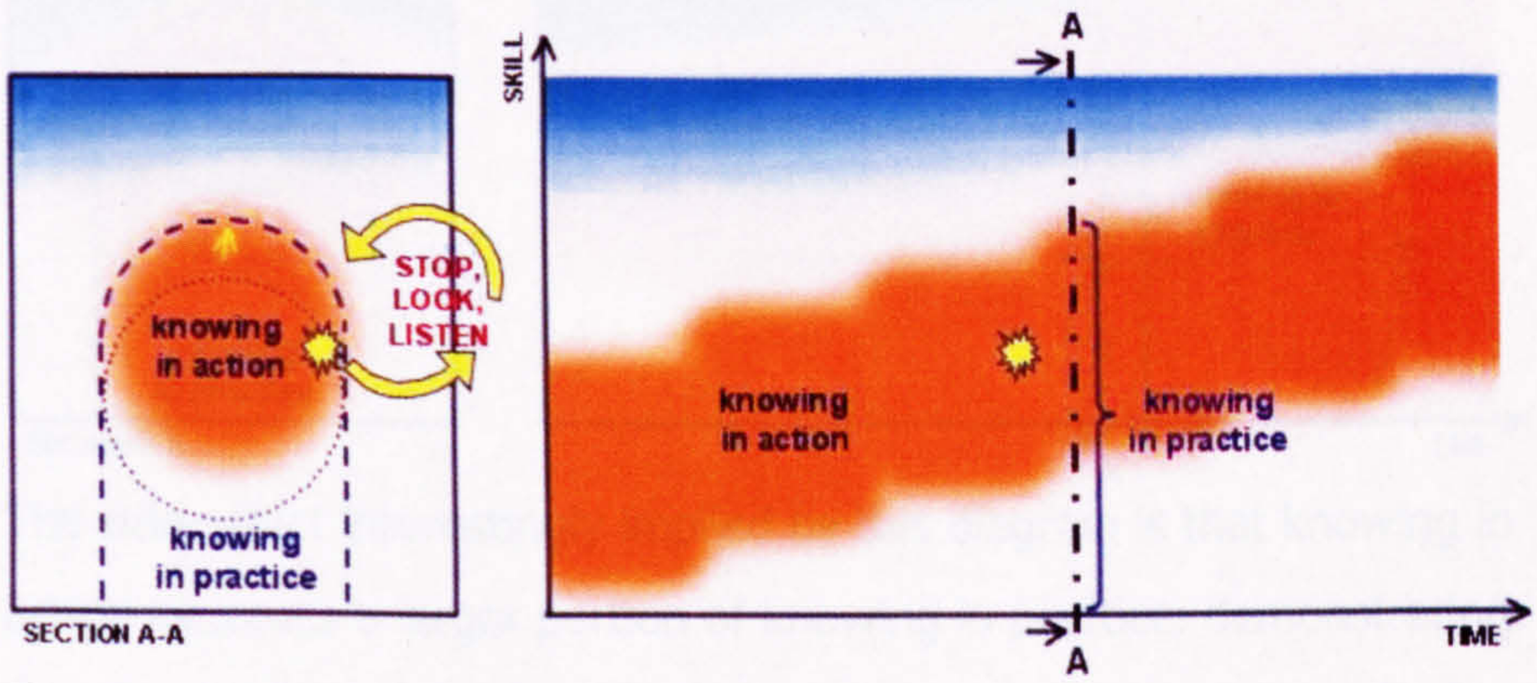


Figure 81: Mode I: reflection on action.

The second mode of reflection I identify is an element of what Schön (1983, p62) referred to as reflection *in* action and is entirely contained in the action present: rather than 'stop, look and listen' the practitioner remains absorbed in his task.

Primary reflection in action is where the unexpected event causes the practitioner to become aware of the procedure he has tacitly been carrying out, use his understanding of the surprise to construct a new understanding, then test this with an on-the-spot experiment. This allows the practitioner to revise his knowing in action, but now with a smooth upward progression as the process is entirely carried out in the action present:

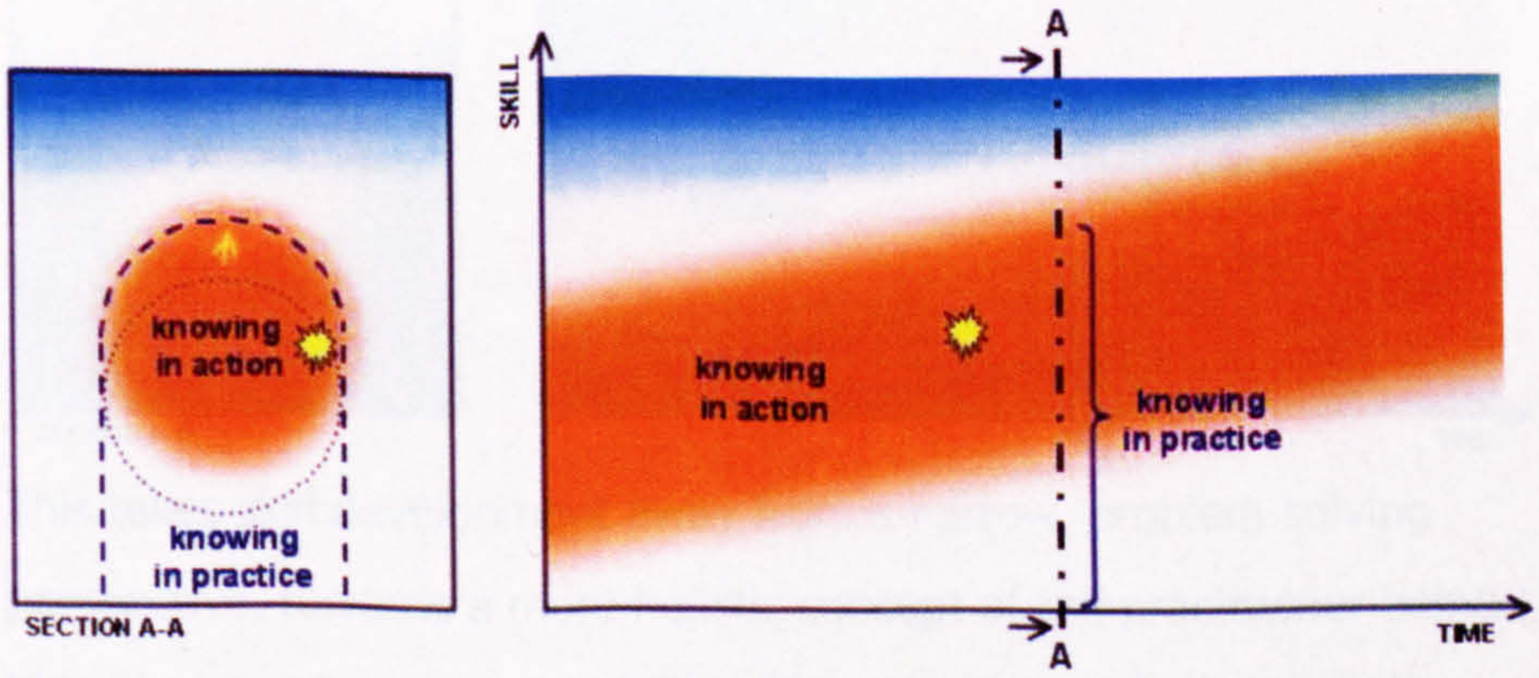


Figure 82: Mode II: primary reflection in action.

The third mode of reflection I identify is described by Schön as an advancement of the above process of reflection in action (Schön 1983

p63). The practitioner finds that primary consideration of the unexpected event does not lead to a new understanding, so instead finds a new way to frame the problem, to see if this will bring about an alternative understanding of the situation. If successful the result will now be an increase of knowing in action rather than just a shifting upwards:

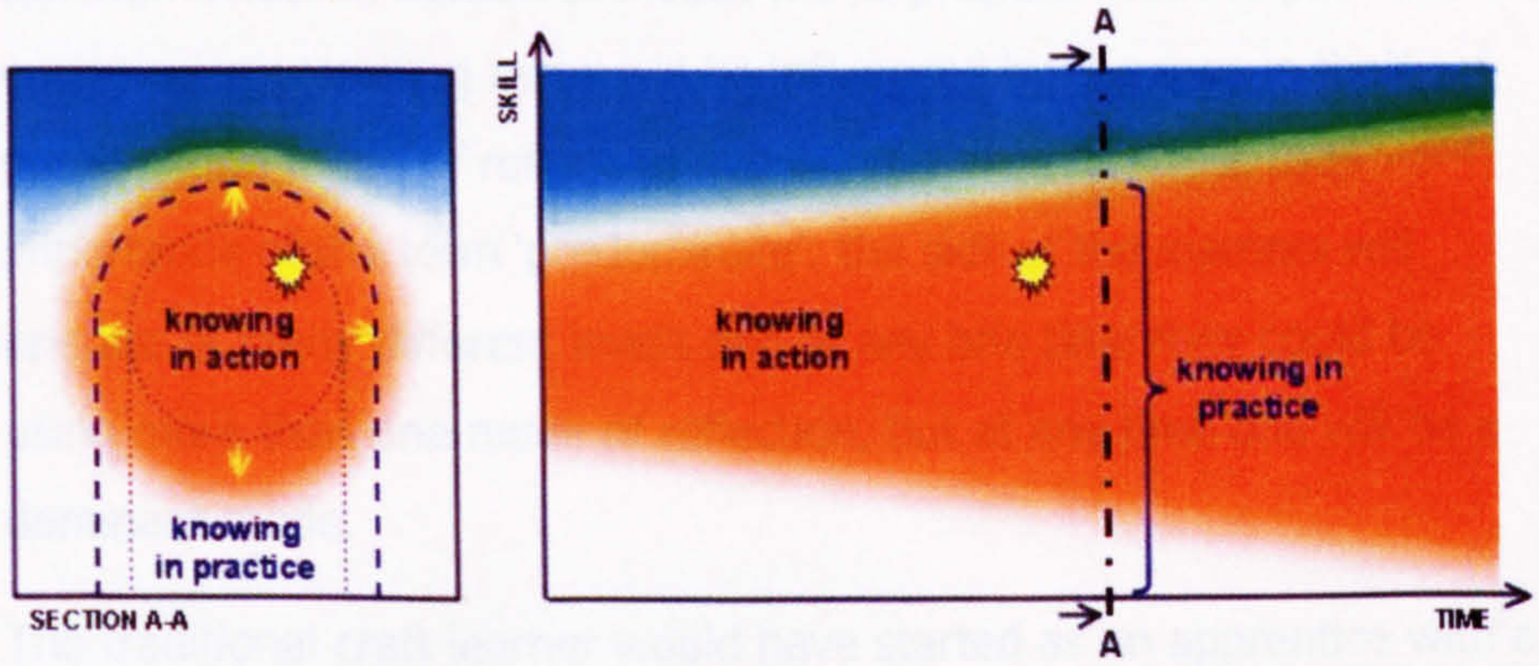


Figure 83: Mode III: secondary reflection in action.

The side-effect interestingly implied by this diagram is that knowing in action becomes a larger portion of knowing in practice, demonstrating the observed tendency of skilled practitioners to become increasingly absorbed and less able to articulate their practice over time.

The fourth mode of reflection I identify is derived from Argyris' concept of double-loop learning where, more than just reflecting on the actions being carried out, the practitioner undertakes action that challenges their established view of their whole practice (Argyris 2003). Through their action, the practitioner is reflecting on the whole of their knowing in practice, not just their knowing in action, leading to a simultaneous increase in both:

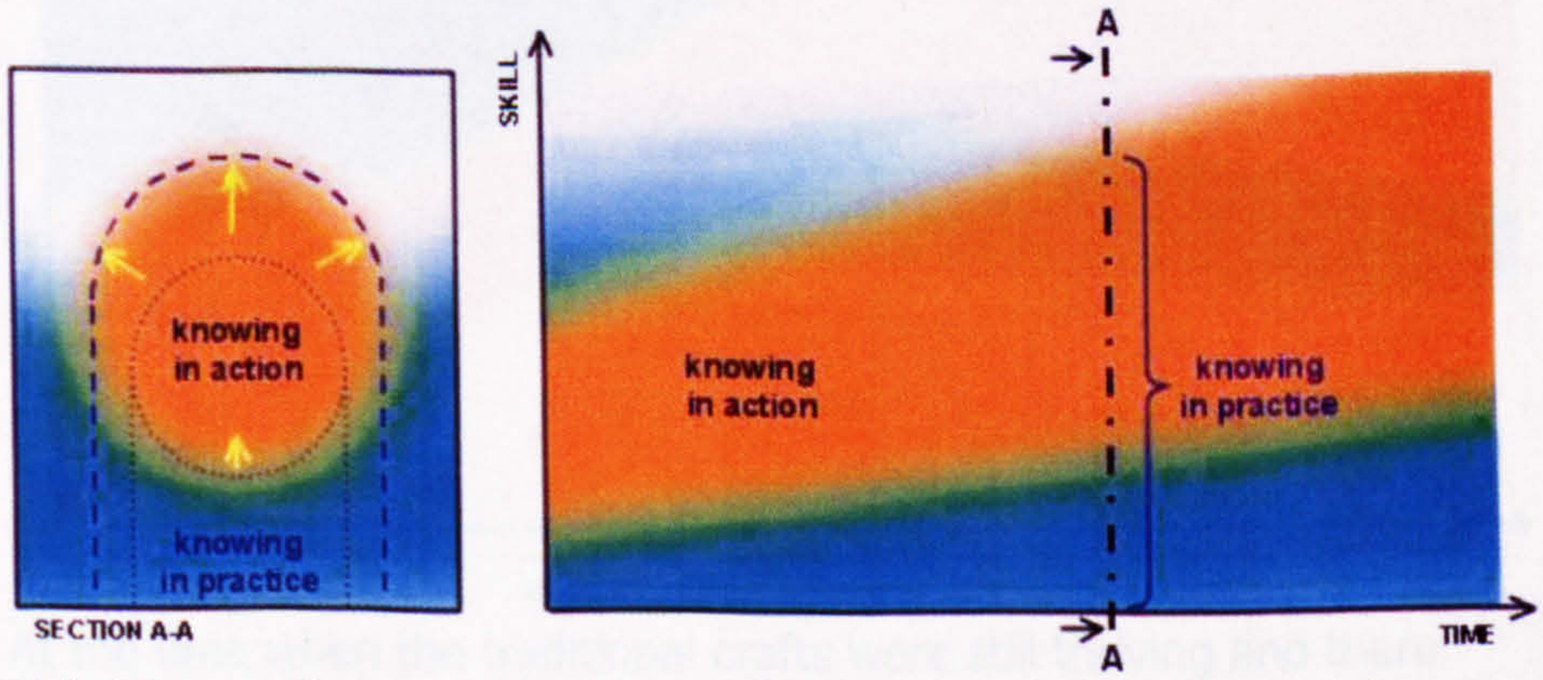


Figure 84: Mode IV: double-loop reflection.

This takes skill development away from a narrow, problem-solving perspective, towards a more holistic concept of the practitioner being able to re-assess and move forward knowledge within their practice generally. I feel it is this mode of reflection that might enable a

practitioner to break the boundaries of the established knowledge of previous master craftsmen and establish new knowledge.

5.5.3 Learning paths

Observation of the different approaches to learning taken by the wood turning novices in section 5.4 leads me to propose that the path that each novice's learning takes will be influenced by changes in their predominate mode of reflection over time. I wish to stress the importance of the term 'predominate': the skill of the learners will operate at many different levels and at any one time they could be using more than one mode of reflection, but at any time one will be a dominant mode.

The traditional craft learner would have started as an apprentice with a master craftsman, then become a journeyman, travelling to broaden his knowledge by working with other craftsmen, and finally become a master in his own right (Epstein 1998). I would speculate the predominate mode of reflection for such a learner would initially be mode I, as they make use of received knowledge from the expert. Over time they would develop the ability to reflect in action, firstly with mode II and then mode III as they made use of their own experience to add to their theory:

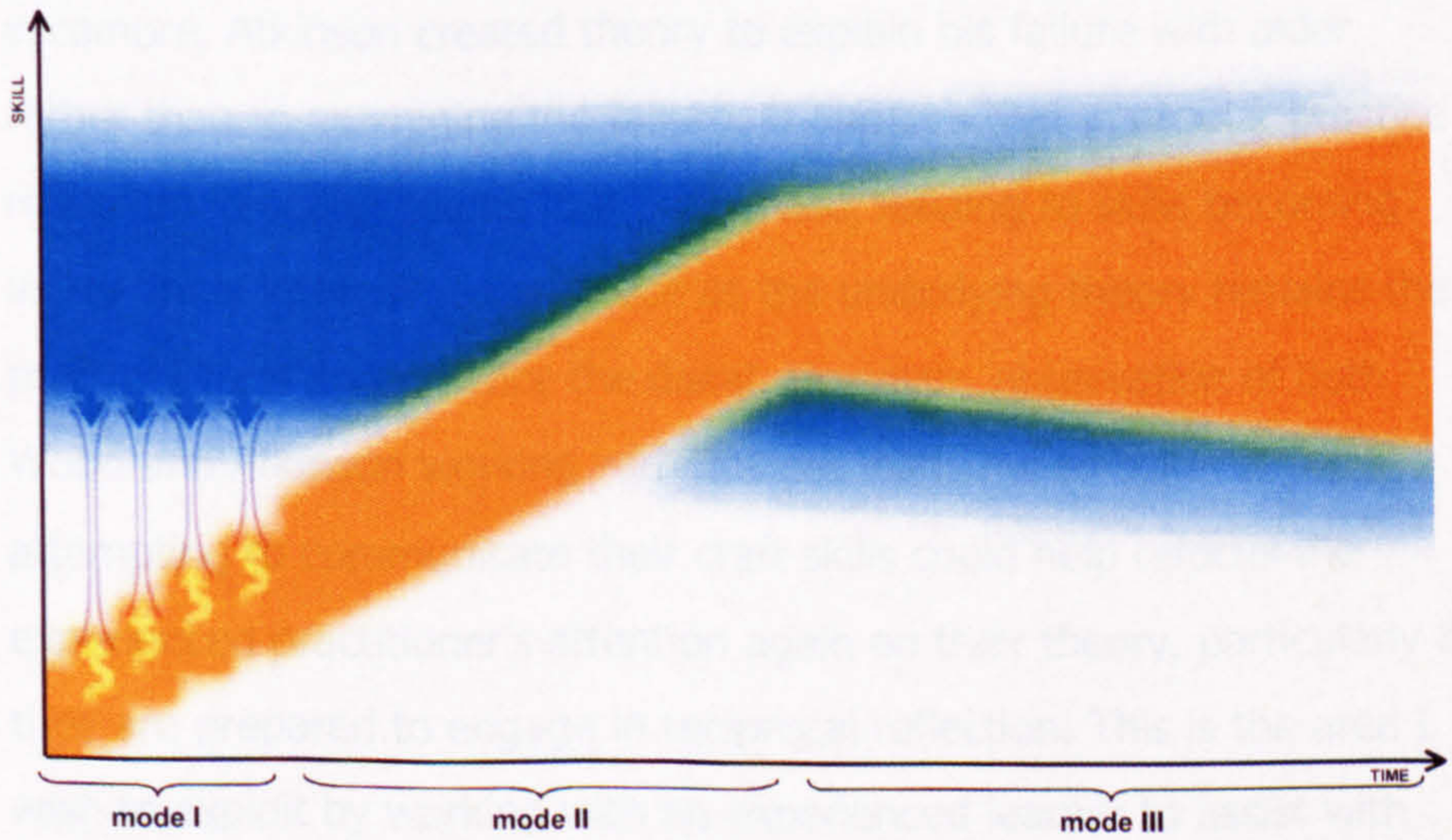


Figure 85: Learning path with novice attaining expert's skill level.

At the time when the traditional crafts were still thriving and there were many makers, 'breaking out' above the level of the master, characterised by mode IV (double loop) reflection, was likely to have been an infrequent occurrence or to achieve only minor increments in the level. As Christopher Alexander (1964 p34) commented about such

traditional craft practitioners: " ... actions are governed by habit ... there is little value attached to the individual's ideas as such. There is no special market for inventiveness. Ritual and taboo discourage innovation and self-criticism."

In the current climate, with craft knowledge in few hands and the loss of much of the basic knowledge base such leaps could be more likely to occur, as shown by Atkinson in the study of the clog makers described in section 5.2. Through a combination of research and practice, Atkinson 'broke out' above the skill level of the craft master who taught him:

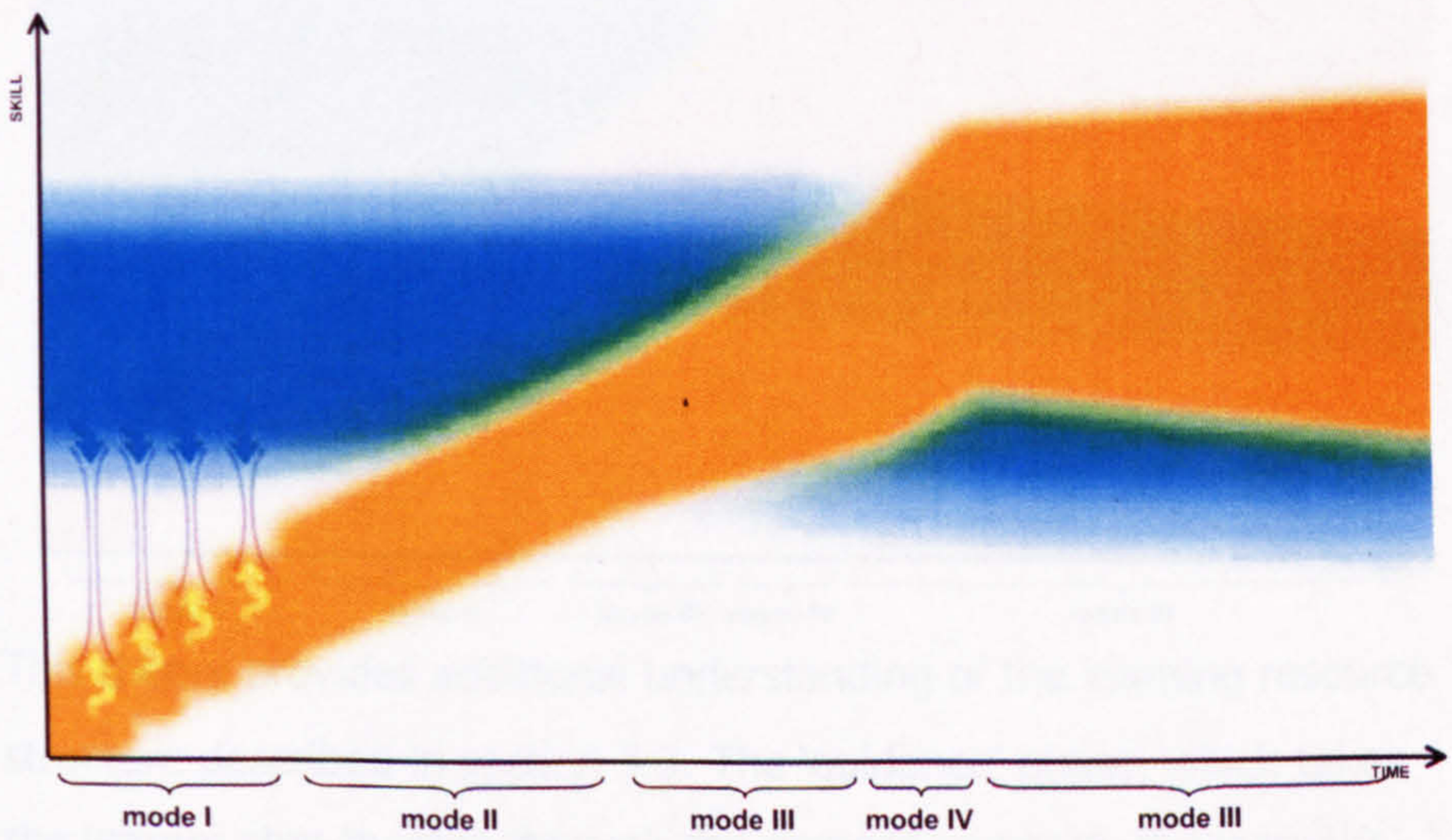


Figure 86: Learning path with novice exceeding expert's skill level.

However, such double-loop reflection appears to be an occasional and transitory phase. Having taught himself to make clogs from green sycamore, Atkinson created theory to explain his failure with alder rather than re-examining the failure. It appears that in regular practice reflection in action seems to predominate, leading to skills becoming increasingly internalised and tacit as the underlying theory remains the proximal term and practice the distal. However, observation of both Wood and Atkinson working with novices leads me to believe attempting to communicate their craft skills could help refocus the experienced practitioner's attention again on their theory, particularly if they are prepared to engage in reciprocal reflection. This is the area I wish to exploit by working with an experienced learner to assist with elicitation and representation in my post-doctoral research.

Observations of the wood turning learners showed that some could be resistant to received knowledge, their determination to work it out on their own could result in their 're-inventing the wheel' or that they

become dispirited and give up. However, Robin Wood learned in this manner through necessity because there were no existing craft practitioners. Potentially this determination could result in a greater ability to see through the difficulties and an early reliance on the feedback from their own experience may mean they can progress with less received knowledge and are more absorbed so could be more likely to dwell in their craft and break out from the established boundaries:

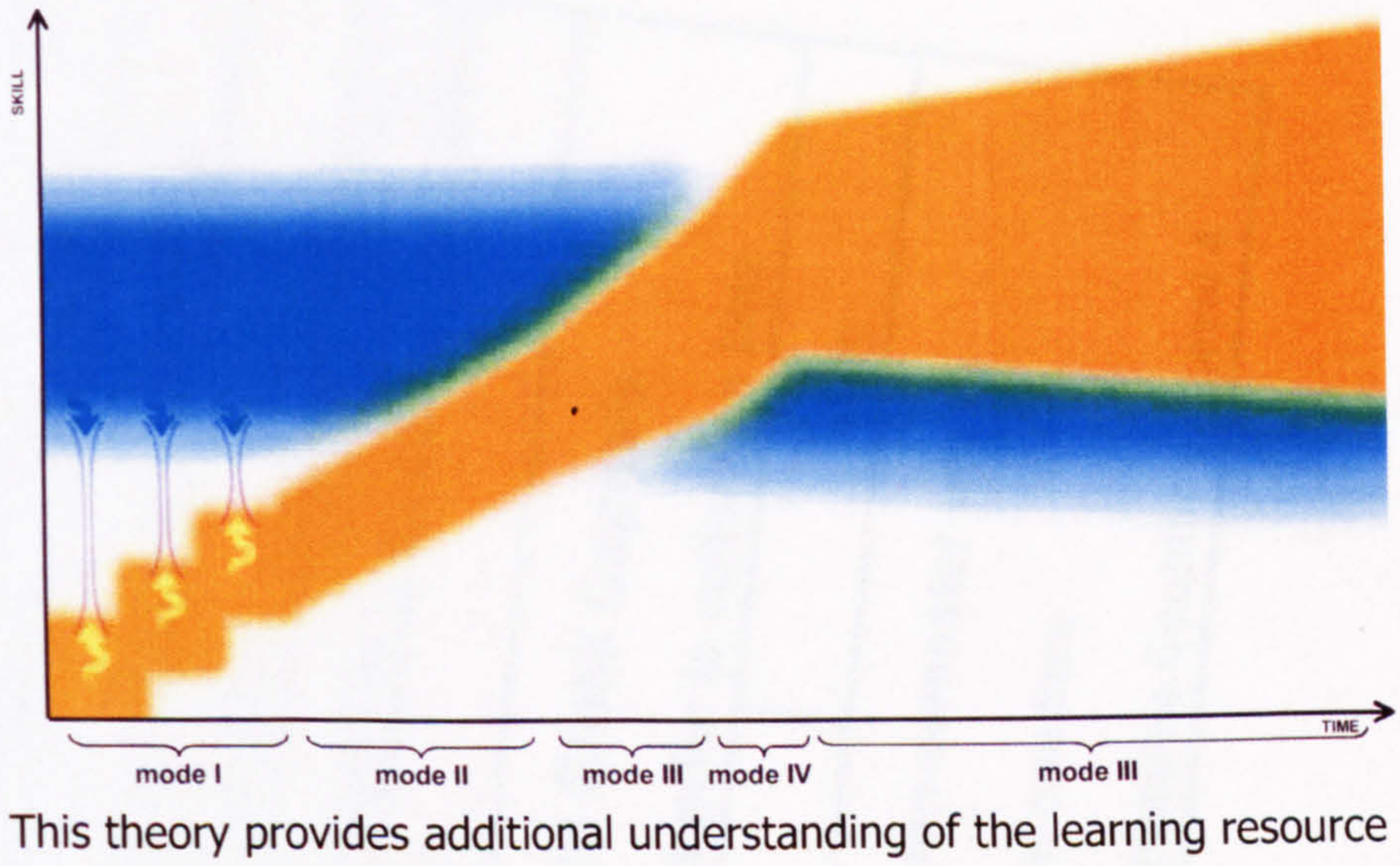


Figure 87: Learning path of self-directed learner.

This theory provides additional understanding of the learning resource structure described in section 3.3. The 'guidance' phase, which takes the learner step-by-step through the process, supports the learner's early learning when reflection on action predominates. The 'development' phase in which the learner develops their skills through repetition and self-evaluation, provides a rich variety of material for the more advanced learner to use once reflection in action predominates.

5.5.4 Conclusion

In this section I have proposed a theory of transmission of tacit knowledge based on the use of bridges of explicit knowledge across the knowledge gap between the personal knowledge of novice and expert. Ideally these bridges are formed through reciprocal reflection where both novice and expert reflect on the response of the other and adapt to the feedback until accord is reached. Over time, the novice should increasingly develop the ability to understand the actions of the expert without need of explicit interpretation and to conduct their own experiments using their own experience to interpret the feedback and

construct their own theory.

This process could be hindered by failures from either side. The expert could be dogmatic in his interpretation, seeking to correct the learner rather than attempting to engage in reciprocal reflection and revise his proffered bridge. Equally, the novice could reject the offered bridge, seeking to construct his own knowledge and become exhausted and disillusioned in the process. Finally, the novice could become too accepting of the received knowledge and not seek to question it, constraining himself to a shallow imitation of the expert's skill.

The role of the designer-researcher in the bowl turning practical work could be seen as facilitating the process of reciprocal reflection. I produced experimental bridges across the gap between the expert's and the novices' craft knowledge and worked with both sides to modify and refine them.

5.6 Conclusion

In this section I have described the decline and revival of clog making skills and reviewed the literature relevant to the learning of craft skills generally. This theory was used to reassess the progress of bowl turning learners described in chapter 3 and develop a framework for understanding how craft skills are learnt.

The background to the current-day context of gaining craft knowledge was provided by consideration of the skills of the last few clog makers in Britain. This revealed that, when the knowledge lay in the hands of so few active practitioners, learning through apprenticeship was not sufficient and broader research and experimentation was also necessary to validate and revise what was being taught.

The writings of John Dewey, Michael Polanyi and Donald Schön were considered to provide a theoretical background to reconsider the learning of craft skills. Polanyi's concept of tacit knowledge is used to describe the way in which an experienced practitioner knows much of the theory behind his skill only through the actions undertaken in regular practice. Dewey's theory of experiential learning and Schön's of reflection are used to explain how a practitioner's attention can be turned back on theory to improve skill.

The learning I observed, which is described in Chapters 3 and 4, was reconsidered in the light of this theory and used to construct a framework for the understanding of craft skills learning. I proposed that the practical skill of a craft practitioner is personal, context-specific knowledge which had a significant tacit element. For a novice to learn such a skill direct from an experienced practitioner they must start by imitating what they are observing, but this process can be assisted by the expert offering 'bridges' across the gap between their own knowledge and that of the novice. These bridges, evaluated in the design and testing of the bowl learning resource[36], take the form of explicit concepts used to help the novice appreciate the expert's tacit knowledge. Ideally these bridges should be negotiated through a

[36] described in section 5.4.3, p125.

process of reciprocal reflection: where the expert offers a bridge, the novice performs on their understanding of the bridge (exploratory indwelling), the expert reflects on the novice's response and considers revision of the bridge until the two are in accordance.

However, findings from the research suggested that, over the long term, the craft experts had a tendency to become fixed in their perception of their practice. They were dwelling in their craft but, perhaps because they had limited experience of teaching or perhaps because they did not have a wider community of practice, they ceased to 'break open' their tacit knowledge and then re-interiorise it. Equally, the novices could have a tendency to be reluctant to learn by imitation, perhaps because they were used to more constructivist forms of education, so such reciprocal reflection could easily fail to take place.

The proposed role of the designer-researcher is to help overcome these problems by assisting both novice and expert. Firstly through engagement with the expert practitioner to stimulate some breaking open and re-interiorisation of their craft skills to discover possible bridges to their tacit knowledge. Secondly through helping the novice to overcome the barriers to imitation by offering an interactive resource that should appeal to the constructivist, but also provide the explicit bridges that could help speed up the learning process by supporting their reflection on action. It would also offer the more advanced learner a rich source of material to draw on to develop their craft skill once they had the ability to generate their own interpretation.

6 Conclusions

"The Chinese character for problem is a combination of 'danger' and 'opportunity'. Every problem is the birth pang of a new solution. If that sounds overly optimistic, remember that every solution is also the birth pang of a new problem."

Guy Browning, How to ... solve problems (*The Guardian* 30.9.06)

In this chapter I present a summary of my research, providing a general overview of the thesis and brief synopsis of each chapter. I describe the contributions this research makes to knowledge in the fields of multimedia design, learning and pedagogy, and specific areas of craft skill. Finally I discuss the limitations of the research and outline my plans for post-doctoral research which aim to address these issues.

Figure 88: The craft practitioners who participated in this research, Robin Wood (top), Jeremy Atkinson (bottom).

6.1 Summary of the research

In this research I have taken a practice-led designer's approach to explore the problem of how to understand and transmit the practical knowledge of skilled craft practitioners. This has involved two practical research projects during which I developed techniques for eliciting craft knowledge and refined previously established principles for the design of multimedia resources to support the learning of such skills. Drawing on the theories of Polanyi, Dewey and Schön, I have developed a framework for understanding how craft skills are learned, validated through reappraisal of the documentation generated during the practical work.

Practice-led design research is fundamental to my methodology and integral to this is my dual role of designer-researcher. The working of the dual role is explained through Polanyi's theory of indwelling, whereby theory becomes interiorised and only known through its

embodiment in action (1966 p17). To assist with empathic indwelling[37] I recruited a group of close associates as participants in the research. To document the practical work and act as a stimulus to reflection I used extensive video recording and wrote 'event logs' to catalogue the video. This is effectively the reverse of interiorisation, where attention is returned to the theory governing the actions, and Polanyi regarded the process as being important to bring about deeper understanding of the actions, although it can temporarily paralyse the actor until the knowledge is subsequently re-interiorised (ibid p19).

Figure 89: Bowl turned by Robin Wood.

In the first practical project undertaken with the bowl turner Robin Wood, I experimentally used a systems-orientated approach involving three stages: knowledge elicitation, representation and application. My experiments with use of established elicitation techniques based on the practitioner describing his actions revealed knowledge which was too advanced for a beginner and my attempts at probing into this knowledge were either dismissed or responded to defensively by him. An observation-based technique produced more suitable starting material and I used a series of prototype learning resources as a means of representing my developing understanding of the elicited knowledge, structured using the framework developed during my MA research (Wood 2003). Application of the knowledge took place through a series of exploratory sessions with a small group of learners based on their using the developing prototype resource to support their learning, although I also frequently drew on my own knowledge and involved the craft expert to assist with interpretation.

I have set out to convey this first practical project in a realistic manner, not concealing the difficulties that occurred, the plans that went awry, my improvisation and modification. This is to emphasise the exploratory nature of this work. Gedenryd (1998 p152) makes this differentiation between experimental and exploratory use of prototyping in design, with the former being primarily concerned with testing the design itself and the latter considering a wider range of possibilities without a specific goal. For example, having allowed one learner to become exhausted and demoralised through freestyle

[37] My term for dwelling in another's actions, see section 2.2.2, p16.

experimentation, I felt the need to intervene and assist another learner rather than leaving her to struggle with inadequate interpretation[38]. I could do this with the knowledge that the ever-running video camera would capture my actions and after the event I could review and reflect on their outcomes.

Figure 90: Clogs made by Jeremy Atkinson.

In my second practical project with clog maker Jeremy Atkinson I developed a less intrusive elicitation technique based on increasingly focussed observation and interviewing. This resulted in a more cohesive piece of elicitation in which I gradually came to a wide-ranging understanding of the craft: the tools, materials and techniques used; and the principles of form and function in clogs. Whilst a limitation of this project was that I did not have the opportunity to validate the elicited knowledge with learners, I subsequently undertook a deeper investigation into the practitioner's understanding of the traditional usage of timber. This revealed how, having discovered a successful technique, he had found no need to re-examine his previous problems so his espoused theory was highly context-specific.

The result of this was to highlight the importance of the interplay between representation and validation of elicited craft knowledge in learning resource design. It would not be possible to investigate the 'truth' of *all* elicited knowledge and, as such investigation could also lead to defensiveness from the practitioner, it could also be inadvisable. The designer would need to validate any interpretation they create for the learning resource and other material generated during elicitation should retain its original context whenever possible so the learner can form their own judgement and make their own interpretation.

In the light of the outcomes from the practical work, I reconsidered the current context for craft knowledge and developed a framework to understand how it is learned. I firstly surveyed the decline and revival of clog making skills over the last century, partly by drawing on material recorded with the clog makers and partly through literature review, and this revealed the difficulty in resurrecting such crafts given such a small community of practice. To provide a context for

[38] see section 3.4.3.2, p66.

understanding the learning of craft knowledge I drew upon three major theorists: Michael Polanyi and his theory of tacit knowledge, John Dewey and his theory of experiential learning, and Donald Schön and his theory of reflection. I reassessed the learning I observed in the practical work in the light of these theories and proposed a framework for understanding such learning. The guidance offered by an expert can be seen as a series of 'bridges' that give the novice the opportunity to access the personal knowledge of the expert. The bridges are not necessarily *the* way to undertake the task, but *a* way that the expert feels to be helpful to get started. As their skill develops, the learner might find some of these to be the foundations upon which their skill is built, but some might be just stepping-stones on the way. Deciding which is which requires the learner to increasingly learn from experience, the feedback from their own actions, and this is achieved through developing the ability to think and act reflectively, moving through the modes of reflection described in section 5.5.2.

6.2 Contributions to knowledge

This research makes three specific contributions to knowledge. Firstly, in the field of multimedia design, it establishes a methodology for transmitting craft knowledge refining principles previously published through my MA research. Secondly, also in the field of multimedia design, it establishes techniques for eliciting craft knowledge which are interwoven with the process of developing the transmission resource. Thirdly, in the field of learning and pedagogy, it establishes a framework for understanding craft skills learning drawing on the theories of Michael Polanyi, John Dewey and Donald Schön and validated through appraisal of the practical work undertaken. In addition, in the field of craft practice, it has established specific knowledge and resources for the learning of traditional bowl turning and clog making.

6.2.1 Learning craft knowledge

The framework I have developed for understanding the learning of craft knowledge draws firstly on Polanyi's theory of tacit knowing. This proposed that such knowledge was personal, built up from a range of knowledge that the person in the act of knowing has, and was largely internalised so the theory governing actions was often only known through undertaking the actions (1966 p17).

Polanyi described the means by which such knowledge was learned as a process of indwelling: the novice seeks to dwell in the actions of the expert through observing them and taking action to imitate them (1966 p30). However, my work with the bowl turners showed that at an early stage of learning it was very difficult for a novice just to observe and imitate successfully. All the learners struggled to imitate what they had seen in the videos and one learner, Giles, when he chose to experiment with very little guidance became exhausted and demoralised. The bowl turning novices who made a more successful start to their learning used guidance in the form of my interpretation of knowledge elicited from the craft expert. This interpretation helped the novice dwell in the expert's actions by offering explicit concepts as a bridge over the gap

between their personal knowledge:

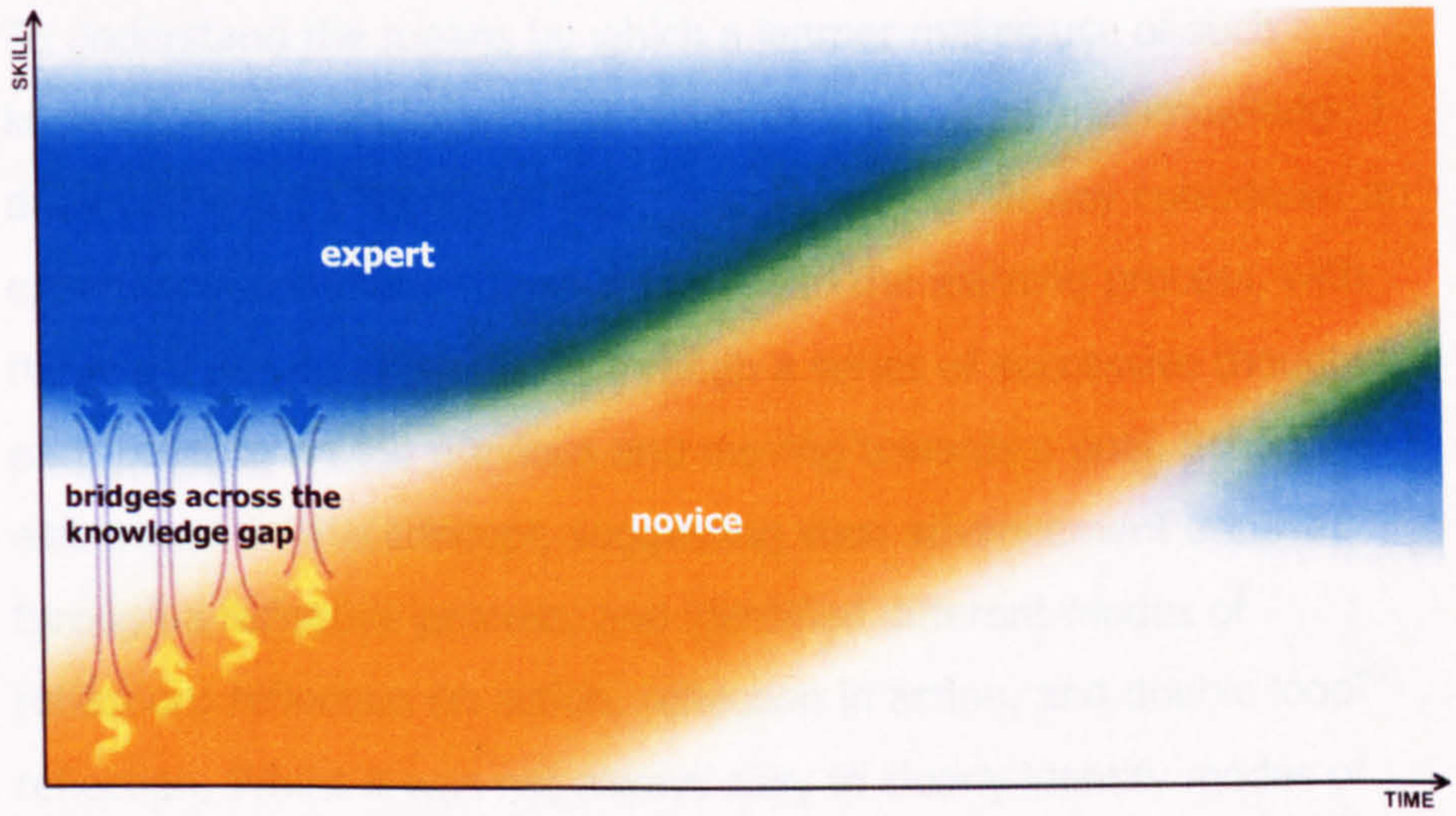


Figure 91: The knowledge gap between craft novice and expert.

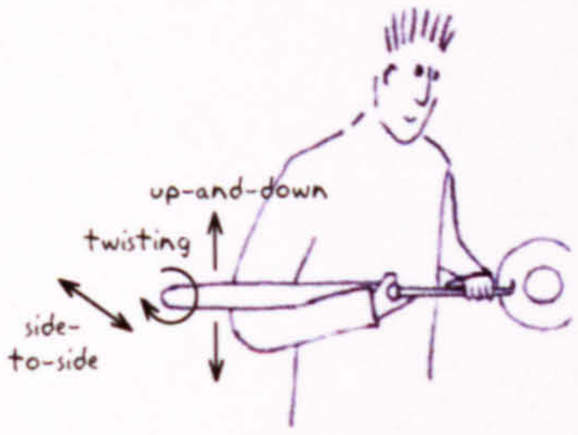


Figure 92: The three movements of the turning tool described by the expert.

For example Robin Wood, the bowl turning expert, used a series of explicit concepts to try to communicate to a novice how to achieve the correct angle so the turning tool cut cleanly. His first explanations were in terms of 'twisting' and 'pivoting' the tool, but the novice found the language confusing, so he tried again in terms of the angle of the tool: showing where 90° and 0° were and telling him to aim for 10°. The novice was then more successful, but Wood was not entirely satisfied and later came up with a new explanation, dividing the movement into three which subsequently proved more successful in conveying the concept to the novices[39].

I am very concerned in this description *not* to imply that the tacit knowledge of the expert was made explicit. In my understanding, the knowledge that guided the angle at which the expert used a tool was largely internalised and could have been influenced by a rich variety of factors with varying degrees of importance. More obvious factors might include the type of timber being used, the moisture content of the timber, the sharpness of the tool, the type of bowl being turned, but there could also be personal factors such as the height and strength of the turner or just that he was rushing to complete an order or taking it easy because he was tired. At one stage when I was observing him, Robin told me that he had altered the tool angle because the wood shavings were spraying in his face. These factors are not the expert's tacit knowledge, they are explicit concepts which can help the expert

[39] My role in this process is described below.

articulate his tacit knowledge.

To understand the means by which a learner makes use of such knowledge from an expert and builds their own personal knowledge I draw on Dewey's theory of experiential learning. Dewey considered an experiential continuum to be important to the learning process, with the learner's skill progressing through a series of successive thoughts, each building on the previous and moving towards a goal. Schön elaborated on this concept, suggesting such advancement occurred through a reflective process, and identified different modes of reflection: reflection on action, reflection in action, and double loop[40] reflection. Whilst it was not always easy to clearly identify modes of reflection in the bowl turning learners' actions, particularly reflection *in* action, the two most successful learners both seemed to progress from predominately using reflection *on* action to increasingly using reflection *in* action. Double-loop reflection was only encountered in discussion with the craft experts and appeared to be an occasional, 'break through' occurrence, and long-term reflection in action appeared to predominate leading to the theory governing their actions becoming increasingly internalised.

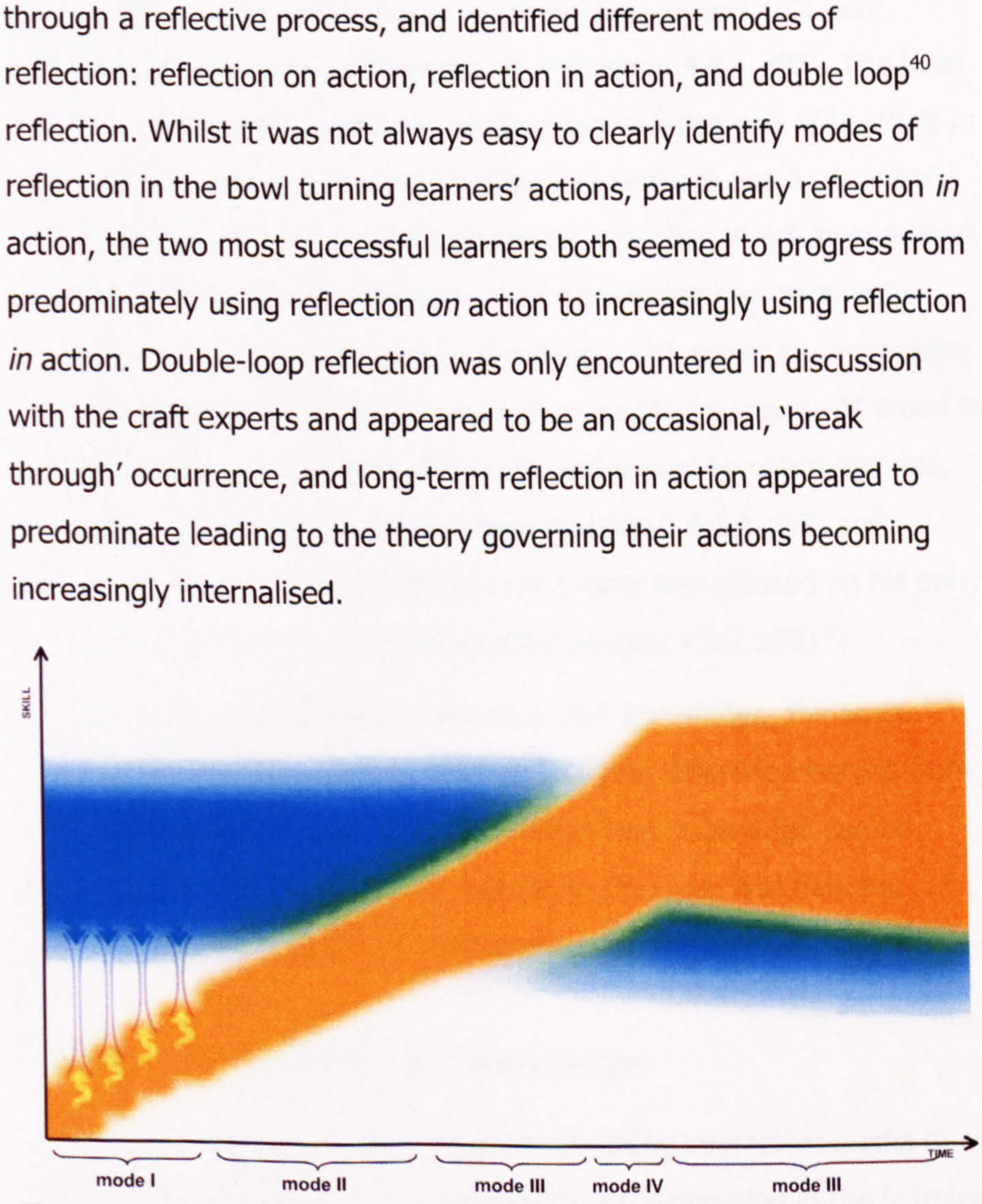


Figure 93: Idealised learning path using all modes of reflection.

The two bowl turning learners who showed most significant skill development at first predominately used reflection on action: with Helen pausing frequently to ask for help and Andy alternating between working at the lathe and seeking assistance from the learning materials. They then spent an increasing amount of time turning, with

[40] This is my term for a concept developed by Schön and Argyris, see p135.

Helen's reflection in action shown through her comments as she noticed and corrected errors whilst she worked, and Andy's implicit in the steady improvement to his technique. Giles commented that taking a short break had been useful in providing him with time to think about the learning materials he had seen and afterwards he was able to think much more as he was working.

Examples of double loop reflection were described by both craft experts. The clog maker, Jeremy, described a discussion early in his career with a retired clog maker which led him to work in a very different manner with a different timber (section 4.3.1 p92). The bowl turner, Robin, related watching another turner using one of his tools in a completely different way and suddenly realising it was a very useful technique (section 5.4.4 p126). However, reflection in action appeared to mostly predominate, leading to their knowledge becoming very internalised. It proved difficult to get either craft expert to re-examine his espoused theories: notable examples are the reluctance of Wood to accept that he held the tool differently to the way he recommended, even after observing himself on video (section 3.4.3.1 p63) and Atkinson's understanding of the use of timber being based on his early bad experiences with unseasoned alder(section 4.3.2 p95)[41].

In the light of this concept of learning craft knowledge, the terms 'elicitation' and 'transmission' take on a subtly different meaning from usual, moving away from the connotation that knowledge can be extracted and passed from one person to the next, and they are explained in more detail the next two sections.

6.2.2 Transmitting craft knowledge

The techniques I have developed for designing interactive media to support transmission of craft knowledge are embedded in the learning resource framework published in my MA research (Wood 2003). Whilst the framework has not changed significantly since publication, this research has both tested the structure and provided significant insight

[41] The difficulty this caused with corroborating elicited knowledge and overcoming this problem is discussed in section 6.2.3, below.

into how such a learning resource can help the learning of craft skills.

As described above, my experience of working with craft practitioners leads me to believe their knowledge is largely personal, context-specific and tacit. Transmission of such knowledge occurs through empathic indwelling where the novice dwells in the actions of the expert through observing and then re-enacting them (Polanyi 1966 p30). The role of the learning resource is to support the empathic indwelling of the novice through three phases of learning:

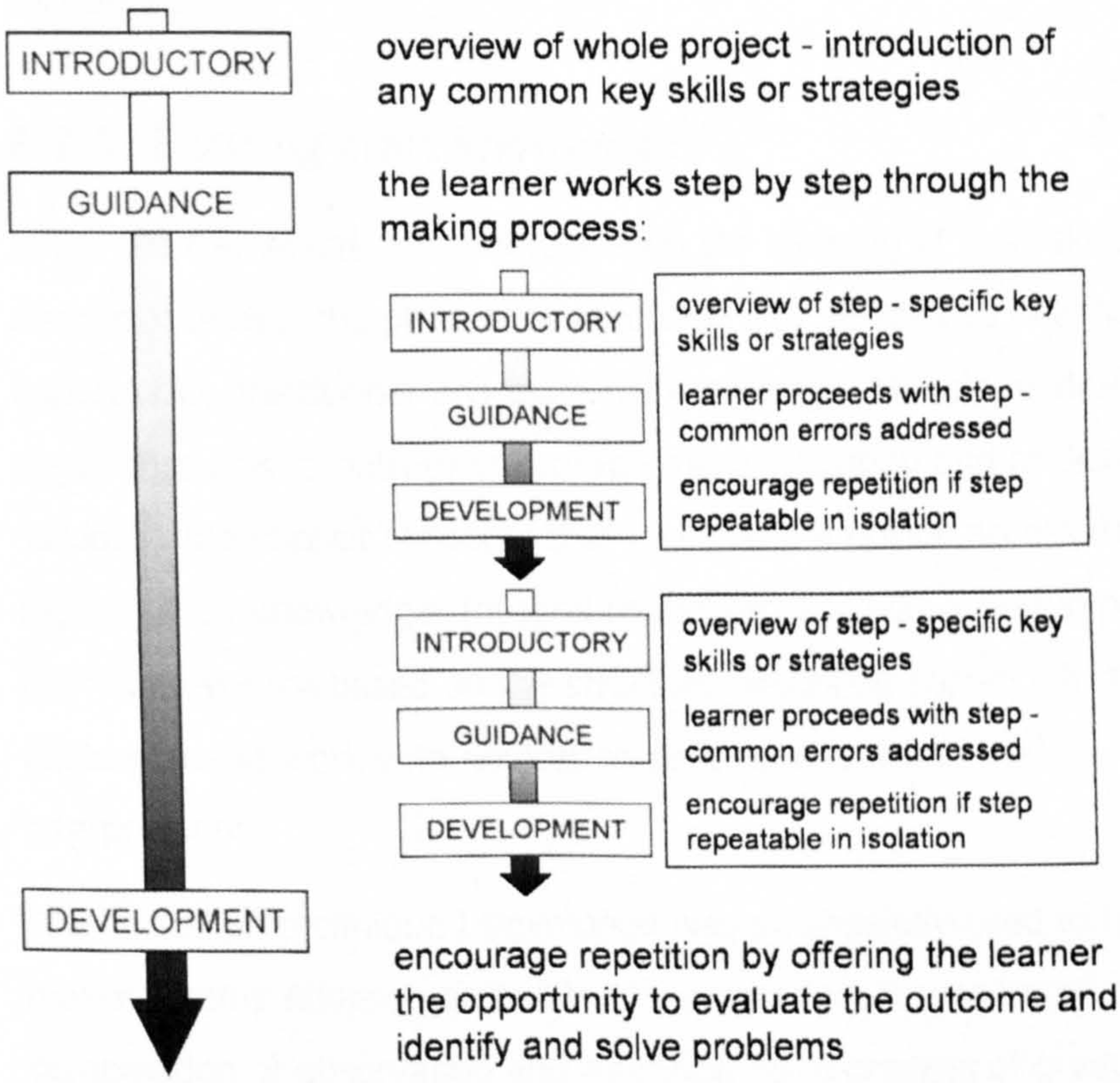


Figure 94: Overview of learning resource structure.

This framework was used to structure material supplied to the bowl turning novices in the first part of the practical work I undertook. Firstly, at the introductory phase they were provided with an overview of what they were trying to achieve, usually in the form of a short video clip, and introduced to any key skills or strategies. However, the novices initially struggled to use what they had seen in either live or videoed demonstrations to inform their learning, demonstrating their need for the guidance phase. This took them step-by-step through the procedure and explained any common errors associated with them. This supported their early use of reflection on action as they attempted to relate the feedback from their experiences to the interpretation, alternating between lathe and learning materials as they learned. Two novices then spent increasing time at the lathe showing steady

improvement to their technique, giving indication of an increasing ability to reflect *in* action.

Whilst this project was too short to allow much time for skill development, the learning resource could further support the novices in their development phase once they had developed the ability to dwell in the actions of the expert without needing explicit interpretation, through offering a wider range of video for them to draw from and this will be explored further in my post doctoral research described in section 6.3.

6.2.3 Eliciting craft knowledge

Given the framework for understanding the learning of craft skills described above, the process of elicitation can be seen as helping the expert craft practitioner articulate his knowledge. My role as designer-researcher was to both to encourage this articulation and to design the 'bridges': the explicit concepts that could help a novice access the expert's tacit knowledge. Integral to this process was a prototype learning resource based on the structure described above, which enabled me to work with novices to develop and refine the interpretation.

The elicitation technique I developed was successfully used to help clog maker Jeremy Atkinson articulate his knowledge. It was based on a combination of observation and interviewing, a process of gradual immersion starting with general observation and open questions aimed at gaining contextual information, and then gradually increasing the focus of observation and questioning as my understanding grew. The elicitation sessions were almost entirely workshop-based allowing me to observe his regular practice and enabling him to illustrate his explanations through demonstration.

The technique of working with an expert to design the 'bridges' to allow novices to access his knowledge was demonstrated in the example described above where I helped Robin Wood, the bowl turning expert, articulate his knowledge of how to achieve the correct cutting angle of the tool. During the formal, experimental elicitation I had undertaken I had failed to understand his technical explanation using

angles. When trying to help a novice understand the concept, he regularly resorted to twisting the tool in the novice's hand into the correct position as he could not find a verbal means of communicating what he wanted. He again tried the explanation using angles, but the learner also struggled to understand it. However, after this experience he came up with the notion of dividing the movement into three which he demonstrated for me to record on video. Whilst this explanation was hesitant, it was sufficient for me to gain an understanding and then to use the prototype learning resource to develop interpretive drawings. These helped the learners gain experience of the correct cutting angle of the tool as a starting point for building their own personal knowledge of tool use.

The novice played an important role in this process and I draw on Schön's concept of reciprocal reflection in explanation. Schön suggested that it required intelligent effort on behalf of both expert and novice to bridge the gap between the two. So, as well as the novice acting reflectively when offered guidance by an expert, the expert too needs to reflect on the resultant actions of the novice and consider revision of the guidance until the two reach accord. Working with the novice appeared to help Wood reflect on his explanation of the cutting angle of the tool. As the novice struggled to respond to his guidance he tried both modifying his explanation and physically putting the tool at the correct angle. Whilst this reciprocal reflection was not entirely satisfactory as the novice continued to struggle to use the tool, afterwards Wood continued to reflect on the experience until he developed the explanation which I was able to use successfully. I plan to make further use of novices to stimulate reciprocal reflection in future research, as described below.

6.2.4 Material to support craft learning

In the practical work with both craft experts I generated significant video footage of both their regular practice and their descriptions of their practice. Whilst I did not have the opportunity to develop material with Jeremy Atkinson to support novice clog makers, the footage of him will be of value to more experienced learners and will be held in the archive at the Museum of Welsh Life so it will be publicly

accessible.

In the practical work with the bowl turners I helped the expert, Robin Wood, articulate some of his knowledge to develop interpretation for a learning resource. Since participating in this project he has taught several short courses and successfully used these explanations in his teaching. Whilst the interactive learning resource is currently only partially complete, I plan fill out the missing sections and make it available to Robin's course participants to support their subsequent skill development.

6.3 Limitations and future directions

6.3.1 Knifemaking project

The immediate impact of this research on my own work has been to provide me with a clear understanding of the process of transmitting craft knowledge. It has provided a methodological underpinning for the recording work I have been doing and I plan to continue producing archive and learning material for traditional craft practices. I have planned a two-year post doctoral research project[42] which will enable me to continue this research and explore possible solutions to some limitations I have identified which are discussed below.

In the first practical project with the bowl turners I chose a group of participants and a craft of which I had close acquaintance to help me dwell in their actions and understand my observations. Whilst the second practical project was a partial step away from this, working with participants and a craft less known to myself, it was still within the realm of woodworking of which I have specialised knowledge that I drew on during elicitation. In my post-doctoral research project I shall be studying the skills of a number of traditional knife makers, a craft of which I have no prior knowledge. I shall be using a contemporary knife maker who will act as an 'expert learner', working alongside and learning from the traditional craftsmen, with the aim of stimulating reciprocal reflection to aid elicitation and interpretation.

Whilst the event logging process I used, running the video in QuickTime and writing the log in Word, was sufficient for cataloguing the bowl turning learners, it proved increasingly cumbersome and slow with the large amounts of video generated recording the clog makers. Since I started this research new video analysis software has been developed primarily for use in social science research which offers the potential to streamline the operation. At the production stage the software can manage both operating the video and writing the log

[42] "Transmitting Craft Knowledge: eliciting and passing on the skills of craft masters with the help of interactive media" AHRC award number AH/D001838/1 awarded 17/5/06.

rather than having to switch between two programmes. It also offers a more efficient catalogue for later use as the video is automatically bookmarked when an event is logged, so can easily be located and reviewed.

There was not time during this research to fully develop and test an interactive learning resource. There are specific elements I wish to investigate more thoroughly, such as the use of narration alongside text and video, and I wish to observe more advanced learners who have a greater ability to dwell in the actions they are observing to help structure the development phase (see Figure 94). In the knife making project described above I plan to produce a fully functional resource and test it with a wider range of novices who will use it to support their ongoing learning after being initially taught by the 'expert learner'.

Finally, I did not have the opportunity to explore the social aspect of learning in either practical project. Looking back at the short courses I observed as part of my MA research, the relationships between learners on the courses appeared to be beneficial to their learning, offering different but still useful support to that offered by the craft expert. Literature from the field of education (e.g. Vygotsky 1962, Lave and Wenger 1991) highlights the importance of the community of practice to the learner and I plan to further explore this aspect with the knife making novices.

6.3.2 Wider implications

This research has had a wider impact on other areas I am involved with, in particular recent work I have undertaken with Robin developing short courses teaching hand carving with knives and axes: a craft we have both practiced for many years (see Figure 95) but have only recently started to teach.

Figure 95: Eating spoons made by myself and Robin

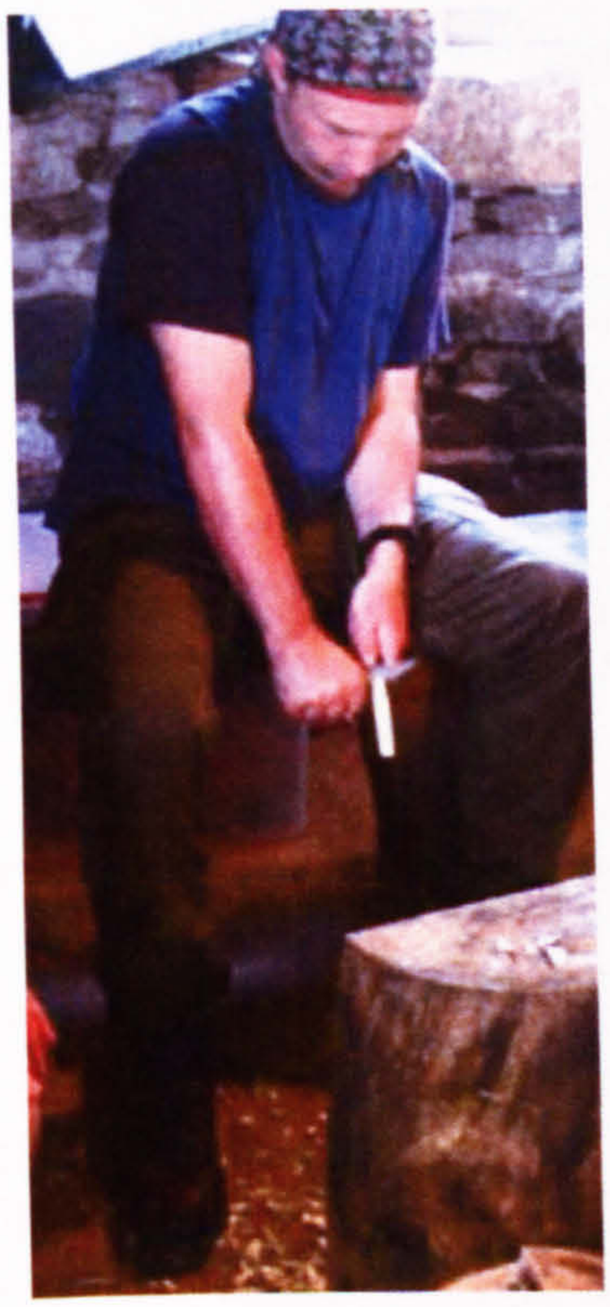


Figure 96: A student practicing a knife grip.

The structure of these courses has been based on the learning resource framework[43], using the three phases: introductory, guidance and development. Key skills, such as different hand grips on a knife whilst carving, have been taught firstly in isolation, getting learners to whittle a stick away to nothing (see Figure 96), before they apply them by making a spatula. I have designed a simple spatula that is easy to carve and the students are encouraged to replicate this to learn the key skills before producing their own designs which inevitably call for more advanced skills.

Whilst I have been occupied completing this research, Robin has been delivering the teaching, but over the next year I plan to lead some workshops myself with a particular interest in encouraging women makers like myself who frequently need to adapt techniques to make up for lack of strength.

In addition, I believe the project has broader implications for learning in the crafts and I am exploring ways to translate the principles of elicitation and learning for application in mainstream education, for example involvement with metal workers and ceramicists on undergraduate courses.

I would speculate that this understanding of craft learning and the model of apprenticeship I have developed could have applications not purely in the immediate area of the crafts but also in any area where tacit understanding needs to be developed. It leads people to attend to the tasks and activities of professional work, not purely as a means to

[43] see Figure 25 p44

a practical end, but as bridges to a richer understanding of the practice. I am already aware of others who know my work using the bridging concept in explanation of their own work and, through further dissemination, I plan to make the theory more widely accessible for further adaptation.

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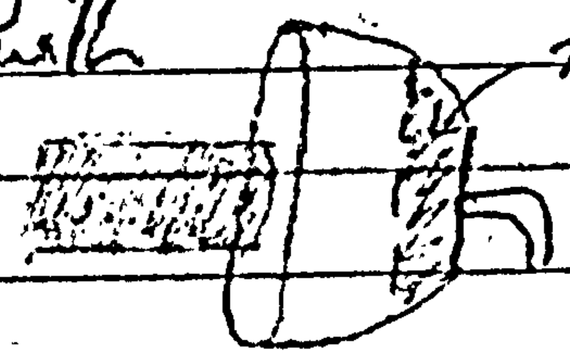
8 APPENDIX I: prototype resources

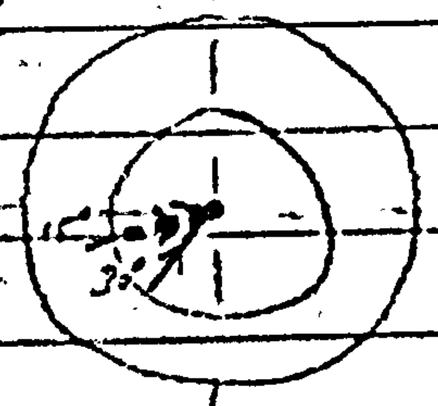
29/1

STAGE 1 TURN BASE FLAT

1.1 Rough turn a little way up the side of the bowl so you can see how thick the base is to start with



1.2 Flatten the base with a series of "stabbing cuts" - can work several times across until base is even + slightly "concave" stabbing cuts work up from about 15% horiz - tool held down ⇒



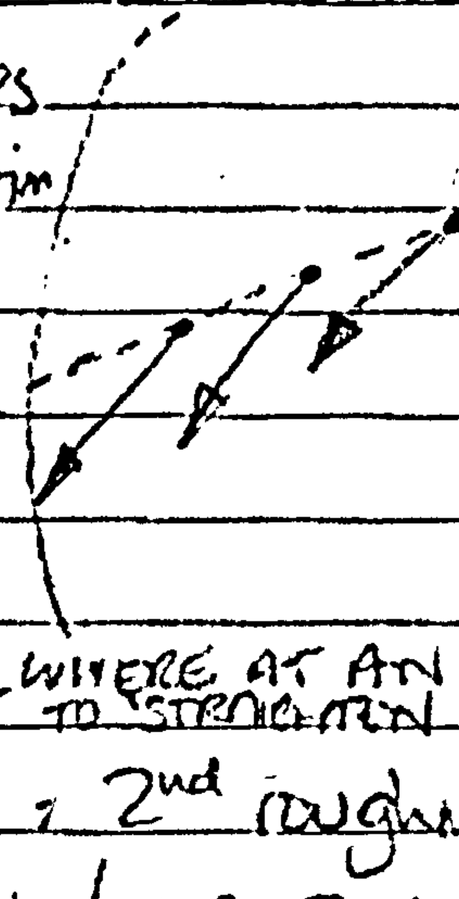
at about 30° tool held flat towards wood ⇒

If the ridged finish is not what you want - smooth across base with a ~~thing~~ planing cut or two (Good dip from B3).

ALL THIS DONE FROM ONE HAND HOLD ON TOOL REST

STAGE 2 : 1st ROUGHING OUT CUT

This is to knock the big bumps off the side of the bowl working from the base to the rim in a series of steps



for each hand hold making sure to hold the tool & hand still

NB. Gets harder to cut closer to rim

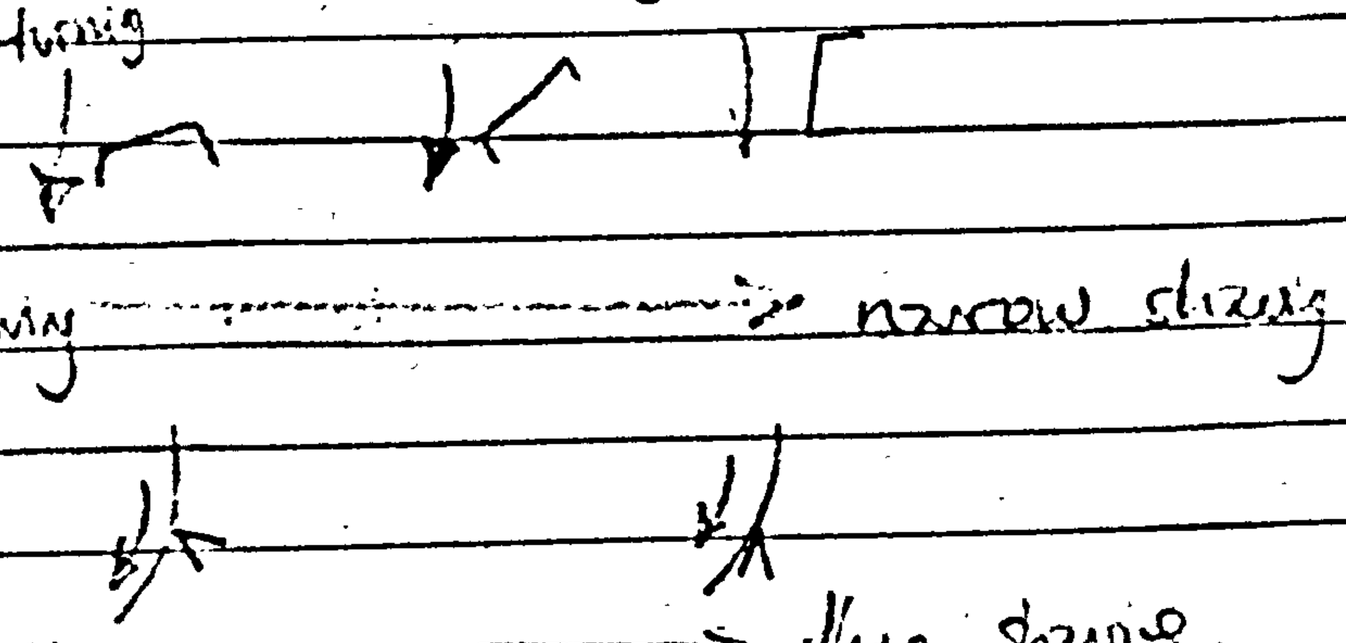
[A THIS IS WHERE AT AN ADVANCED STAGE YOU'D DO A RIM CUT TO STRENGTHEN OUT THE RIM EDGE]

STAGE 3 : 2nd roughing out cut

- Stop + have a good look at the surface of the bowl for any burning chatter/saw marks. Consider how much has to be taken off to smooth them
- Consider the overall form of the bowl & where more wood needs to be removed to balance it.
- Take a second (finer) cut off the side of the bowl, with the aim of achieving a basic [To start with will have

The important thing is that the tool acts as a pivot for the tool on the rest but it stays still whilst turning. Mustn't slide the tool along the rest whilst cutting + must be placed so as the tool tails + bump it doesn't ride over it but slices through

2. The angle the tool meets the wood
This is very tricky to describe: you have two curved surfaces rubbing each other & what's actually happening is very subtle the two issues at play are how much of the blade is in contact with the wood and at what angle it meets



What's happening at any one time is difficult to ascertain around the side of the tool.
Across the base the "clubbing" cut is a series of narrow, thick cuts using the top of the blade

and the "flowing" cuts is a broad thin sweep using the tool in towards the base of the tool.

The rest we'll have to work out as we do it!

3 Tear-out
Cutting along the grain is easy across the grain tool At right angles one of the other is the tool cutting, the grain tends to tear out. It also acts more difficult the closer to the direction of cut. => look at a tool to illustrate this point.

to stop frequently to look at surface
& consider form & keep planing until
it's about there - this may take several
"passes" but have working from base
to rim approx as pictured above]

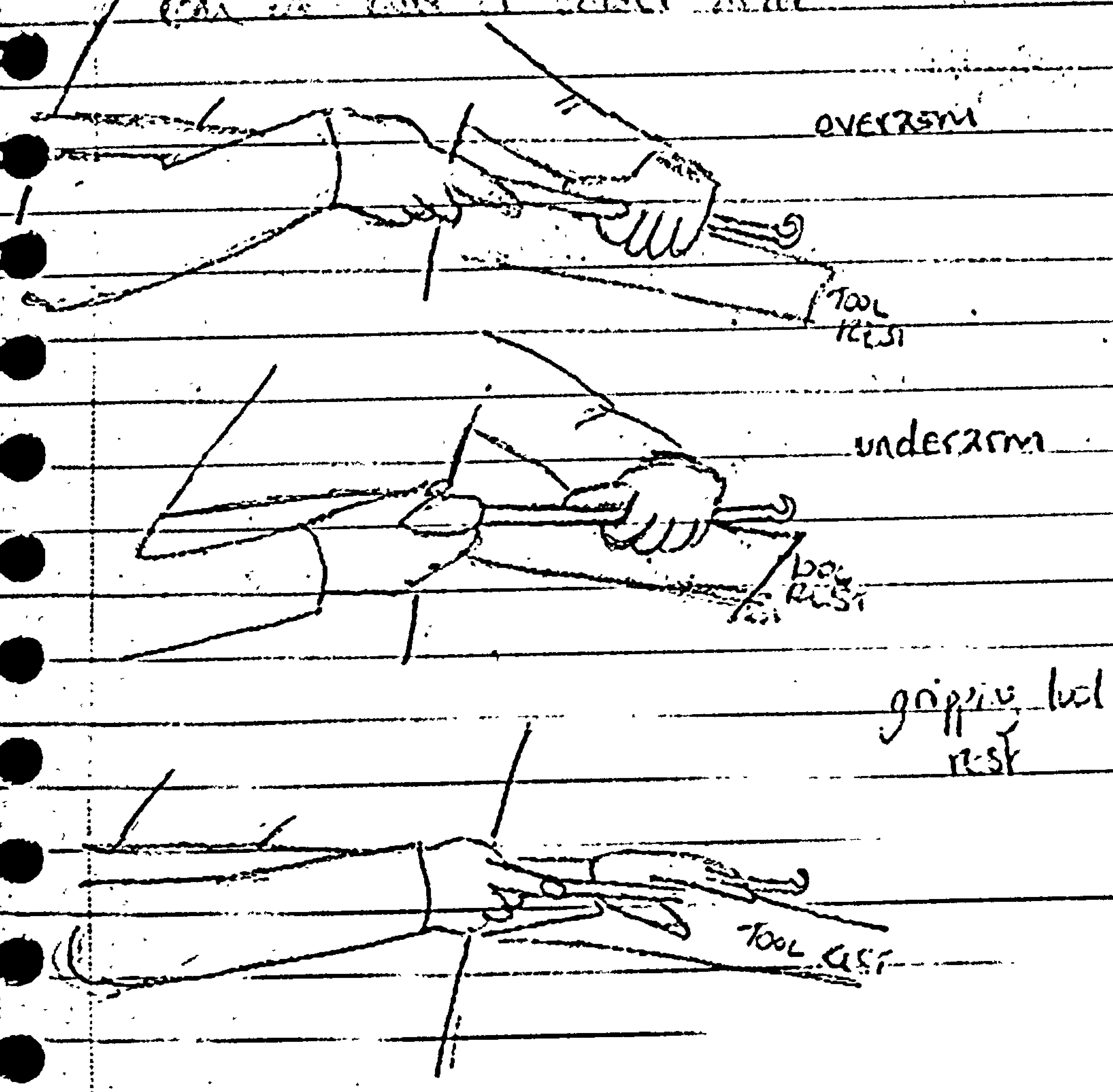
STAGE 4: Finishing cut
- look at surface & tool for where/how
deep any tear out is - judging how
much will have to come off in this
cut

[THIS COULD BE A CUE FOR A MORE ADVANCED STAGE?
- cut back line into base aiming at
slightly bevelled edge:]

- take fine cut up side of bowl stopping
frequently to examine state of tear-out
(this is the stage at which you can
do any ridges, grooves or other
ornamentation on the bowl if you want)

(Grasping)
Basic Stance

1. Holding the tool: most common stance
is with left hand gripping the shaft
and right hand the handle, though it
can be over or under arm



^ over arm ... usual

< under arm ... OK

^ holding tool rest ... occasional

MOVING THE ANGLE OF THE TOOL

Note the "step" where the tool is cutting - the width of this is adjusted by moving the tool from **SIDE TO SIDE** see video clip.

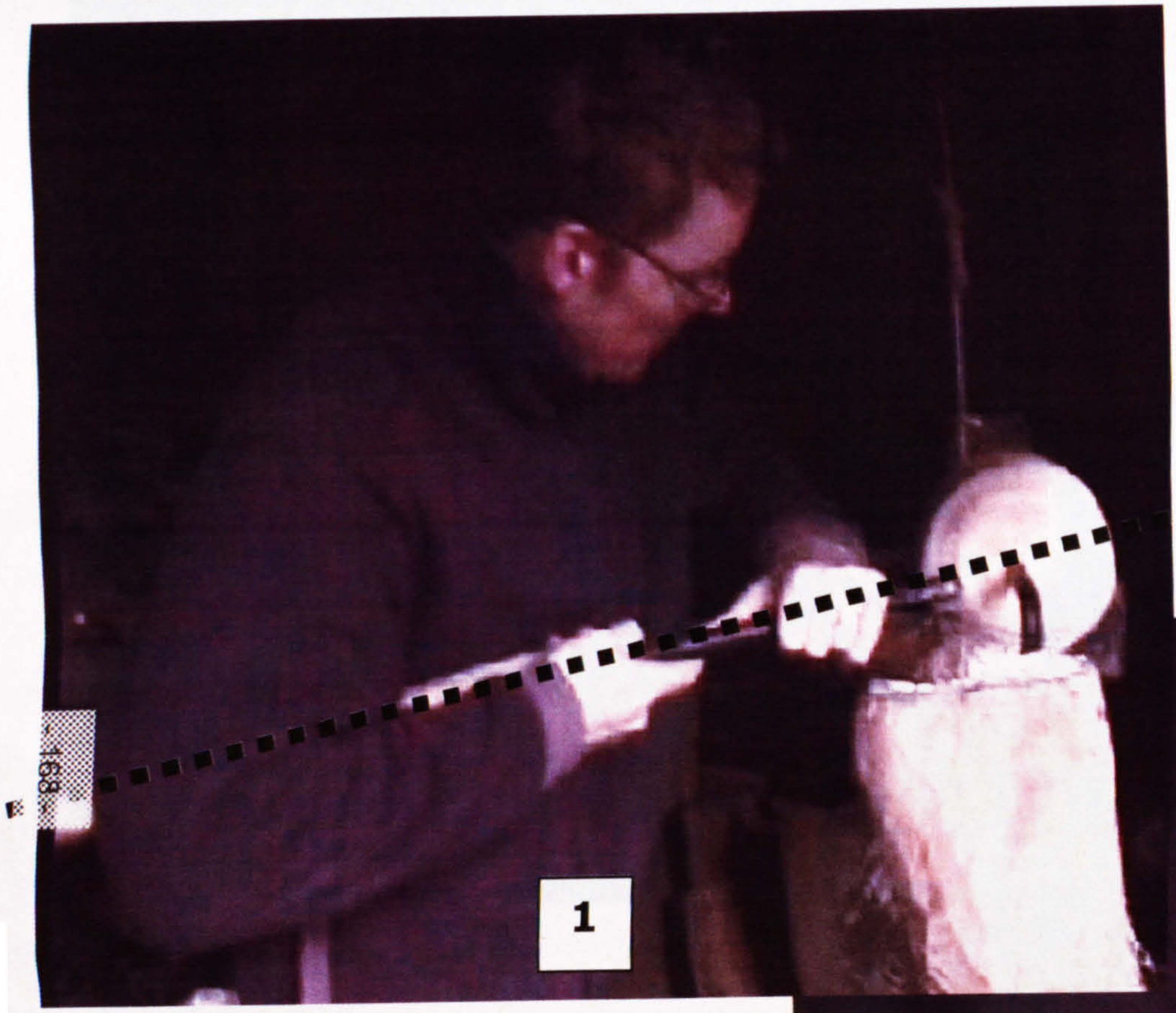
UP & DOWN ... the effect of this is less clear, but commonly the tool is held around horizontal to start with, then the cutting edge is lowered as the rim is approached (see pictures below)

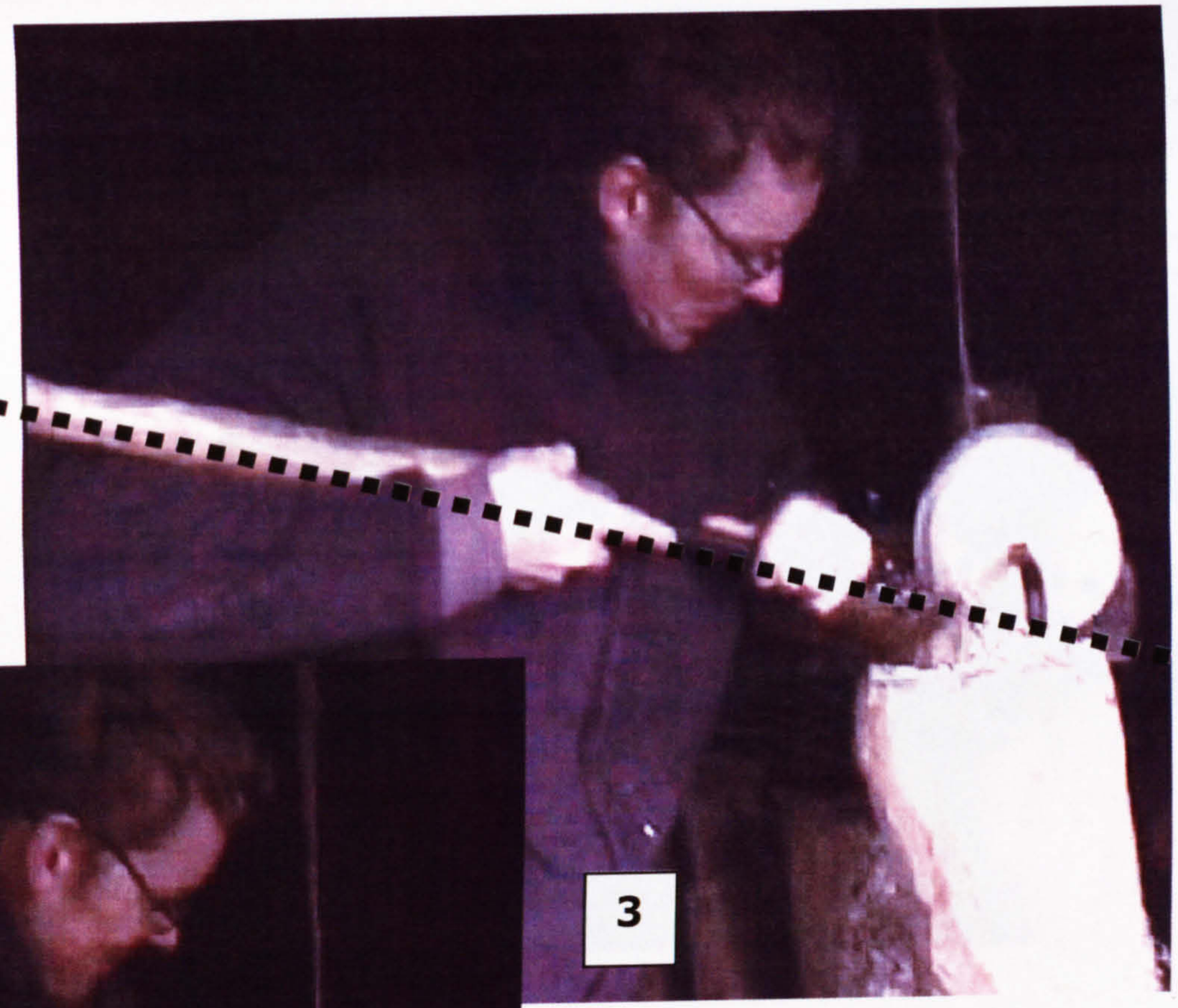
TWISTING the tool effects the "aggressiveness" of the cut - the greater the angle the more wood you cut off.

greater angle =
cutting more off =
rougher cut

smaller angle =
cutting less off =
finer cut

ROUGHING OUT






1


2


3

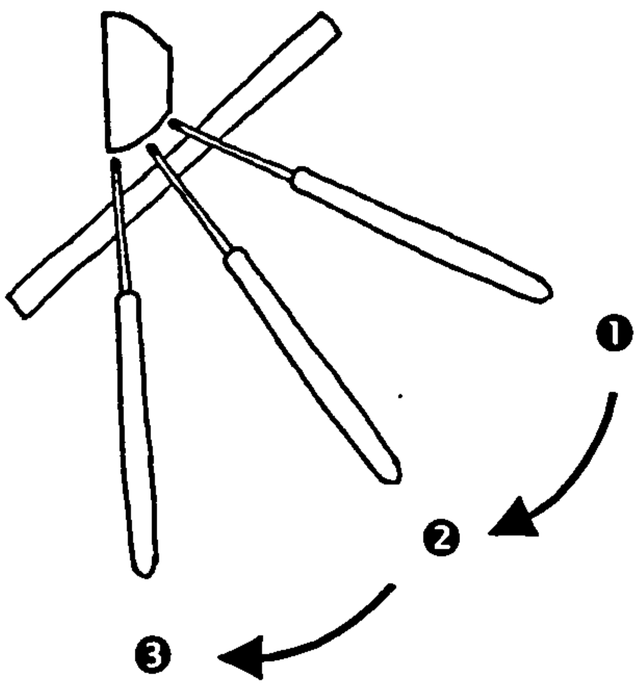
CUTTING BASE

< stance

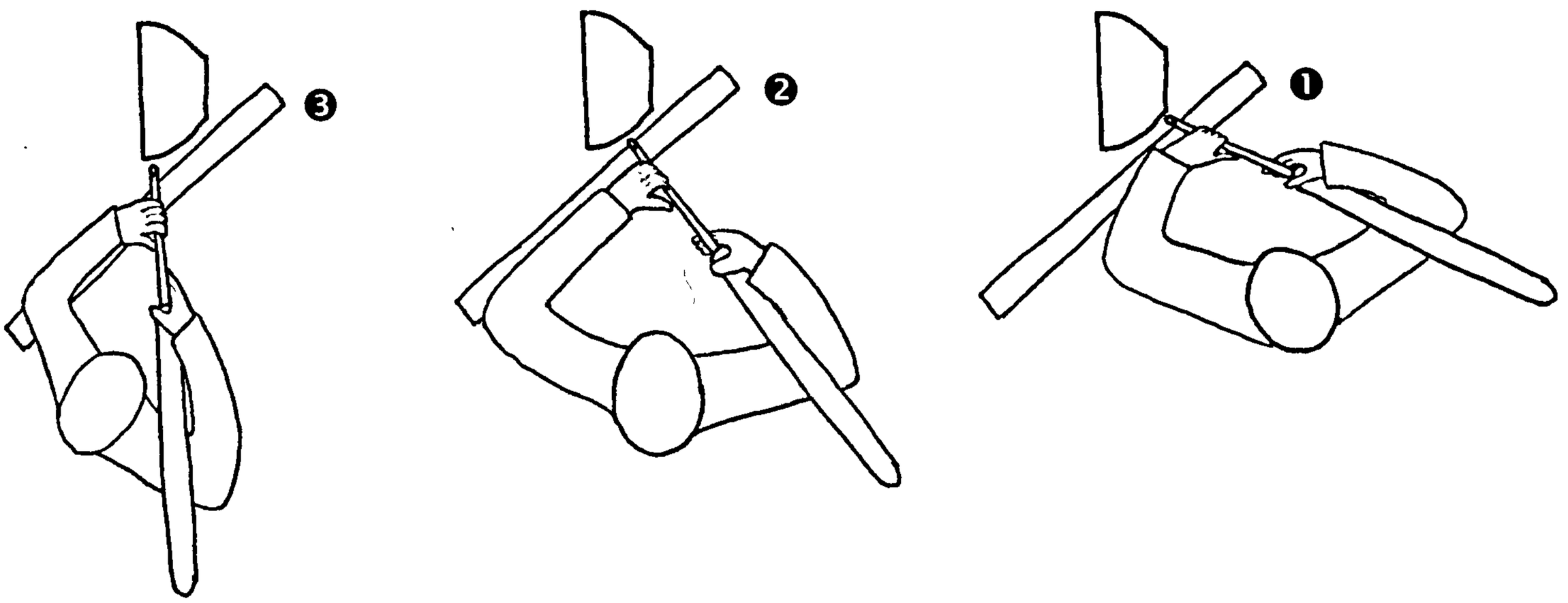
move the tool **side-to-side**

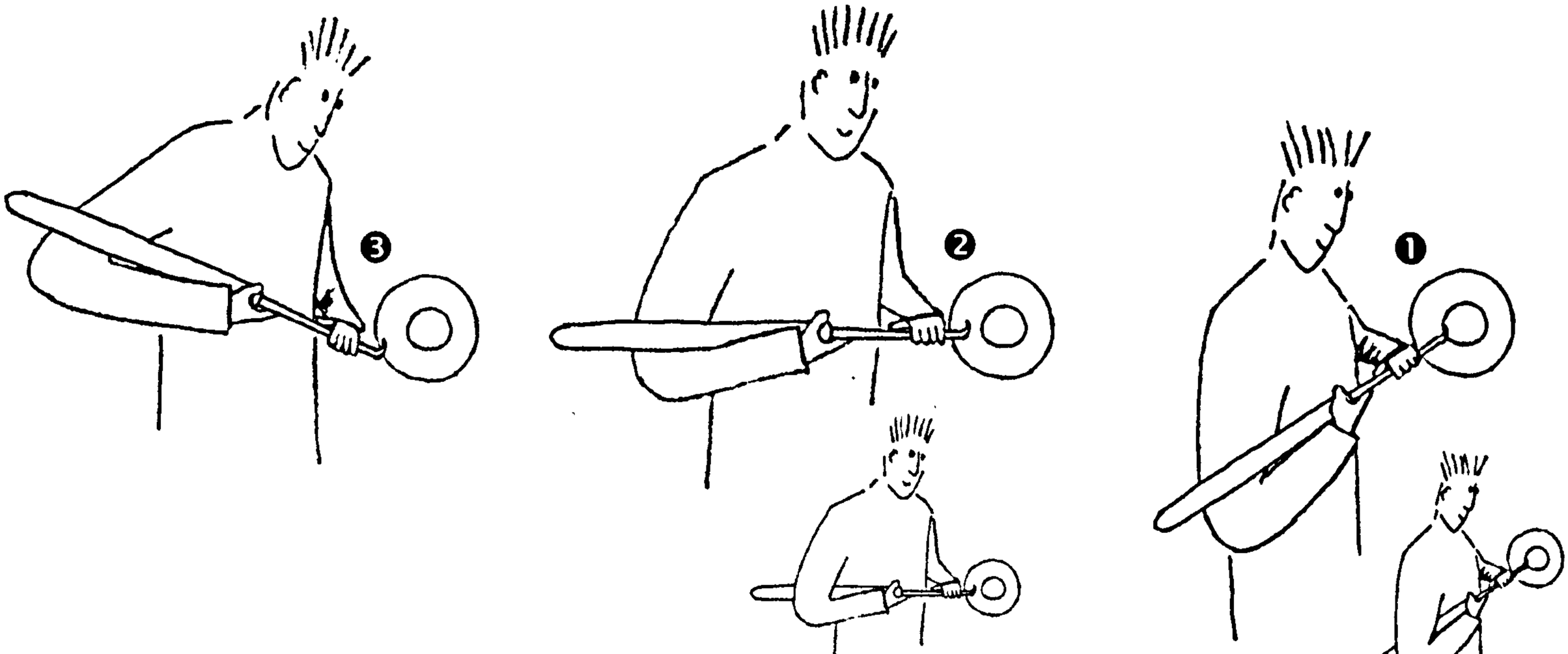
this gives you a

- smooth surface
- rounded shape



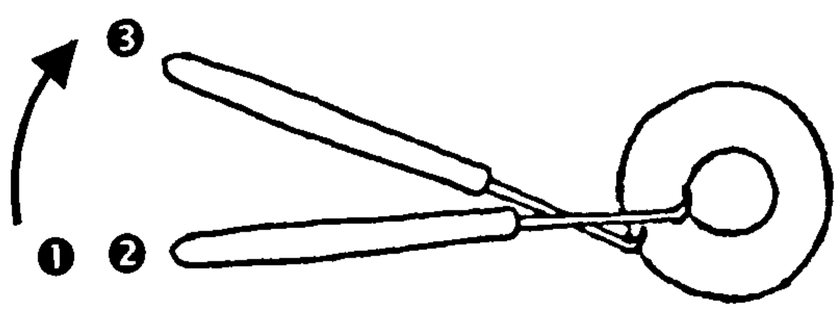
❶ & ❷ the tool handle can be **above or below** the arm
❸ is easiest with the handle **above** the arm





for a clean cut
close to the rim

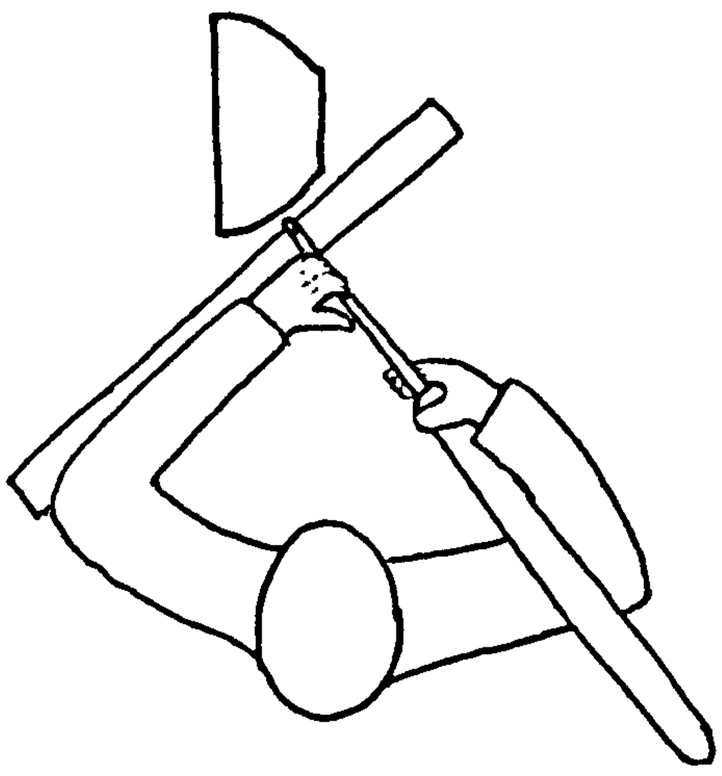
move the tool **up-and-down**

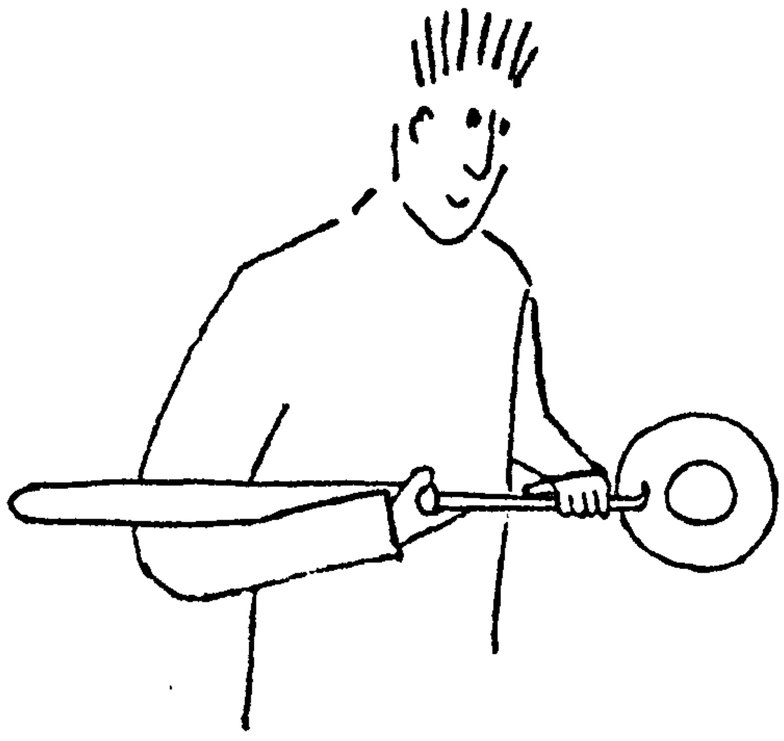


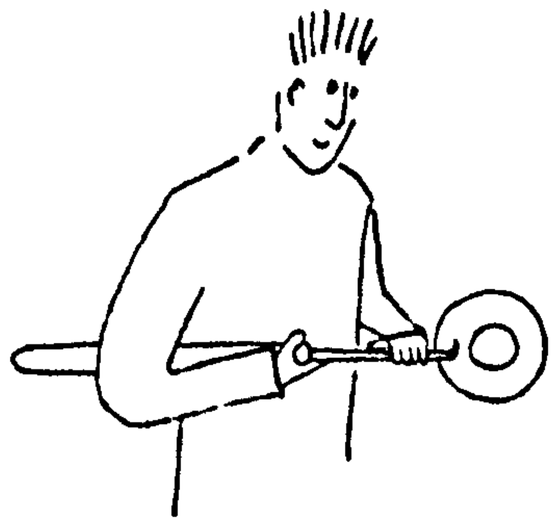
holding the tool

to get a clean cut the tool has to be held relatively still: this is easiest with

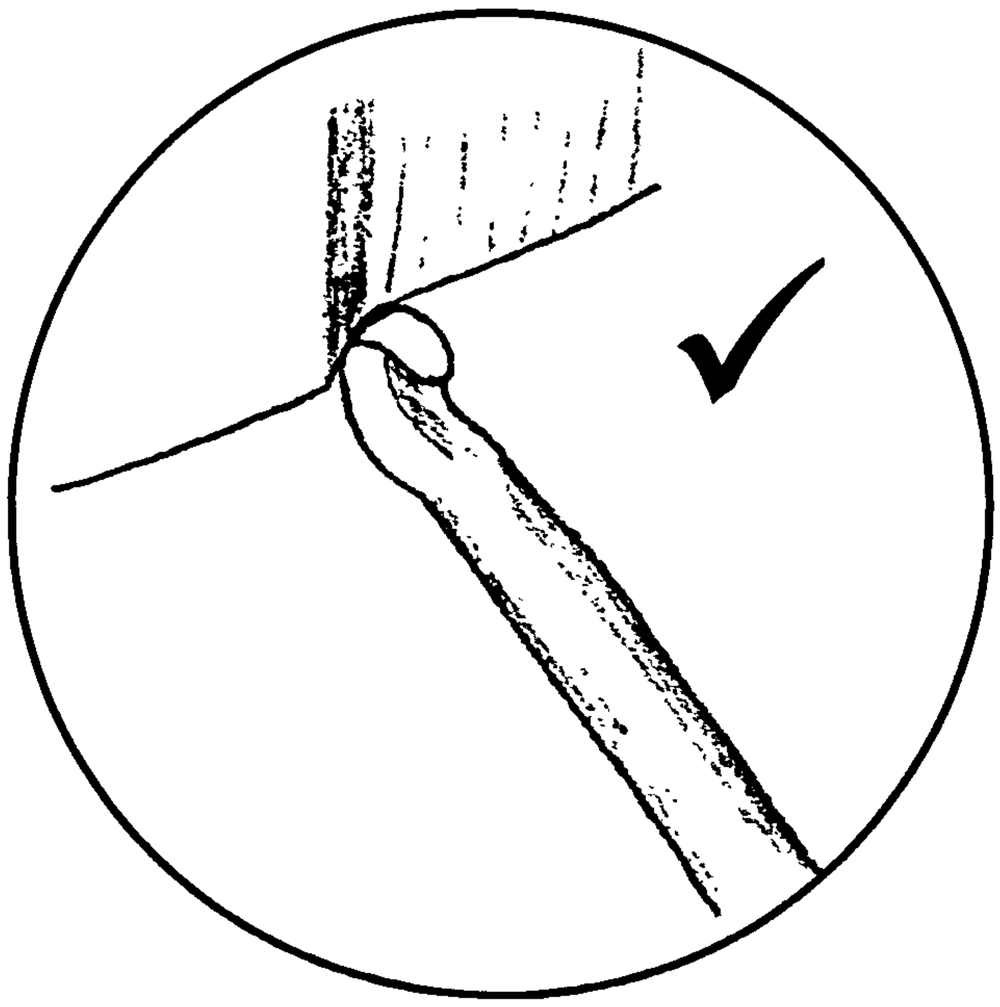
- left hand in a fist on the tool rest
- right arm bracing the tool with the handle above or below the arm

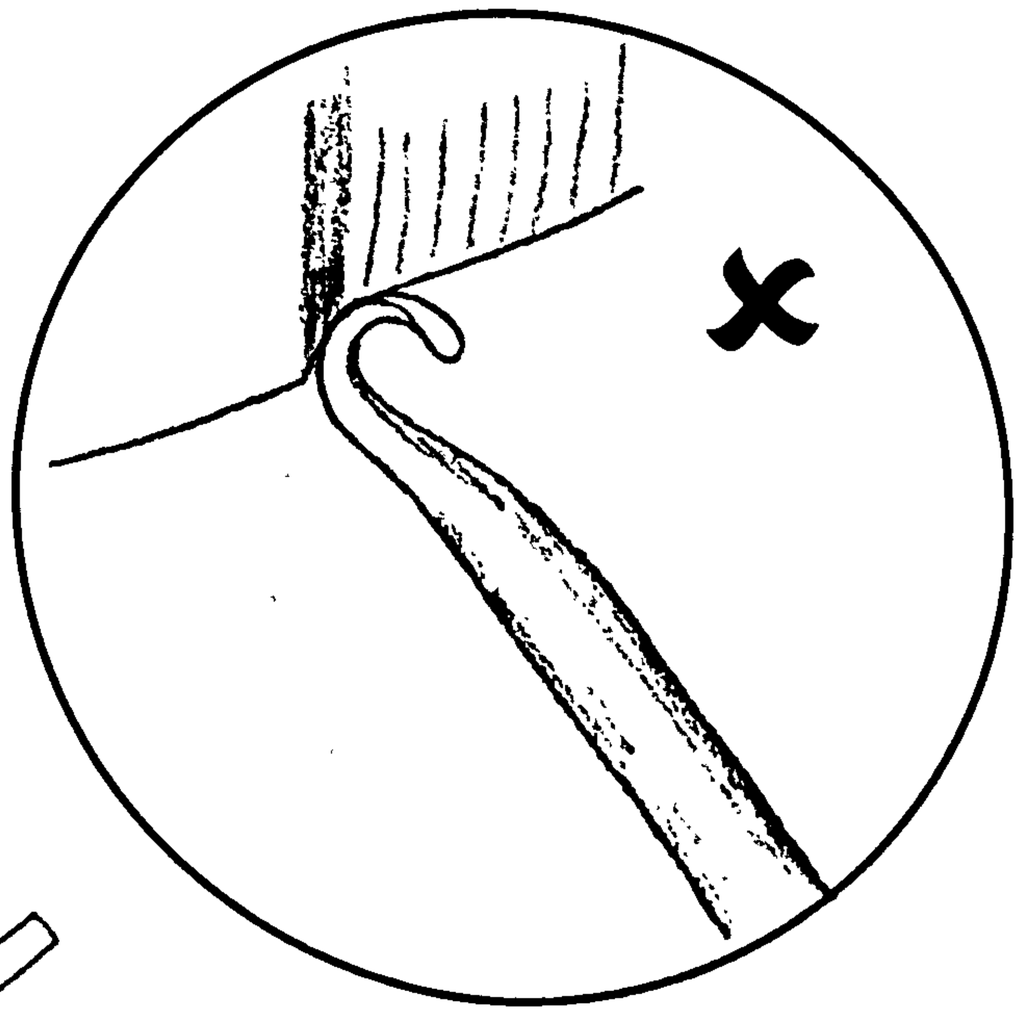


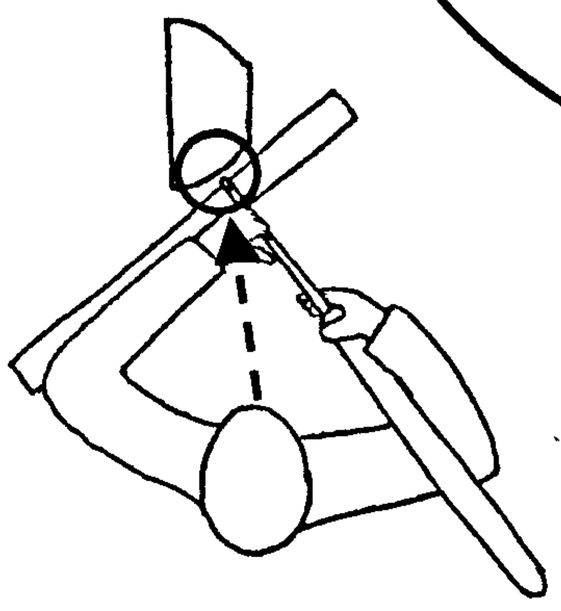




Keeping the tool more upright gives a finer cut which will be much easier to control to begin. With experience, the tool can be used at a greater angle for faster roughing out. If used at too great an angle it will dig into the wood and cause bad tear out.





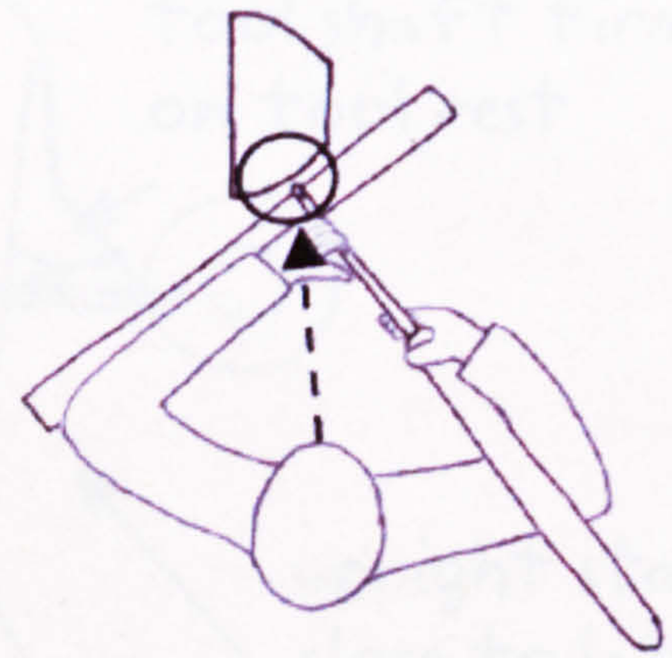


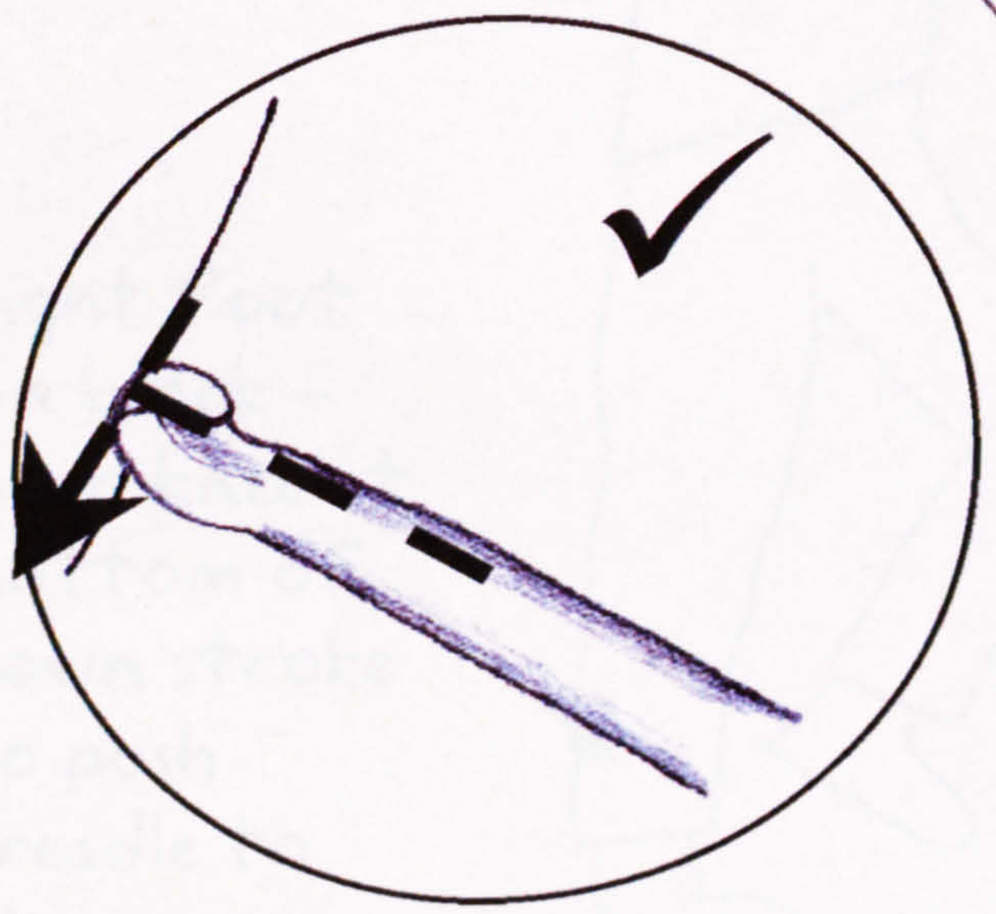
stop dig-ins!
twist

page heading

main body of text here - needs to be kept short and punchy - maybe make this column a bit wider??

'sketch-pad' section with illustrations and handwriting-style notes





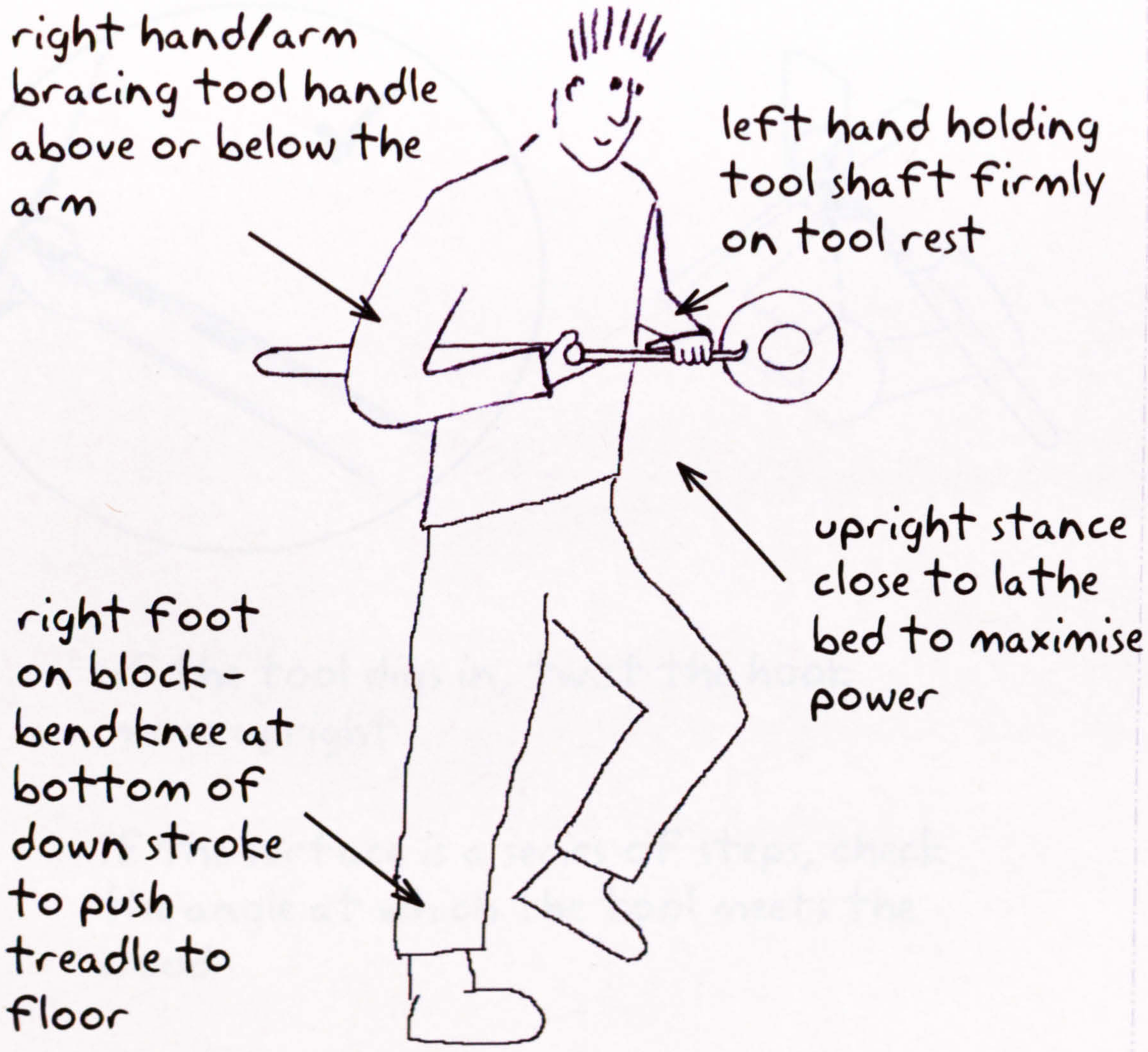
help!

help section here looking a bit like a post-it note - hyperlinks through to problem solving section

ref to video

getting started

Take a moment to make yourself comfortable at the lathe - try to find a position from which you can both hold the tool firmly and treadle confidently.



watch how it's done

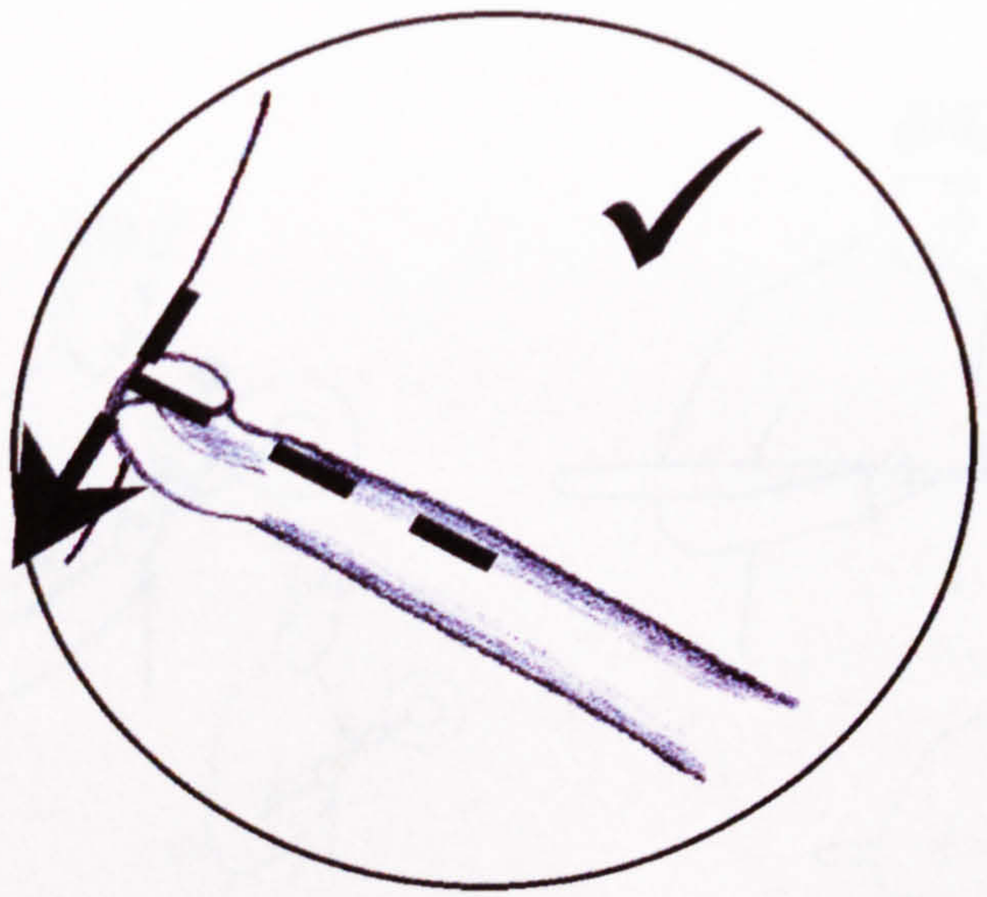
remember

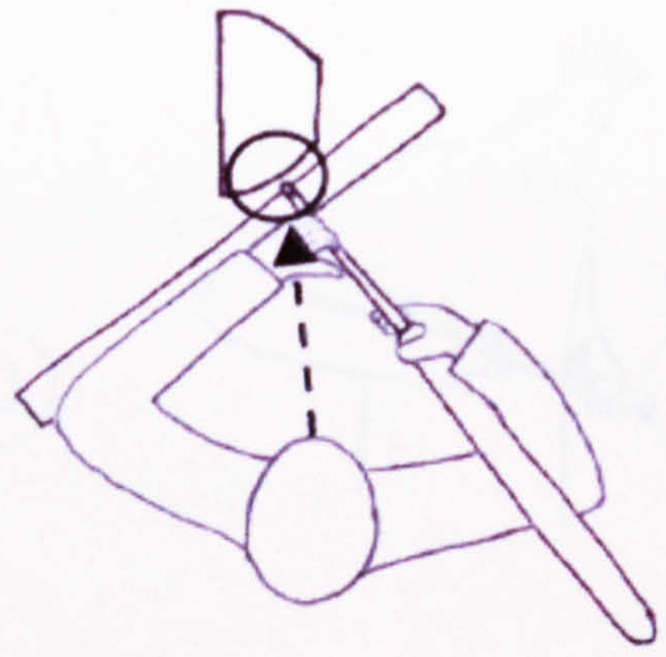
keep the tool still on the down stroke

push the treadle from its highest to its lowest point on every stroke

using the tools

It is critical for the tool to meet the wood at the correct angle so it does not dig into the wood and leaves a smooth surface.





close up

if the tool digs in, twist the hook more upright

if the surface is a series of steps, check the angle at which the tool meets the wood

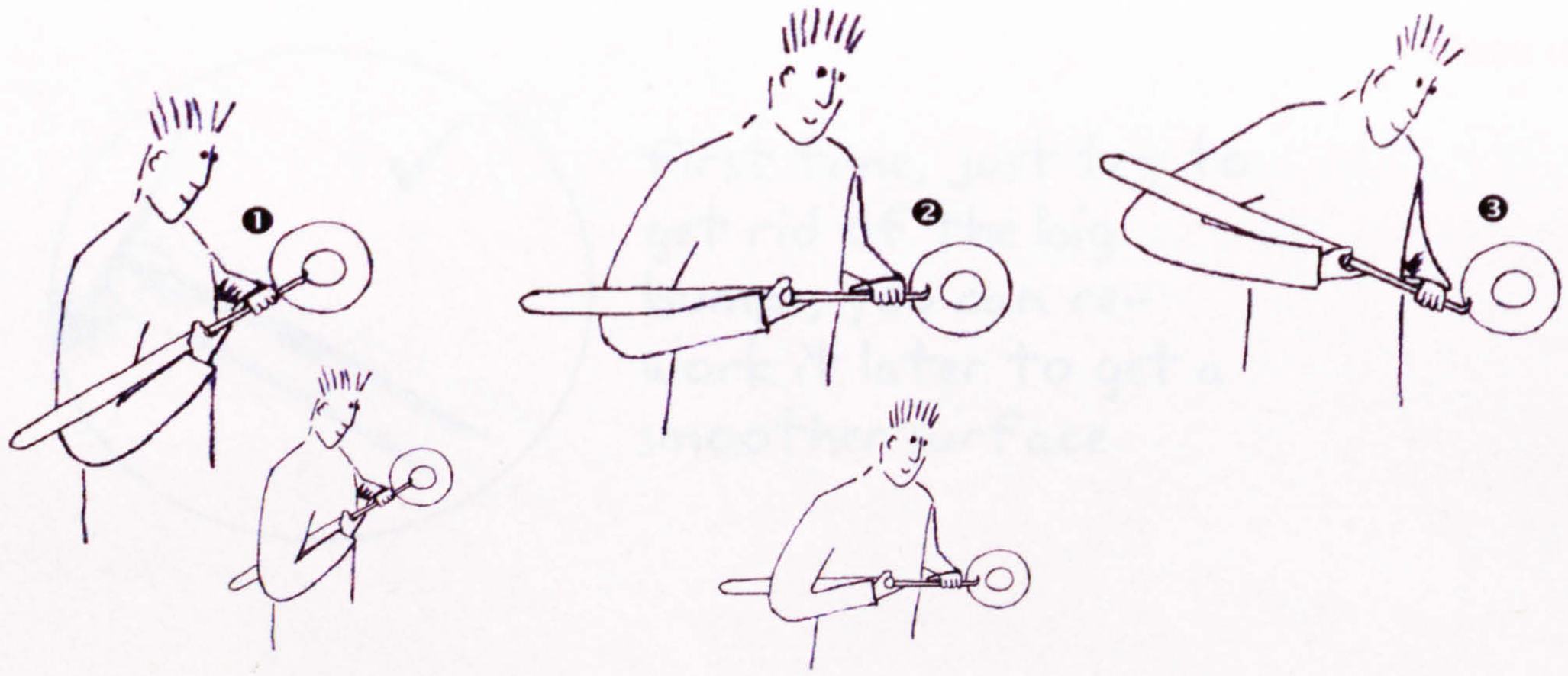
remember

keep the hook of the tool upright to give a finer cut

the tool cuts at 90 deg to the handle

changing stance

To keep the top of the hook in contact with the surface just cut you will need to change your stance as you cut from base to rim.



remember

start with the tool away from the body

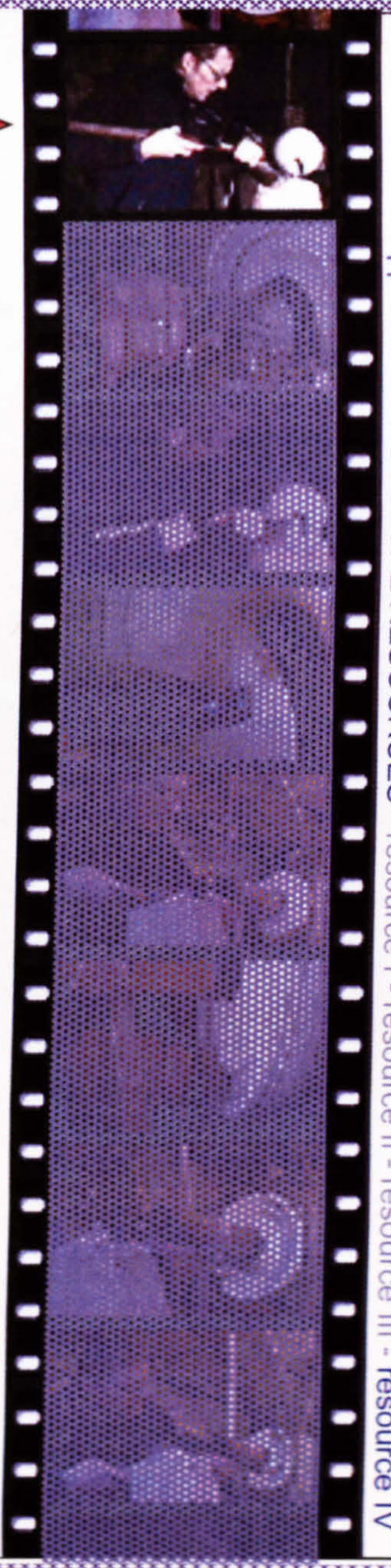
gradually bring it towards you as you cut towards the rim

1 it will take some practice to get your balance and treadle like this

2. this should be easier - concentrate on getting a good cut now

3. it help if you raise the end of the tool at this point

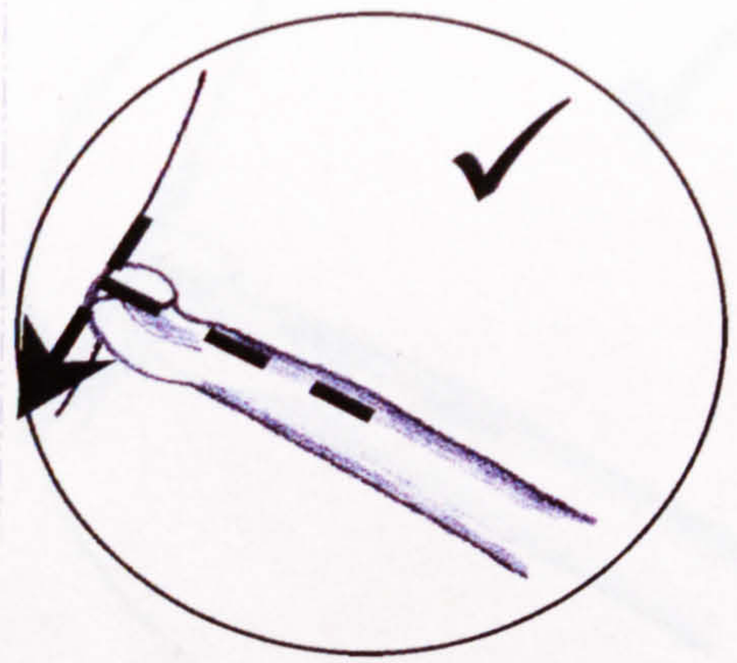
close up



turning the outside

Start at the base of the bowl where the tool touches the wood right around the bowl blank.

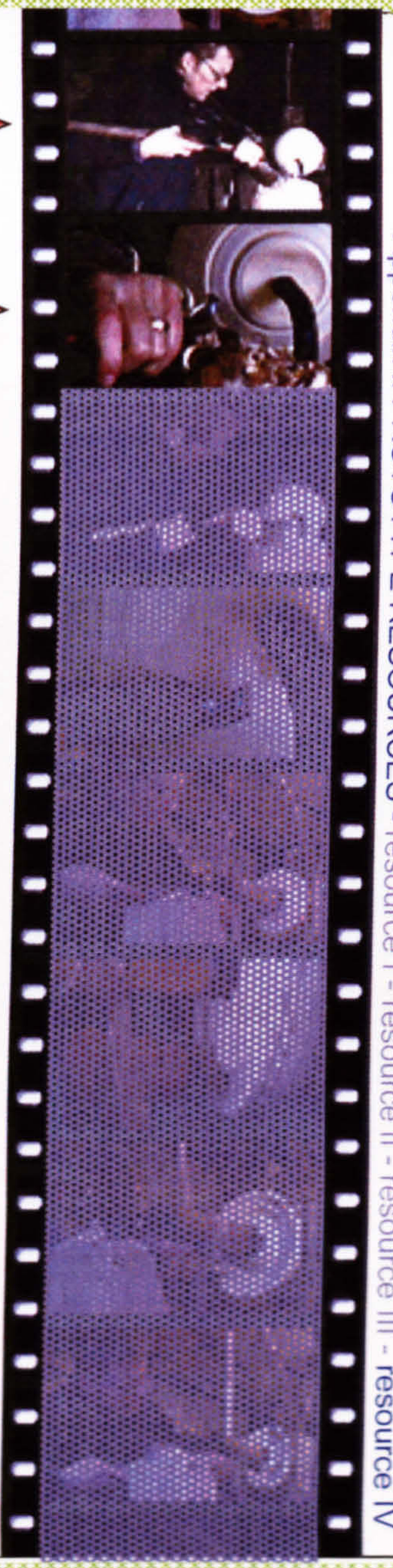
Work slowly towards the rim, changing your stance to keep the top of the hook in contact with the surface just cut.



first time, just try to get rid of the big bumps, you can re-work it later to get a smoother surface

watch this

close up

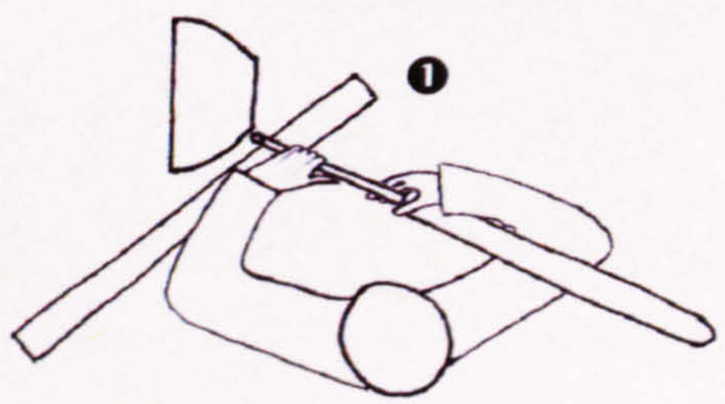


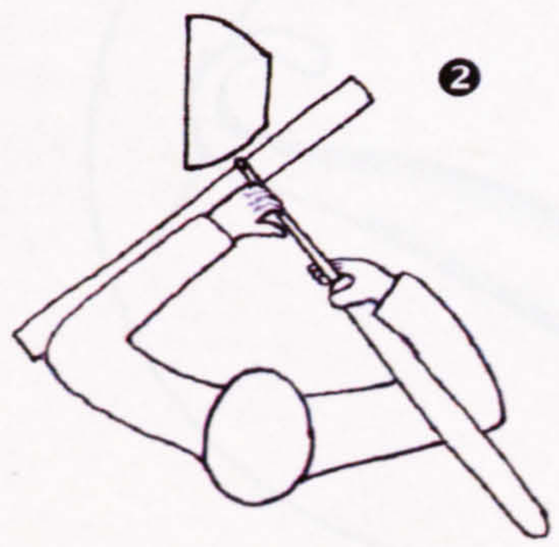
help!

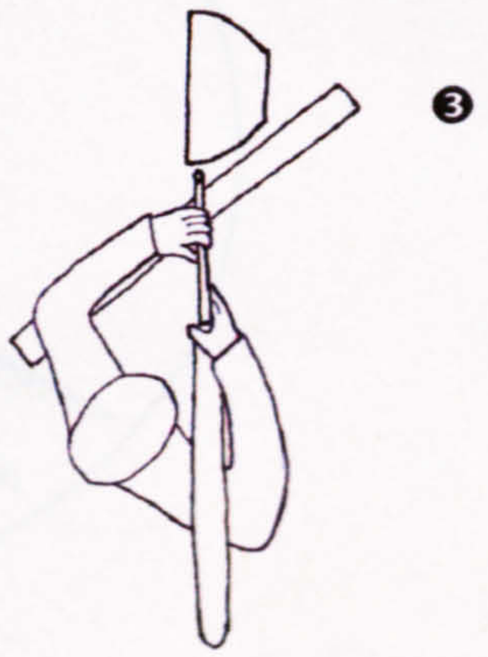
the tool keeps digging in

the surface is a series of steps

my bowl's not round



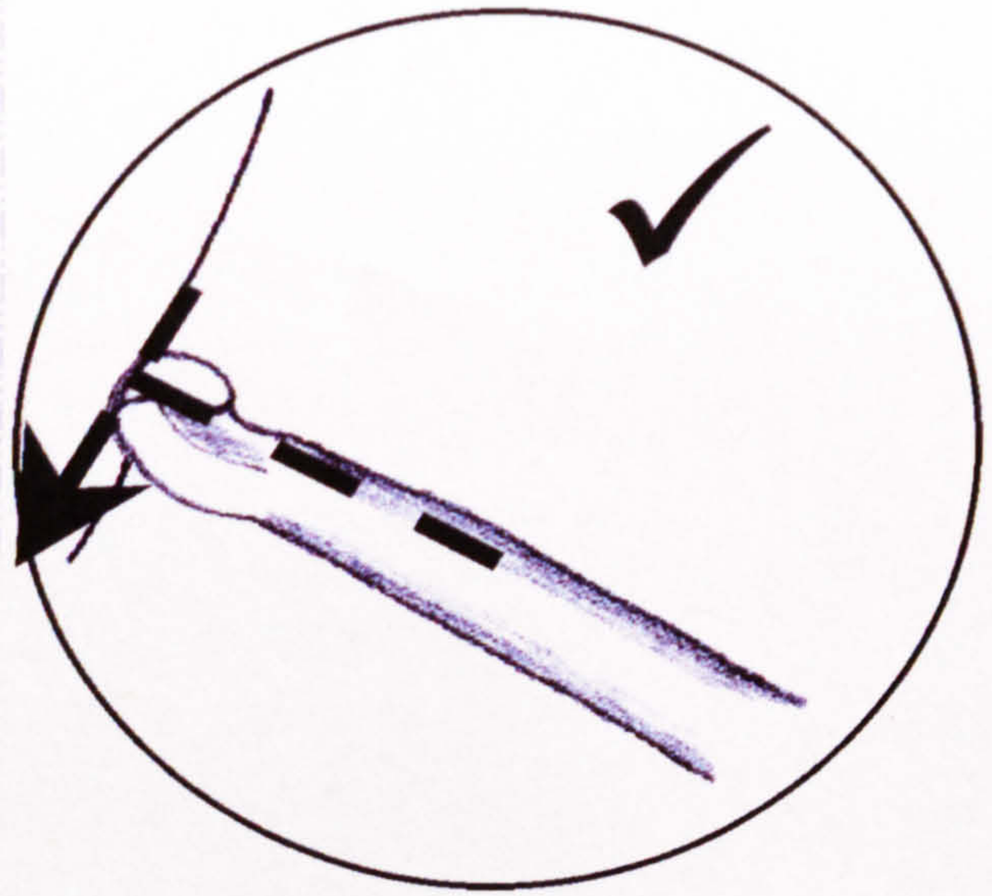




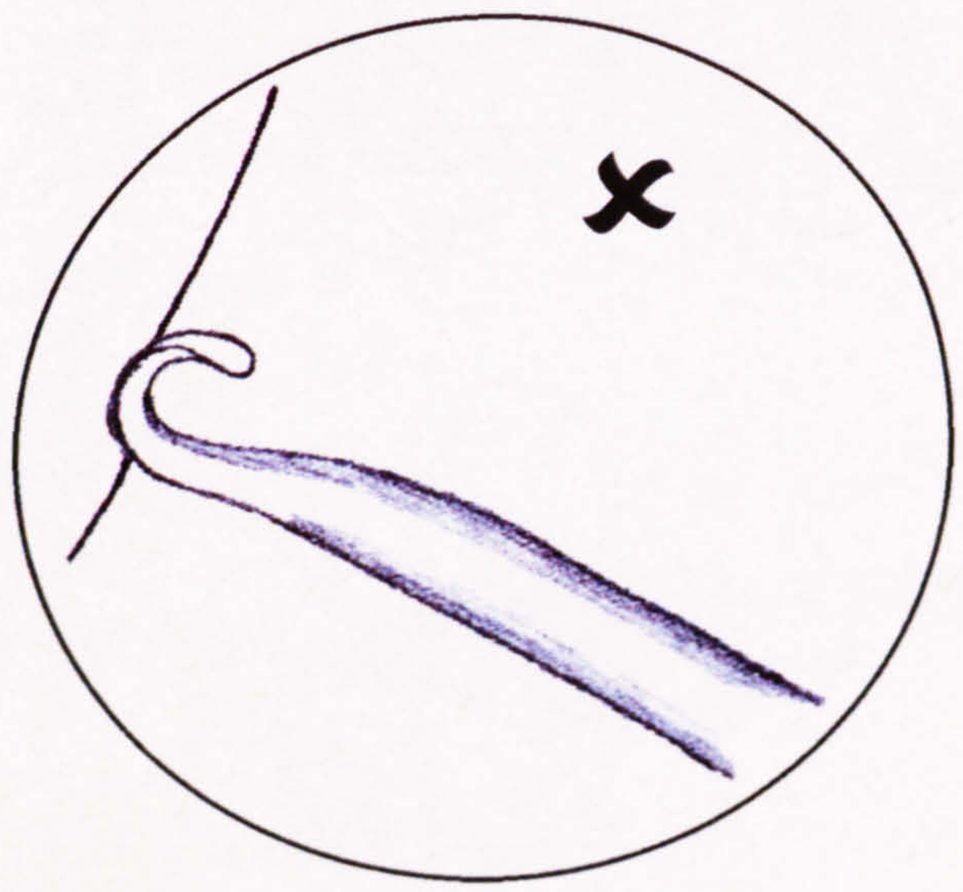
the tool keeps digging in

The angle at which the tool meets the wood greatly affects the effectiveness of the cut.

When you have learned to control this you can use a more aggressive cut to remove more wood when you are roughing out and a finer finishing cut



text with this??



watch this

close up

index

watch this

close up

9 APPENDIX II: sample event logs

9.1 Bowl Turning: 4th July 2004 Helen's return visit [HS2]

Tape HS2.1

0.00	HS discussing twist angle - seems to remember from last time. Also thinking about side-to-side angle, but holding tool in her left hand so it is completely wrong. HS asking me but I'm busy so not really looking and just saying yes to be agreeable. She looks at the sheets and I ask if they make sense - she says yes.
0.02	Starts tentatively turning, but left handed and it's not cutting. Swaps tool and asks NW if it's her left handedness. NW says its because she's holding the tool left handed. We discuss the pros and cons of the set up and H decides it's best to go right handed.
0.05	H turning very cautiously - not cutting much off - H refs to sheets. Starts to turn more confidently, but side to side angle isn't right - far too far to left.
0.06	H and NW fiddling with block - getting in right position for her - now new larger block with another "slice" to go on top if she needs to be higher.
0.08	Turning more confidently - angle still wrong - H concerned about unevenness of blank - NW reassuring.
0.10	H now trying to turn with tool completely pointing the wrong way - she seems aware of the problem but resorts to dragging the tool over the surface of the bowl as she pushes the treadle down. This creates high and low spots on the blank that will lead to trouble later.
0.14	H getting cramp in her hand. Tries working left handed for a bit but can't get it to work, so goes back to right handed. Scraping - not enough travel.
0.19	H swaps tool to see if it works better. Still scraping it across surface of the bowl on down stroke. NW finding it v hard not to say anything. H asks how he gets around the corner. NW suggests moving the tool rest. We struggle with the big hammer for a while then have a break. H looks at sheets.
0.23	[no sound] H is still struggling and swapping tools. Now with handle up on shoulder, but still at wrong sideways angle. Problems with tool rest slipping on nail NW put in - manage to whack it through another hole in rest and make it firm.
0.27	H decides that being a bit higher might help and we put the second block on. Still same angle problem and dragging tool across surface on down stroke.
0.29	H swaps tool. Still same problems
0.33	[sound returns] NW suggests H makes tool cut a bit more aggressively by tipping it up. H confused as to whether I mean twist or up and down. H still scraping away. Now has huge step to deal with.
0.38	NW intervenes to try to get better cutting action to make it rounder. H still scraping.
0.39	NW tries to get her to move sideways. H says yes and tries but has such a large step that it makes little difference. Still dragging across surface on down stroke.
0.41	H struggling. NW suggests she starts higher up the bowl "and just go slowly down". H does start higher, but moves down too quickly and angle still wrong.
0.43	H trying to explain what she thinks her problem is - NW just says "mmm" - doesn't really understand

0.44	H stuck - tool's twisted around - then "that way" having worked out what's wrong
0.45	H says she has an awfully big flat bit there. N says its difficult to know how to deal with it. H tries left handed for a bit then starts hacking at it right handed. Her angle is now better, but she now has a huge step to deal with.
0.49	NW says how difficult it is to just watch without making suggestions. Then suggests H holds the tool higher. H says its just that she hasn't found the right angle yet. Big lump she cant get around NW suggests she just gently skims it off
0.51	H finds a more even bit and starts to turn well. Still a bit scrapey though. Now she's down by the rim the angle's better.
0.55	H getting tired. Tries swapping to L hand, but sideways angle all wrong now and it doesn't cut well, so swaps back and grinds on.
1.00	NW explains basic problem is that tool's sideways angle is always to far to left, so tool is always cutting straight into wood. H starts again - NW encouraging and saying if you can find a place you can follow then you're away. the problem is that the blank is now very uneven, but H does comment "Yes, it's a lot better".
1.04	H asks is it getting better. NW says yes definitely, but it's still a bit steppy which is because she needs to keep her angle a bit wider. Body posture? RW stands much closer to the lathe. More upright too. Hands closer together. Closer to lathe gives more travel on treadle.
1.13	H stuck on a difficult bit NW suggests running it down from higher but H says she's tried that.
1.15	NW suggests that H holds the tool higher close to the rim. H says it makes the tool cut more aggressively. NW says maybe that's why he does it! H tired so we take a break and look at sheets.
1.16	H trying to remember which tool. NW reminds her about her angles and says it'll help get rid of the lines. H says it puts them in, but part of the problem is that the blank is now very uneven. Some confusion over NW's term "back edge of the tool" - need a vocabulary for describing the bits of the tool.
1.18	Lathe has a squeak NW finds some oil for the mandrel.
1.23	H concerned that it's really messy in one place. NW explains that this is the difficult quarter where you are cutting against the grain and even Robs bowls often have tear out in that quarter.
1.31	Still hard going, but when H goes back to turning towards base she does use a greater angle. H looking tired - tries changing tool, but finds it's not good. Tries another. H "quite nice because it's go a big flat bit on it" Turns for a bit with it, then says "not sure about that one either" and tries another.
1.35	H is dragging across the surface of the bowl on the down stroke again. H "It's very weird" NW comments that it's not good as it's making the bowl not round. Some discussion of what the diagrams on the paper mean. H had though she was supposed to move up/down or sideways during cut, not as progressed along bowl. NW explains and tries to find a clip to show, but it's explaining the twist action. Instead runs distance clip and talks over it.
1.40	H back at lathe having a go again, but blank very uneven and v difficult. H's left handed problems too. NW still having to tell H what to do - she still hasn't got the point of the sideways movement.
1.43	NW fixing tool rest position for H. H grinding away badly - not spinning it but trying to think about how she'd seen RW on video.
1.46	NW suggests moving down too fast - says it's key to getting a more smooth finish.
1.47	NW again has to get her to adjust the angle of the tool, but H struggling as there's a big lump and can't hold the tool steady at that angle. H talks a bit about what she sees in the video and how impossible she find it to do.
1.49	NW encouraging H to get more travel as she's maybe compounding her problems by

	not going all the way around.
1.54	H pulling a face and twisting the tool around. NW suggests that as its pulling underneath she might be better cutting a bit higher up. It's starting to cut a bit better, but still sounds a bit rough.
1.56	H stops to look at the dodgy bit by the base. NW suggests that she'll need to loose a bit there to make a flat bottom, so just to concentrate on the rest.
1.59	NW points out H's not going all the way around again. H starts treadling harder.
2.02	H pauses NW "any better?" H "no, I've got this huge lump here, but it's moving out..."
2.04	H "I think I'll stop. It gets very boring at this stage because you don't really feel that you can thin it off any more. And it's difficult to do it any slower. If you could do it slower it would be better because you could see what you were doing a bit more, but if you do it more slowly you don't get such a good cut because it catches"
2.05	Back after break and review of materials. H trying a new tool - she reckons it feels sharp. Struggling with it and making small noises of panic. Has good stance with fist on tool rest and other hand at end of tool. Still a bit wobbly though.
2.09	H saying legs tired, but NW thinks it's cutting well and doing well at reducing bumps.
2.10	H "it is sharp - it's much easier to do that with the sharp ones" tries treadling with the other leg for a bit.
2.14	NW encouraging, saying it's turning much better now, but still some lumpy bits causing trouble.
2.17	H "oops, I'm putting more bumps in now, I should have stopped"
2.18	H has bad dig-in NW asks why it happened and H says its because she had twisted it too far. NW says it looks as if twisting it a little that way helps H says yes but if it goes too far it catches.
2.20	NW suggests H tries to reduce the base a bit and gives a brief explanation of what she thinks she should do. H tries cautiously.
2.21	H "and then you have to make that bit flat then"

Tape HS2.2

0.00	Turning across base - changes tool - back to previous one as it was sharper.
0.02	NW suggests looking at some video - H seems keen. H comments he's going inwards - working from edge to centre. Then goes for tool "with big flat bit on it".
0.04	NW suggests that she could also use the tool with the hook pointing downwards H "how?" the tool is only sharpened on one side. H cutting fairly well - decides its ok and will have one more go at smoothing side. H comments Giles' bowl was quite smooth on the outside - NW reassures that he had Rob there to get his angles right as he was doing his finishing cut.
0.09	H "OK, I'll just try to get this rough bit here" NW suggests trying the little sharp tool she had liked using earlier - some discussion and H finds it but says it's dangerous because it takes chunks out more easily. "You only have to turn it that little bit too far and it puts a whole new step in" but confesses it is the best tool.
0.12	H decides its still a bit rustic but she'd like to start on the middle. First we have to turn it over and NW spends a while setting it up.
0.15	Watching video H "It's weird that he works inwards - I instinctively want to work outwards" RW on video explains about cutting down the grain. NW points out how he's holding the tool on the tool rest.
0.20	Watched the video right the way through. H wants to watch the first bit again and takes it back to the beginning and watches until he starts to clean the rim up. Starts to treadle and finds that the treadle has fallen apart when we turned the bowl around. We spend some time fiddling with it all.

0.23	H doesn't know what tool to start with - she picks one saying "I don't remember" NW says she thinks it was a big roughing out tool he used.
0.24	H says she can't be sure what angle it was. Then more treadle problems.
0.26	H starts again. It all feels a bit wobbly - treadle still not right - NW tries again.
0.28	H is holding the tool at quite an acute angle to the flat at the top of the bowl - surely this should be more parallel now? H comments "It's really difficult working out the tools again".
0.30	H asks why he smoothes across the top before he hollows NW doesn't know. H says maybe he does it to make it easier to go down.
0.32	NW reckons it looks pretty flat. H swaps tool and tries to work out angle to use it to tidy the rim. H looks at video to find angle and where on the bowl to start to cut. Changes tool again.
0.35	Not working well H tries L handed, then L handed with tool on shoulder, then with it sticking out way over tool rest support.
0.37	Treadle problems again - NW does another bodge. H can't remember which tool. Goes back to holding tool in more regular way.
0.40	H decides that she's not doing very well with the edge and she'll just leave it. NW points out that the bowl is not spinning right around which is why she's getting the bits sticking out. H says yes, it's because she's leaning because she's tired.
0.41	H starts to hollow. "So, he'd got it ... down here somewhere wasn't it?" Starts cutting well below the rest. She struggles for a bit the swaps to the big hook. The angles not right and it sounds like its scraping.
0.44	H "where does he start turning it upside down? Lets have another look at the video" We look at him using the tool with the hook pointing downwards and look at what is double-edged and what isn't. H goes back to look at the video again. Then tries to copy "Weird, but it works though". NW talks about him using them either way up and just swapping over when blunt.
0.46	H "It's difficult to find a bit where its less aggressive. You don't want to turn it that way."
0.50	Swaps tool again. H comments "I think hacking was more appropriate than stabbing"
0.53	NW comments its working nicely H says its starting to go. H swaps tool again NW suggests using the other way up, but H wants to continue as she has seen. Then swaps tool again.
0.57	H trying different up and down angles to get the tool cutting.
1.00	H has good hold of the tool and rest and is holding the handle where it joins the shaft with finger pointing down like Rob does. H comments that her favourite bit is working down the core NW says its just because she has found a good angle and that she hasn't done so yet with working towards the core. NW suggests a different angle by moving the tool to stop it digging in so much. H tries different things whilst talking about it.
1.02	NW talking about twist angles and finding it hard to relate it to how we've had the tool cutting on the outside. NW suggests turning the tool over. H tries with a different tool. N thinks its scraping, but H thinks its right.
1.06	NW reminding H to keep an eye on how thick the bowl is so she doesn't go through the side as its cutting well.
1.08	H swaps tools again - complaining that tools are feeling too heavy because her hands are so tired.
1.10	H having problems cutting in bottom, NW suggests it might be the big tool. H carries on a bit then looks for another tool. H tries swapping legs as her right leg is dead.
1.13	NW suggests that she tries to smooth the side before hollowing any more before it gets wobbly, but H can't get the right angle or can't hold the tool still enough.
1.14	NW refs back to the video, but H not really interested and wants to carry on. NW

	looking at different tools, but the ones which look the same are all only sharpened on one side and H doesn't want to use it that way up.
1.19	H starting to struggle - can't get tool to cut in the bottom - not taking out much wood. Stopping more frequently and turning slower.
1.23	RW arrives. H says "It's not very smooth" RW "No, but getting it smooth is difficult but you have been chewing big shavings out." RW says she's done really well down the core and offers to show her how to cut down the inside of the bowl.
1.24	H and RW discuss tools. He shows her the two he would use and she says that they're only sharpened on one side. He says this is OK and they swap places for him to show her. R comments that the way the drive cord is wrapped around is not good and is restricting the travel - he corrects it and gets a knife to trim the cord. NW suggests H might prefer to do it herself rather than have RW turn the bowl, but H OK, she just wants to get it finished now.
1.26	RW explaining how the tool cuts and which bit of the tool cuts. Then turns slowly so she can see and shows it in a couple of different places. RW offers to tidy the rim and H is happy for him to do so. R: You need to hold it low down, like that, down there, ok? H: Right, so it's virtually underneath then. R: and then looking at the edge of the tool I'm thinking that I'm always using this corner of the tool not the bottom. It's kind of this corner or this edge (holding the tool out to show her). So I'm holding it this way so it's sort of slicing as this spins, so it's sort of a slicing cut. (starts turning, then does a bit quite slowly) See how that works? You can do it a bit further down if you want to. It works similar down there. H: so most of the tool is kind of hugging the side of the bowl. R: Yes, the side of this (the tool) is kind of pushed against the side of the bowl or just touching, its not pushed against, just touching. And I'm holding this steady here (tool on rest) and I'm swinging this through a pivot so I'm effectively swinging this through a pivot that will sweep along the edge of the bowl and swing up towards the base like that.
1.29	H comes around to have a go. RW tries to fix the treadle again.
1.30	H "so, like that?" RW gets tool and puts it at correct angle and moves it through the sweep for her - encourages her to get some speed up. H goes to shout at the dogs.
1.32	RW asking her if she can push it down to the floor. RW showing her that she has been doing a scraping cut and showing her how to get it to cut properly (tape runs out - pause whilst change tapes)
1.33	R trying to get her to stay on the step and not move so rapidly down the bowl. R corrects the twist angle as it's cutting too deep.
1.35	N asking if it was useful having R there. H says yes. N commenting that it looks smooth now - H says its because R did it!
1.39	H turning slowly and not very effectively. Swaps tools and starts to turn better, but still moving too rapidly over surface of bowl, so not getting a smooth finish.
1.42	H starts from the rim again to do a last cut, but its still pretty uneven.
1.43	H "I'm sure I must be holding it at the wrong angle ... yes"
1.46	R comes in says wall thickness is good and explains that the next thing is undercutting the core - either he could do it on the lathe with a little hooked tool or H could do it off the lathe. H says she would rather R did it as she doesn't want to risk breaking the bowl. R does it and lets H snap it off. ENDS.

9.2 Clog making: 23rd July 2005 Museum of Welsh Life [JA2]

	Tape JA2.1
0.00	J is sharpening his hollower and talking about lasts, compensating for modern feet being much broader than 1950s feet. G is using the rebate knife.
0.01	J talking about the effects of sharper knives on G.
0.02	J says the hollower is the easiest knife. NW or the easiest part of the process? J says it is quite an easy knife to use.
0.04	J talks about Gs knife not being as good as Js and blacksmith versus mass produced blades.
0.05	J smoothing the top of the sole with the curved knife. Then J talks about getting in a mess with one of Gs knives which they couldn't get sharp because it was made with a softer steel. J is scraping the hollow with a twca-cam. G gets the blade out and they talk about the angles. At first it wouldn't cut at all, then they worked it out. J is now sitting marking the high spots on the soles to make them match (we talk about it). He says he made that pair in about 10-15 minutes.
0.09	J has 2 pairs to make. G talks about problems he had had yesterday and using a piece of leather to protect them as he's cutting. They talk about how they both react when they mess things up and about throwing things away and starting again at the beginning.
0.11	J saying he's balancing them. Then talks about being at a show at the weekend and finishing with a surform. Mentions after talking with Rob he's thinking about leaving a tooled finish. Then says about the wood cracking as he was working because it was so hot and dry. Recommends rubbing beeswax into the heel to stop them cracking. Says cracks in heel don't move forwards. A crack in the toe will go right to the heel because of the tension caused by walking. Use of superglue to hold stuff. N says Rob had same problem at his show. Talk of humidity and weather.
0.14	J and G talk about G's inability to spit. J spits on his blade to sharpen it. G has to get a cup of water. N asks if he can just use the water or if he has to swill it round his mouth first. J reckons the sugar in your mouth makes a difference. J is drawing around pattern on top of sole.
0.15	J says customer wanted heavy sole. Many old ones were very thin. Sometimes it was a deep rebate. G thinks this will be needed for dancing clogs. N asks if it is so they look like shoes. J reckons they had work clogs and best clogs and the best ones wanted to look finer. G reckons he'll make dance clogs which will need to look fine.
0.18	Discussion of Walkleys Clogs (Hebden Bridge). J says they used sycamore for a while, but gave up on it and he reckons this is because it blunts the blades. It doesn't matter with hand tools because you sharpen them all the time anyway. Talks about it being a sterile wood [cutting rebate on clog]. G agrees it doesn't stain and has no taint. J talks about his theories about sycamore bowls and water content. Also about making green timber ships. He thinks the salt water will preserve them. This is why he thinks they used sycamore for clogs... J (discussing Walkley's clog factory) "I rang them up actually, or I went to see them about something, whatever. I said what are you using and they said oh, we're using sycamore and I said are you getting any problems with it and they said oh no, it's

	great. Within a year they weren't using it any more because it blunts the machine tools. It picks up a lot of silica in the ground, pulls it up through and buggers the blades. Well, it doesn't matter with a hand blade because you sharpen them all the time. That's why it's not used for machining. It's got a few uses. End grain, it's used for butcher's blocks, apparently it's a sterile wood. I don't really understand what that means. It seems to prohibit the growth of bacteria. G "If you've got ... with sycamore it doesn't taint the food or anything ..." J "No, it's got no stain, no taste, which is why it was used for all dairy bowls. All the nests of bowls I think were down in West Wales and I think a lot of them were with dairy equipment. Because, I think what happened, well Rob would probably know about it way better than I. My theory is that they cut the stuff green, they went off to market, they went back into a dairy again, they got washed down twice a day, the water content is probably the same as they were green. So, what's the point of doing it dry. I mean if you're doing it dry and it gets full of milk and cream and then it gets washed out and its in a cool scullery then probably its water content is very much the same as it was as a tree. It's a bit like ship building. I think they probably built the ships in green timber and it dried out as they were building them. Down in Essex they were building them, you know building something like 15 ships from one dockyard in a 10 month period. They always had 2 or 3 on the stocks, I don't think they were using dry timber. I think they were using green. They just went straight ... you know ... once it's gone on the water with all the salt in it, its always got moisture in it and it's back to pretty much how it was when it was a tree. So I'm not sure about this, but I suspect that was the case. So I think it was all ... a lot of the welsh made bowls were made for the dairy ... that's why I think they used sycamore for clogs my theory's been that they ..."
0.21	J breaks off ... this is tricky ... he is cutting with the rebate knife across the toe. G says that was why he had the leather on his bench.
0.22	J goes back to his theory on welsh clog makers using sycamore, then breaks off to say is that alright and look at his clog. N asks what he's looking for and he says he has gone a bit low but it'll be alright. J goes on again about the cross over from bowls to clogs. Sycamore is the only clog timber you work green. All the others work dry. Peripatetic clog makers going from farm to farm. Talks a bit of the village structure in rural Wales and how its linked to agriculture. J "I think that because they used sycamore for quite a lot of things in ... they knew how to work it. They used it for bowls mainly, I'm sure they were working green. You see all the other woods that you use for clog making you work dry. You don't work them the same way as sycamore at all. Well the same way I use it and I assume that's how they used it. It doesn't work any other way. I know through inference. From what ... from the ways that the trade was purported to go they had to be using green timber. They go from farm to farm, the peripatetic clog makers. They have a wheelbarrow or hand cart or something, they just drag it behind them. They just wander from farm to farm making clogs. Now the lady who told be this story told me they used to go to a farm, stay for a day or two, make everybody's clogs and go onto the next farm. It'd be a family of people, it would probably be husband, wife and children doing different things. N "So somebody would be doing the leather, and somebody would be cutting the soles and all the rest of it? J "Yes, they'd do fittings, they'd sort it all out, then onto the next farm. You haven't got big villages up in Wales because you haven't got crops, you've only got big villages where you've got crops, that's why Wales has got a lot of villages that are basically just three houses and a chapel. Unless you get together for harvest there's little point in having a village. You've got to go further out to the land to work it. It's normally based around

	a mill. And it's also based around the social get together of everybody harvesting fields. If you haven't got that the village structure is completely different. ... So anyway, I think they cut green sycamore for that and as craftsmen always talked to each other and always have I think that's how they came to use sycamore. There's no recorded instance of it being used in England. It only ever seemed to be used in Wales."
0.24	G says they used green sycamore to make the table in the castle N what period was that? G about 1900 it's supposed to be. G talks about it competing with ash and being resistant to salt so they'll grow near the sea. Copes with short growing season - been told it grows on Skye - have to cut it back once.
0.26	J so that ... so is that good enough ... no it isn't. When I started there was no record of people using sycamore, but goes on to relate someone who works at the museum's father says he used sycamore (over Carmarthen way). J goes on to talk about it being a S Wales, Pembrookshire think, not in N Wales. (Thomas James is from Tregaron, Ceredigion.)
0.28	[J using rebate knife] Talking again about the cross over of knowledge with bowl turners. Talks about when he first started (using alder) - rough cutting green - stored on N side of stream, under cover against a wall on rack for 5/6 weeks - then finish it. If you didn't it'd crack. This was why he knew they couldn't have been going from farm to farm using alder, it must have been sycamore. J only started using sycamore because Thomas James used sycamore. Talks about his early experiences of sycamore and how he can tell what timber old makers used by their knives. TJ's son said 10 years ago that he was very particular about the profile of his knife. J has his hollower and it doesn't work. Instead he used the twca-cam. J talks about what his knife wouldn't do and how you can tell from his clogs. He had a good rebate knife. He bought in his blocker because it has a laminated blade which is very difficult to make. J "I've had other clog makers say to me you can't work it [sycamore], it's too hard and you're going yes, because your trying to work it as if it were a substitute for alder or birch. When I first started, what we used to do was we'd go out, we'd cut a tree down, we'd come back, we'd rough cut it and when you ... we'd leave it on the north side of a stream, under cover against a wall. I mean you couldn't get a damper place. It would be left there in the air to circulate on a rack for 6 weeks, maybe, at least 5. If you didn't do that it would crack on you. That's why I knew this story about them cutting alder clogs and them going from farm to farm was complete rubbish, you know, it couldn't have been that timber. I thought the story was rubbish, because it didn't work you know until I started using sycamore. I only started using sycamore because Thomas James started using it. He used it and after I'd been to see him I thought I'd give it a go. It was much, much harder to cut and the tools that I had basically didn't want to cut it. The profile was wrong. Quite often you can look at people's knives, you can look at old knives in museums and you know what timber they were working, or at least what timber they weren't working by the profile on the knives. Because they are quite often rounded off about 30-35 degrees at the tip and they won't go through sycamore." N "But that would cut alder?" J, "Yes, yes, that would cut alder. I mean Hywell's knives were always that profile. A lot of the old ones you see are the same as that. Thomas James son told me when I went up there about ten years ago that his dad was very, very particular (anal would be the English word) about the profile of his knives. He had to have them absolutely ... you know ... well ... Well I wanted them and actually you know his hollower was always wrong." G "It was , wasn't it... that's it by here" J, "It was never right but that wasn't

	his fault. It was not because he was putting the wrong profile on them it was because I was wrongly made." N "Yes, I remember you telling me about that last time ... mmm ... that's just never going to work" J "Not properly, no. His son told me, oh he did an awful lot with the twca cam and that turned out to be because the knife doesn't work." N "Oh, that's the curved spoon carving knife thing." J Yes and what that won't do is it won't do a sweep right down through here [running his finger down the sole of the clog he's cutting from heel to instep] But if you look at Thomas James soles they are ribbed. He is taking little cuts out all the way down like this because the knife won't sit and do a push. It will flick out all the way and then they just did ... they scraped across here [indicating ball of foot] and they scraped across here [indicating heel] And you can see the rest of it when you look at it and you're thinking well ... it had to be the knife. But his rebate knife was good ... it was better than this and it was a blacksmith made one, but it was good. But his, um, they used to buy in the blocker for reasons which we've found out, because they're very ... because they're laminated." N "So that's a difficult one to make." J "According to Andrew it's well neigh impossible." N "Well it's skills that are gone I guess." J "Well it's skills you'd have to develop by doing it. You wouldn't do it as a one off."
0.32	J relates the discussion with the blacksmith at museum about laminating steel. Then talks about hippies importing foreign craft work whilst working with rebate knife.
0.35	N asks if it needs to be at a right angle (rebate) G explains how it should be and options. J talks about making adjustments to the rebate if the clog is a bit tight.
0.36	N asks about lasts for G. J says he is still trying to negotiate for them without letting on that he really needs them or they'll get too expensive. He wants J to take a load of stuff he doesn't want. J won't say who it is, just that its "oop north". He'd had a load of stuff off them already and is under pressure from his wife to get rid of the rest. J is telling him that he is the only person who'll want them. If that doesn't work then G can have J's second set which do not have such a good profile. J using rebate knife to tidy up.
0.37	0.39 J rummages in basket and comes out with two lasts. Starts telling N about them in a fairly authoritarian way. Some are old ones which have a good curve which is good for hand cutting but wouldn't fit a standard machine cut sole. The others J had made up for him by a shoe maker with a grant he got years ago. The problem was at the time he didn't know what he was after and had them made up wrongly (this was before he got the old ones which he bought second hand at £5 each).
0.41	Talking about old man Walkley cutting costs. Showing Maud's sole, they were bought out by Walkley. Shows with putting flat last onto curved sole. Flat soles can be good for people with arthritic feet who don't want their toe turned up. J only thinks in curved shape because he's made so many. Automatically cuts to shape of curved last. Can't cut to flat last.
0.43	N asks if he could get another set made. J says there is nobody left making them now. Those were made by Bob Witton in Northants but he doesn't make them any more.
0.44	Shows sole he's just cut with last and reckons its ok, nearly but not quite right. Normally he gets them a bit better than that.
0.45	N asks if he will do any more before getting the customer to try it. J says he will probably anally fiddle about with it, but in reality he ought to just leave it there. Will chamfer edge at 45 deg then put leather on. If its slightly proud he'll put a little shoulder in like a peasant made pair from Gallethia (N of Portugal). They had really bad knives, but were still quite quick.
0.46	J working out how long it has taken him, reckons they have taken an hour and a

	half, but he's done lots of chatting. Probably should have taken about half that. Relates discussion with a peg maker talking about how long and how much. He reckons the old makers who made lots (20prs) in a day were buying in blocks and had apprentices helping.
0.49	J flattening face of log with blocker. G relating Trevor talking about Luther who claimed to be able to make 18 pairs a day. J reckons that means he was using machine cut soles. Thomas James could make 3 pairs a day from start to finish. J reckons he could make 3 pairs in a twelve hour day. N relates claims about Lailey and the number of bowls he claimed to make a day.
0.51	Geraint Jenkins asked a lot of questions but misinterpreted the answers because he didn't understand. If he was a craftsman he would have known what questions to ask. N have you drawn on that block before you cut it. J no - this is what they used to do in the woods - blocking out. it would have been much quicker for them working in alder. Should be working in thinner bit of wood.
0.53	J has never actually seen the blocks they cut, just photos. They had 3 sizes, men's, women's and children's. Shows block as he thinks, G has photos. They haven't cut a heel.
0.54	G fetches a sole over to J who is very impressed and praises him. Tells G where to take more out. J says yesterday they were really struggling, but today what G has been doing on his own is brilliant.
0.56	J carries on cutting the sole. says he has made a bit of a mess, but that's how it would have been. J and G talking about spoon makers.
0.57	The bit of wood has squirrel damage so it's no use.
0.59	J's lost his Stanley knife. N chatting about fishing.
1.00	N says she's going to do a video of out-takes of J looking for things. J talking about hippies moving out to the countryside. G talking about seeing documentary about homeless people. J is trimming the rebate with a Stanley knife.
1.04	J says to G he made a really good job. Has to be careful on the second one. If J hadn't been there it would have been fine. It might have split if he hadn't angled the nails well down. G says he found using the Stanley knife easier today. J talks about Stanley knives and relating them to other random stuff.
1.09	Tape ends
	Tape JA2.2
0.00	G talking about budget problems with the museum since free entry has come in. Discussion of Welsh assembly.
0.02	G cutting with the rebate, J still with Stanley knife. J talks about what he's doing and is it worth it. J has always tried to make them as well as a shop pair. N questions this and says she thinks tool marks would look better. J thinks the person who wants these has ordered a more finished pair. J has done stuff like that for the re-enactors, but not many of them use clogs. J reckons there are not many old pairs about as they ended up in the fire. N relates it to bowls. J talks about shows he did with RW.
0.06	G is using a piece of leather to protect the clog as he's cutting the rebate. J still going on about shows. J & N discuss a mutual friend.
0.07	J balancing the two clogs. Previous day had spent mostly doing 'second fix' changing stuff that ultimately can't be seen. Relates this to the building trade and his brother's work. Still fiddling with Stanley knife.
0.10	J bemoaning the questions public ask at shows. He is trimming around edge with blocker. Many of the shows he does just make their money on the gate and the quality isn't good. J asks about Waterperry where N has just come back from.
0.12	J talks about Roy Walkley who is son of Walkley's clog man (he wanted the

	business but his father wouldn't sell). Talking to a customer saying the clogs would last years - customer says she's not interested, they'll be out of fashion in 3 months.
0.13	J still trimming the edge - talking about shopping centres. N asks what he's doing. J says he is picking his nails. He is doing more knife work now so he has to do less finishing later on when the leather is on.
0.15	J check thickness of leather and put 45 degree chamfer on edge. Undercut on instep to make it look less lumpen, makes it look more shapely. Talks about difficulty of cutting blind on one side. Looking at angle on heel, rolling around to get a smooth curve. Better than they used to be. Can't do if wood is dry - won't roll on heel.
0.17	Talking about Rick Rabiki who worked dry (alder?). Comparing two soles for differences then taking bits off to make them similar. J says it's not cost effective as it won't probably be noticed once they are finished.
0.19	Chamfer in instep. Thomas James didn't do that because he was working to a price. H did it (asks G did he teach you it? G yes). Thinks it's finished and comes over, but it's still not quite right.
0.20	Pencil test and marks on high spots. Should have got that right before he did rebate. Puts curved knife on and hollows a bit more. Relates to a French clog maker who cut a pair of soles in 40 minutes but spent another hour hand finishing.
0.22	J this is a dodgy cut where you can hurt yourself. Checks on last -doesn't like the last, not quite right, need to drop the inside. Spits on last to show high. J shaves off high spots.
0.24	The last is knackered, but it'll do (he's lost something). Discussion of making resin moulds of lasts and casting new ones.
0.25	J used to follow lasts slavishly, but now he's realised he can make better. Puts them together with pattern to dry.
0.26	J sawing piece off log. Discussing with G accommodation at the museum and tin huts. J asks to cut it from the video!
0.28	N asks about adapting after drawing around somebody's foot. J says he can do it. He cuts through the log and swears, there's some rot in the middle and he's not sure how far through it goes. J has very nice new axe and he's very pleased with it.
0.29	J talking about somebody who wants 100,000 tent pegs. J splitting log with mell and axe. J says he could make the pegs, but not geared up for it, it'd take a lot of ash.
0.31	N asks if the rot will come out. J says yes he'll do what G says and take it out with the toe. He talks about how he'd usually cut the sole from the log, but he's having to adjust it to get rid of rot.
0.32	J talking as he's working to explain making it level - has been trying to get into G that he needs a good base line to start with otherwise you are always correcting. Fetches log over to camera to show how he is putting the pattern on the log to make best use of the wood.
0.34	J has lost his pencil. G finds it.
0.35	J draws around - talking about chippies pencil. Brings pattern over to camera and explains how he's made it from drawing around the foot.
0.37	J cutting aggressively around the edge. With alder it'd be half the no of cuts. N how old is the timber? J and G work out it was felled a few days, but inot got very much sap in because weather has been quite dry. Talks about where he gets wood from and the sycamores around his house sucking the stream dry in the winter.
0.40	J talks direct to camera saying it looks too tight but it'll be ok. Cutting from toe to centre and talks about twist action to break grain. Cut from heel to centre talking about it. J thinks he always does a right foot first.
0.42	J it's on a twist now, don't want to loose any of the height at the toe ... that's levelled it out.

0.43	J done all that and not checked it against the last. N to G do you check more frequently. G yes. J talking about thinking that shape.
0.43	N What did G find difficult that you thought would be easy and what did he find easy that you thought would be difficult? J says G had a lot of difficulty with the Stanley knife before today. G explains how he has learnt to use it and J talks a bit about it. J hadn't realised that he had learned so much about the knife, just gradually developed over time. G used to carve love spoons.
0.45	J cutting roll on base. N what did you think was difficult that he found easy? J says the knives. G had had a lot of practice with bad knives, so now J has got them ground correctly they seem very easy. J says he has the equivalent of about 4 months practice with the knives. His concern is that G should fall back on his old habits once J has gone and he wants to keep a watching brief.
0.48	G shows some clogs he had made before starting with J. J says it shows that he was keen. G critiques the clogs and says J's are more graceful. G was using veg tanned which is thinner and stiffer.
0.50	Discussion of hand stitching and demos.
0.52	J tidying around the edge of clog. N & G discussing interpretation in museums.
0.53	G says they have video footage of Thomas James at the museum.
0.55	J shows the final clog sole and we look at it together.
0.56	J goes over to look at Gs. Tells him quite firmly where it isn't right. It's got to look right as well as matching the other one. Actually it's very good. Yesterday I thought he'd take a week to get it right and he's got it right in a day. Lunch break.
0.58	J nailing upper onto sole - stretching sole that is too small for somebody. G is standing watching. J talking about potential problems he could have and how he's going to deal with them.
1.02	J has run it under the tap to heat it up and make it more stretchy. He comes back to work more on it and G comes over to watch again. J talks theoretically about how to deal with different problems to G.
1.05	J looking closely at Gs soles on a board and marking them with a pen where they need trimming. J moving them around the board because it's not flat. N suggests he should invest in a new one. J mutters no.
1.08	N asks G if he'll get some days to work when J is not in. G says it depends on general staffing on site, if they have enough people to cover elsewhere.
1.09	G using hollower. N asking him about it. It has a separate blade. Useful as G is left handed. It was cheaper to make them like that.
1.11	J going to cut and dye a welt. N asks if it's the same leather and J says it is thinner.
1.12	J watching G with the hollower. J says this was traditionally done in Wales with a twca-camb. J talks about the potential injury you could cause somebody if they were wrong and the need for insurance.
1.14	J gloving up before dying leather. Jokes about medical cabinet and h&s. They talk about injuries they have given themselves.
1.15	N looking through G's photo album and asks who's who. Thomas James? J says he was the last Welsh clog maker he met. He met one in England up at Caulbeck [??] who was Strong's dad [??] did it in the 40s until he found out you could buy soles. So he never got particularly quick at it because he wasn't doing it for long enough. Thomas James did it for his whole life, or until he was in his early 70s. I don't know exactly what styles he made, but the two styles I saw there were a boot and a Welsh slipper. I don't know he made anything else. N these pictures are dated 1961. J says he quite like to go down there and do a show. He doesn't know if there would be anyone left who would remember him now. G says The pictures are from the museum's archive. N asks if they are taken in his workshop. G says yes, the

	contents were offered to the museum but they didn't want it.
1.17	N talks about how Laileys stuff in the museum in Reading and it got RW started.
1.18	Did TJ make good clogs? J yes. He knew just what he was doing and he was a particular man. He talks about solid lasts and how they were used. [Good shot with J & N in the picture talking]
1.22	J looking at the straight last and explaining how to get a left or right foot.
1.24	J talks about toe problems and the advantage of the duck toe. Then talks about Thomas James didn't nail into the last but used a thread to draw it in. It means your last will last a lot longer.
1.26	discussion of hornbeam. J uses sprung lasts and it is more reliable to get a good fit.
1.27	Asks G how he's doing. G is worried about something. J says don't worry about that, that's more worrying.
1.28	J says he has never met anybody who used solids, only Thomas James. He can't remember where he got his lasts from. J talks about being given stuff.
	Tape JA2.3
0.00	J and G discussing some clogs that G is going to make and how she wanted the uppers. They are for Debbie, G's partner.
0.01	J rummaging amongst his patterns looking for one. J has hundreds, need a different size pattern for each size shoe and each style.
0.03	N asks how he got started with them. J says he copied many of them from museums, the others he's drawn himself. He shows a nice design he has copied from an original. G is going to copy all Js patterns. J is going to get some thick card.
0.05	J & G had been talking over lunch to somebody from the museum who had brought his father in who used to be a clog maker. J had quizzed him about timbers and he said he used sycamore not alder. G is using one of his knives
0.06	J carefully trimming sole. General discussion of vegetarianism, meat eating etc.
0.09	J says you haven't seen me do this - this is a bodge. It's the pair he did before lunch and they are not quite right. The 8 last is in another clog, but it doesn't really matter as he largely does it by eye.
0.10	N so that's trimming up to the line. J more or less. Probably shouldn't be doing this much. Should be making the other one now. Explains that G was taught to make one then the other, but you never get the balance right. It is much quicker to take them down as a pair.
0.11	Discussion between G and J about Debbies shoe size. J says the pattern comes from the first pair of clogs he ever made for someone. G worried that last isn't sitting right. J reassures him that it's ok. [good shot of the two together]
0.14	G looking at leather and checking which way grain should run. J looking for thicker leather for back. J showing how to cut out wasting as little leather as possible.
0.16	J flattening face of next log whilst talking about being a celiac.
0.19	g asks if it's ok before he cuts it out. J wants him to turn pattern, G resisting. It's ok.
0.20	J returns to flattening face of log. Goes back to talking about his health etc.
0.21	J puts pattern on and there's a problem because of the unevenness, but he moves the pattern over and gets it in. J talking about friend 'Reg the wimp'.
0.23	J cutting around the edge, says that's very close. N asks too close? J no, it's about all right. Starts cutting around aggressively.
0.25	Cutting from toe towards centre.
0.26	Turns it over and cuts back the other way. [good long quiet clip and before and after]
0.27	J twists his wrist and it hurts.
0.28	Puts the two together to compare

0.28	G calls him over. J feels there is a lot of waste cutting from where he is. Move it over, but not too close to the edge as the hide is a bit thin. J not happy with the quality of the leather he's been sent - ordered it over the phone.
0.30	J has both soles together and is marking them up for where to cut the roll and heel. J asking about the show N does with RW.
0.31	J sawing heel then cuts heel with blocker. J talking about friends who make Gimson-style chairs.
0.34	J has soles side by side, takes one back to cut more from top and compares again.
0.34	G says they are done. J says he doesn't need to put a stiffener in because she has such a small foot. They discuss hand or machine stitching. G does not have a machine and quite likes hand stitching.
0.36	J says to take the other out where he told him.
0.37	J has lost his pattern and is walking around swearing. G finds it on the bench.
0.40	J comparing soles and swearing. They were made of cherry and have shrunk badly. He puts a towel on the bench before cutting them flat as he's worried about marking the leather. It cuts easily, but dry sycamore is really difficult. G tried to make spoons from dry cherry and found it really difficult.
0.42	G so this goes underneath the back? J (without even looking up) agrees.
0.44	J still cutting underneath of cherry clogs. Random talk about awkward tourists.
0.45	J ideally I should have done this before I lasted them up ... G asking about chamfering the leather. J says no, just run an edger along the top side. I don't want it chamfered, the transition never looks right. G fetches it over. J says you need a brand new Stanley and goes into instructor mode, we joke about so many skills with a Stanley. J talks about demanding genuine Stanley blades, which are more expensive but better.
0.48	J that's close enough ... still not flat, rubs them on the floor so the dirt shown on the high spots then cuts them off.
0.49	G asking for help again. J goes over and tells him.
0.50	Takes blocker off and puts hollower on to take scoop out of underside of sole so they won't bow if they shrink more.
0.51	J says he will put the welt on at the show.
0.52	Goes to G and asks for a look. Comes back with pattern and offers it up to sole. J puts blocker back on and cut a bit more off top of sole.
0.54	J compares them again, drawing on high points, then trims them again.
0.55	Discussion of what colour Debbie wants her clogs - purple. G needs to mix red and blue. J rummages around for them, has dye on hands and it's getting everywhere.
0.58	J says purple or mauve? G hasn't a clue. J goes over and tells him what to do, plenty of red and a tiny touch of blue. G is spilling it everywhere. Needs hardly any blue - J talks about the strength of the blue dye and it overwhelming everything.
1.00	J and G discuss green dye which got everywhere and difficulty washing it off.
1.02	J marking pattern on top of soles now. Then trims around edge again.
1.04	J talking about why they cost so much and amount of labour in them. N talking about the ethos of AinA. J reckons when people see him working they understand why its 100 for a pair.
1.06	N looking at a piece of leather and asking if it's a back. J says it is for a pair of shoes not clogs. J told them it'd be 3 weeks, three months ago. The last lot should have been 3 months and they were a year.
1.07	J checking G has dyed everything he should have. G saying what he hasn't done and why. ENDS