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.