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## **‘Plumb line scribe’: Using multimedia to preserve traditional craft skills**

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### **Abstract**

The skills required in craft practice involve a high degree of tacit knowledge which is frequently difficult for the craft expert to articulate. N. Wood, a multimedia designer, has undertaken extensive research over the last ten years seeking to understand the knowledge of skilled craftsmen and find methods of capturing and passing it on. She has developed an elicitation strategy that employs an expert learner to uncover the skilled knowledge of master craftsmen, and a transmission strategy based on the concept of bridges to assist the design of learning resources for novices. U. H. Lassen has used the techniques developed by Wood to record and transmit the skilled knowledge needed to make timber-framed buildings, knowledge that today is in danger of being lost. The focus of the study has been the procedure for scribing timbers, which is a central part of the building process. The aim of the research was to investigate the possibility of combining the two roles defined in Wood’s research as an expert learner and designer. Being a skilled carpenter, Lassen has acted as an expert learner, learning the skills of scribing through a combination of researching existing documentation, working with master craftsmen and his own experimentation. At the same time, he developed and tested a multimedia learning resource to provide ‘bridges’ for new learners to this knowledge. The outcome of the application of Wood’s elicitation and transmission strategy to plumb

line scribing is a demonstration of the transferability of Wood's methods within this new context. This is important because it reveals the potential for other craft practitioners to apply Wood's methods to their own learning and teaching, and produce learning resources to provide bridges to their craft knowledge and preserve their unique skills.

### **Keywords**

multimedia

learning

tacit knowledge

education

craft

timber framing

scribing

plumb line

### **Introduction and theoretical background**

Today many traditional craft skills are in danger of being lost because traditional craft knowledge is taught less and less, and the transmission of this knowledge is dependent on its practice. This is because craft skills involve a high degree of tacit knowledge and the principles governing a craft practitioners' actions are often only known through their

undertaking those actions (Polanyi [1966] 1983: 17). The result is that it is frequently difficult for a craft expert to articulate their knowledge, and learners must gain it experientially through undertaking the actions, absorbing the underlying principles by extension of performing these actions. M. Polanyi ([1966] 1983: 30) describes 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.

However, N. Wood (2006: 126) observed that, at an early stage of learning, it is difficult for a novice craft practitioner to observe and imitate successfully without additional instruction. According to Polanyi, the difference between the skill of a novice practitioner and that of an expert is ‘a gap to be bridged by an intelligent effort’ ([1966] 1983: 6). Wood (2006) proposed a model for developing learning materials, which provides the novice with such ‘bridges’ in the form of relatively simple and explicit task descriptions (Figure 1). These are not an encapsulation of the expert’s knowledge but provide a bridge sufficient for the novice to move on in their development and approach a level where they can engage directly by dwelling in the knowledge of the expert.

**Figure 1:** Bridges across the knowledge gap between novice and expert.

The learning resource format developed by Wood (2006) supports learners by initially using these ‘bridges’ to provide very explicit instructions, enabling novice learners to gain a positive experience of a way to undertake the procedure. This provides them with key skills and ways of correcting common errors. As they become more confident and their critical ability develops, the focus of their attention gradually moves from the explicit instructions to the video of the craft expert for which they can increasingly form

their own interpretation. In addition, an elicitation strategy was developed to overcome the difficulty that many craft masters had in questioning their own understanding of their skills (Wood et al. 2009). This involves the use of an ‘expert learner’ who has the ability to learn new skills from the expert with minimal instruction (Figure 2). With their knowledge being recently acquired and their being consciously engaged with the elicitation process, the expert learner is able to rapidly adapt their understanding of it and create effective bridges to improve transmission to the learners.

**Figure 2:** Bridges across the knowledge gap between expert learner and novice learners.

Following Wood’s model, the aim of this study was the creation of a learning resource that would enable U. H. Lassen to record and transmit the timber framing working methods to provide novices with ‘bridges’. Lassen adapted Wood’s elicitation strategy to suit the particular circumstances of his research, demonstrating transferability of the technique. He acted both as an expert learner and as a designer of the learning resource in the research. He first acquired the basic knowledge from a number of workshops in France and England, and second from studying a series of texts on the subject. In this manner he was taught by more than one expert giving him more options and different tools for solving the specific problems in the different stages of the building process. Second, he constructed and tested the learning resources himself rather than acting as intermediary between the expert and designer as in Wood’s research. This article first describes the creation of the multimedia learning resource of a scribing method for timber-framed constructions; the second part describes the application and testing of the resource in two workshops with learners with different levels of carpentry experience.

### **Timber framing**

Timber-framed buildings are found all over the world (Vellinga et al. 2007: 30). Wood is a light material and can be used under both compression and tension, in contrast to stone and brick, which can only work under compression. Timber has therefore long been used to make shelters, and timber-framed constructions have been developed to bridge large spans such as bridges across rivers or roof constructions in cathedrals and other buildings with large rooms (Figure 3).

**Figure 3:** The interior construction of the fifteenth-century timber-framed barn in Aclou, Normandy, France. Photo: Ulrik Hjort Lassen.

Within the process of building timber-framed constructions there are many different procedures involved, such as the design and layout, handling the material, scribing the timbers, cutting the joinery, boring for and producing pegs, marking the timbers and raising the frames (Lassen 2007: 20; Rower 2011). Within and between these procedures, there is a great diversity of decisions to be made depending on the type of construction, the structural behaviour, the quality of the timbers, the tools at hand, the workplace arrangements among other things.

The knowledge of how to build timber-framed constructions is of great value in the preservation and restoration of old buildings. Most historic working methods are also based on low-impact technologies and, in a sustainable context, they can be seen as a source for creating new and more sustainable alternatives to many modern building practices.

This knowledge traditionally lay in the hands of master craftsmen who passed it to their apprentices through practical work (Epstein 2004). However, as the construction of traditional timber-framed buildings was supplanted by modern materials and techniques, the associated skills are in danger of being lost. Through his research, Lassen is gathering the disparate knowledge on this subject to gain a deeper understanding of it through his own craftsmanship, and to make it widely accessible to craft practitioners, both for restoring old buildings and making new ones.

### **The plumb line scribe**

The focus of this study has been the procedure for scribing timbers, which is a central part of the building process. Scribing dictates where and how to cut the joints where two timbers will meet and, although there are several different methods, they generally all build on the same principles of reference planes and reference lines (Lassen 2009: 103; Newman 2005: 99; Beemer 2011: 123).

The method of using a plumb line as a vertical reference for scribing the timbers was chosen for this study because it is useful in complex constructions and situations and can be used to deal with irregular timbers that were commonly used in older buildings as they allow more efficient use of timber and can add strength. It is also a useful tool in a carpenter's 'invisible' tool box because, once the principles of using the plumb line as a vertical reference line have been grasped, it is relatively easy to understand and use most of the other scribing methods (Lassen 2009).

The principles of the method is that by using gravitation it is possible to create a 'perfect' square by using level and plumb and by working in a horizontal and a vertical plane. All

posts and beams in a timber-framed wall are put horizontally on top of each other and, by using the plumb line as reference, the shape of the timber can be transferred in spite of deformations and irregularities (Figure 4).

**Figure 4:** A still from the video, a three-dimensional and a two-dimensional line drawing showing the same situation in the scribing process.

The use of the plumb line scribe can be traced back to the fifteenth century (Lassen 2007) and it is still used in production today, mainly thanks to the French journeymen organization ‘Les Compagnons du Devoir’, which is an official educational system in France and which supports young people learning trade skills through travelling apprenticeships, keeping rigorously high standards.

Information about practical use of the method can also be found in some of the French encyclopaedias from the nineteenth century as well as in recent craft journals in the United States, where a number of carpenters have revitalized its use. A thorough review of the information in these texts was used as a starting point to develop a functional interpretation of the skill.

The French publications are vast, impressive encyclopaedias which document in great detail many different aspects of carpentry skills. Originating in the era when such skills were learned through practical work and literacy amongst craftsmen was low, they provide an academic representation of the method that requires a reasonable level of literacy and an existing understanding of the subject.

The first two examples of descriptive procedures for the plumb line scribe can be found in the work *Traité de l'Art de la Charpenterie* published in 1841 (Emy 1841: 303–40),

which consists of two text books and a separate ‘atlas’ with illustrations, and in the *Traité théorique et pratique de charpente* by Louis Mazerolle published in 1885 ([1889] 1986: 66–67), which has text and illustrations in the same book (Figure 5).

**Figure 5:** Illustration from Mazerolle’s book.

In both examples, the illustrations are fairly accurate visual representations and show a great deal of detail with both two- and three-dimensional line drawings, which are connected by the principles of projection drawing, making it possible to see the same situation from different views at the same time. The use of letters and numbers in text and drawings helps the reader follow the procedures and to understand the different aspects of the rather complex process. These descriptions are intended to share knowledge amongst experienced craftsmen, and they are often made to such a degree of complexity that only initiated carpenters will be able to understand them, therefore excluding outsiders to acquire this knowledge.

The description of Mazerolle was in some respects easier to follow than A. R. Emy’s because the text contains less information and lies alongside the illustrations. However, the drawings are not as clean and tidy. For example, realistic wood grain is drawn on the timbers, and there is too much information in each picture to be able to easily interpret their meaning.

In the late 1970s a number of skilled craftsmen from the French journeymen organization ‘Les Compagnons du Devoir’ collaborated to produce *Encyclopédie des métiers, La charpente et la construction en bois*, a large encyclopaedia of eleven volumes covering the entire profession of carpentry. This manual contains an extensive description of

plumb line scribing (Le Port 1979: 261–73) with a more descriptive text and much simpler illustrations of the specific situations. This is easier to follow than either Emy or Mazerolle because the text forms a comprehensive narrative that is illuminated by simple drawings placed at relevant points in the text although more illustrations would have made understanding the practical situations easier.

The American publications are more recent interpretations written by, and for, the new generation of more literate carpenters in *Timber Framing*, a journal produced by the Timber Framers Guild, an organization founded in 1985 that provides training and information to professional timber framers. They have published a number of articles over the last fifteen years dealing with the plumb line scribe. These have a more instructional purpose, being written by [the new generation of contemporary](#) carpenters who come from a less regimented society in which there is no clear delineation between masters and apprentices. Whilst the majority of learning still happens in the practical situation, with more experienced carpenters passing their knowledge to those less experienced, greater literacy means that theoretical knowledge can be accessed by all.

Three descriptions of the plumb line scribe have been found written in the English language. The first is found in the last of a series of articles on ‘French scribe layout’ by the French carpenter Marc Guilhemjouan (1995), dealing with the general aspects of scribing a roof truss. The second description is found in a series called ‘Timber framing for beginners’ written by Will Beemer (2005). He describes what to do sequentially throughout the process, dealing mostly with a particular situation with bracing, where the timbers do not meet in 90 degrees. The most recent and longest description comes from two papers written by another American carpenter, Glenn Dodge (2010a, 2010b), where

the first paper deals with the scribing of two-dimensional frames and the second deals with the situation of scribing the timbers in a compound roof by using the plumb line scribe.

Common to these papers is the narrative style and the clear descriptive language that is easy to read. There are generally more illustrations than in the French papers, and they are placed in the text in order of appearance but especially for Beemer and Dodge there is no attempt to place them next to the relevant text. This might be caused by journal layout, but makes it difficult to follow in a practical situation.

The illustrations of Guilhemjouan are three-dimensional line drawings that contain even more complexity than those of Emy and Mazerolle. They show large amounts of information and are rather difficult to comprehend. Beemer uses a combination of colour photographs and relatively simple three-dimensional line drawings, mostly taken from the same side-on perspective. Dodge's illustrations are a combination of very simple line drawings and occasional colour photographs. He has used colours to annotate the drawings with important details and texted information with arrows, and in combination with the use of both two- and three-dimensional line drawings they convey complex information with greater clarity than others have achieved. Unlike the other articles, it describes the making of a specific building, showing the complete layout as well as the techniques for scribing the joints that makes it easier to understand the different situations.

The procedures described in the papers focus on different types of scribing situations. They demonstrate the complexity of the building process and the diversity of problems and solutions. Lassen's own experience of teaching carpentry students how to scribe

irregular timbers as well as discussions with colleagues from the timber-framing course, Department of Conservation, Mariestad (personal communication) highlighted certain problems of using these sources for the course. Partly because of the sources being in French language, which most learners would not speak, and partly because of the lack of step-by-step descriptions, these sources were considered as too difficult to comprehend for the novice learners, and that a better format was required. Lassen therefore compared and evaluated the procedures of the different papers, separating them into numbered step-by-step descriptions, to enable applying the different procedures in practice when building a timber-framed construction.

The review of these papers yielded much important information that enabled Lassen both to further his understanding of the skill and highlight important points that the learning resource could address to assist less experienced carpenters. The analysis of the above representations revealed four points in this respect:

First, there was the need for clearer illustrations, showing only what was necessary and excluding all extraneous detail. In this respect, two-dimensional images were often more effective than three-dimensional ones. This was backed up by findings from Wood's earlier research where experiments with use of photographs and different drawings revealed that simple two-dimensional line drawings were most effective for learners (Wood 2006: 53).

To facilitate this, dividing the procedure into smaller steps was necessary so that each illustration only had a small amount of information to convey. Again, this corresponds

with Wood's structure of learning resources where a guidance phase taking the learners step by step through the process is central (Wood 2003, 2006: 150). This enables the learners to accomplish the task in hand successfully and to learn to address any common errors, providing a sound foundation upon which to build their knowledge.

The analysis also highlighted the importance of the layout, and that text and images should appear together so each adds meaning to each other. Much of this corresponds to the cognitive design principles for learning resources which require 'adding pictures to words, eliminating extraneous words and pictures, placing words near corresponding pictures, and using conversational style for words' (Mayer 2003: 137). Whilst in some respects this might seem like common sense it was notably lacking in the Timber Framing articles reviewed.

Finally, there is today's possibility of including video in the learning materials. In Wood's research (Wood et al. 2009) this proved to be an effective tool both as a way of providing overviews of what was to be achieved and as a resource for learners to return to as their knowledge builds to enable them to further their skill.

### **The learning resource**

Based on the four points identified above, the planned format for the learning resource was to produce a video showing the whole process, but created in such a way that it can also be watched in separate stages. In support of the video, paper-based guidance was produced that could be used by learners as they did the practical work, taking them step by step through the procedure, highlighting key skills or strategies. This provides the

learner with ‘bridges’ into the knowledge in the video, supporting them until they have sufficient experience to form their own interpretation (Wood et al. 2009).

Static drawings have been favoured as supporting material in the workshop because they are more effective with novice learners than photographs or video clips (Wood 2006: 53). The resultant paper-based resource is cheap, easily portable, relatively durable in a dirty working environment and easy for the user to annotate. The exciting possibilities for making video more accessible in this context, which have been brought about by the advent of the tablet computer and its increasingly widespread use and affordability, will be explored in future research.

To create the interpretation of the scribing procedure, Lassen played the role of an expert learner. While learning the method, he used step-by-step descriptions, video sequences, photographs and drawings to identify and articulate the different steps in the procedure to be able to integrate the knowledge into his own work. The resource went through several stages and even though there is not one definitive description that covers all aspects of the method, there are some key stages that have to be considered in all situations. Once these were established the video was produced with Lassen demonstrating the method and explaining the procedures to two video cameras filming from different angles. The material was then edited to exclude all extraneous details and enable division of the whole process into smaller procedures to make it easier to find specific movements and repeat viewing of these to further understanding. To highlight important movements different features were used in the editing such as freezing frames, slow motion and repeating movements with extra explanation.

The final video is 30 minutes long and breaks down into nine parts, the time for each shown in brackets below:

1. A short introduction to the procedure (1:40)
2. The layout drawing on the floor (2:00)
3. Putting out the timbers on the floor (1:50)
4. How to level the timbers Part 1 (3:50)
5. Putting out and levelling the second layer of timbers (4:00)
6. The drop of the timbers (1:10)
7. Scribing the timbers (6:50)
8. Mortise and tenon (3:20)
9. Scribing 2 (5:30)

The first five parts (13:20) form the preliminary work to be done before the actual scribing procedure is possible. The next three parts (11:20) show the actual scribing procedure, and Part 9 (5:30) shows how to scribe another joint in a slightly different manner.

The paper-based resource consists of nine A4 pages with numbered key stages, instructions to the left with both two- and three-dimensional drawings in the middle showing the described situations. On the right side of each page there are supplementary notes in an information panel, which are connected to the instructions (Figure 6). It follows a similar structure to the film, but includes more detailed information and also

briefly deals with an additional situation with a diagonal brace to post joint, which adds a degree of complication and means the numbering does not strictly follow the stages of the video.

**Figure 6:** Sample showing layout of Lassen’s paper-based learning resource.

The aim of the paper-based resource was to make it possible for the learner to take the instructions into the workshop and to communicate the basic practical instructions as ‘bridges’ into the knowledge. This description does not cover all situations, possibilities and variations when using plumb line scribe and it does not follow one single tradition, but it focuses on the outcome of Lassen’s experiences and his way of applying the method.

The learning resource was tested in two different practical workshops, first with a group of experienced Norwegian carpenters, who had no former experience of this specific scribing method and second with a group of more or less inexperienced Swedish carpentry students to see how both novice and more experienced learners would respond to the learning material.

### **Skills workshops 1 (Norway)**

The first workshop was organized through the University of Sør-Trøndelag (HIST) and was run as part of a course for carpenters in the Oppland region. The 25 students were divided into two groups to keep numbers in the workshop manageable, and the teachers of the course also participated as learners.

Before the workshop the students had a two-hour presentation of Lassen's research and the opportunity to ask questions on the subject. The following practical workshops lasted for four hours, during which Lassen observed but did not teach, and the practical part of the workshop was videoed to allow subsequent review of the sessions. After a short introduction to the aims of the workshops, the students were given the paper-based resource and were asked to watch the complete 30-minute video. Thereafter they had approximately two and a half hours to scribe a small wall frame on quite roughly hewn timbers, working in groups of two or three (Figure 7).

**Figure 7:** Learners at the workshop in Norway putting out and levelling the second layer of timbers (Part 5 in the video). Photo: Ulrik Hjort Lassen.

At the end of the practical work the students were asked to complete a questionnaire containing questions about the learning situation, the use of the method and the understanding of the learning resources. This was followed by a discussion where they could ask further questions.

During the workshops it was observed that the students took different approaches depending on how experienced they were. It was possible to roughly categorize the different students in three groups; the learners of the first group did not use the paper instructions other than for the measurements as they did not intend to follow the procedure exactly. They had understood the practical 'problem', a wall frame had to be built, and they used the plumb line scribe in the way they found most appropriate to solve this problem, and mostly from the information they had achieved by watching the video. The learners of the next group seemed to use the paper instructions only when they did not exactly remember the procedure from the video, and it was interesting to observe that

when there were differences between the procedure described in the video and the procedure described in the paper, they mainly applied the procedures from the video. As an example the video only showed the use of the plumb line for levelling the timbers, whereas the paper only showed illustrations of the spirit level for the same procedure. About 80–90 per cent of the students used the plumb line and not the spirit level at this point. This could be appreciated as an example of how more experienced carpenters are more able to take in the procedure from video having sufficient practical experience to be able to follow and understand the different details such as which tools were used and how. The learners of the last group followed the paper instructions very closely, and it was observed that they had more difficulty in understanding and applying the method in the practical situation. It seemed as if they wanted to understand the whole procedure before starting the practical work, and were unwilling to make mistakes. Generally these learners showed to have less practical experience than the learners of the first two groups. During the duration of the workshop there was not enough time to cut the joints, therefore unfortunately the students were not able to fully evaluate the quality of their scribing. Different students reached different stages in the procedure, and only few got to the more complicated situation of scribing the braces. However, those getting to this stage were able to appreciate the difficulties of scribing timbers out of 90 degrees.

From the questionnaire and discussion it was clear that plumb line scribing was new to most of the students, although many of them had more than ten years of carpentry experience. They all agreed that they more or less understood the principles of the method, and that they would find the knowledge useful in their profession. There was a general consensus that the structure and illustrations of both the video and the paper-

based resource worked well. The main criticism of the learning resource was that it did not show the final outcome of the process and that a closer connection between the film and the paper would have been helpful. They also commented on that it would have been helpful if they had had time to do the cutting of the scribed joinery, as this would have given them a possibility to evaluate whether the scribing had been done satisfactorily or not.

### **Skills workshop 2 (Sweden)**

A second comparative workshop was organized with a group of ten second-year students from the Building Crafts programme at the Department of Conservation in Mariestad as a part of their four-week course in timber framing. This group of students were relative novice learners. They were well known to Lassen as he had taught the group during a five-week course in 'square rule' timber framing the year before. The workshop was integrated into the part of the course where the students had to learn to work with irregular timbers in full-scale layout, which was a new subject to all of the students.

The workshop followed a similar structure to the first workshop in Norway, except that the 30 minutes film was shown twice before the workshop and that the students were asked to read the paper-based resource carefully before the workshop. This change was made because these students were inexperienced and therefore needed more time for reading and understanding, but also to make the information in the paper-based resource more strongly present in the students mind. Also this workshop lasted for eight hours and the timbers used were mill sawn but fairly twisted timbers. This was so that all the

students would also have time to cut and assemble the frame so they could see the result of their scribing, which there had not been time for in the previous workshop.

During the practical session it was observed that all the students used the paper-based instructions and that they took their time to understand and carry out the step-by-step procedures. These students could be categorized into two groups similar to the two last groups of the Norwegian workshop; the ones reading the paper and successfully following the step-by-step instructions without needing more information than what was found in the paper-based instructions, and the ones reading the paper closely but having difficulty transforming the instructions into the practical situation. They especially struggled when they reached the scribing situation in Parts 6–8 of the film and had difficulty finishing the wall frame within the timescale of the workshop. It was estimated that these students struggled more because of their lack of practical experience. From Lassen's own experience of teaching this group, these students have always needed more time and instructions for achieving the required results. To help these students, it might have been possible to also offer the video during the making session ~~also~~. However, for inexperienced learners this struggle can also be important as they have to encounter the problems in the practical situation before they can appreciate the information and details in the video.

From the questionnaire and the final discussion it could be seen that the learning resource had functioned well. As expected, no students had had previous experience of the method, but they all agreed they had understood the principles, that they found this form of paper- and video-based learning resource useful to their learning, and that this kind of knowledge would be useful for their future work. Some, however, commented that they

did not consider their own skills level sufficient to be able to properly comment on functionality of the learning resource, as they did not have sufficient experience from ‘real’ production.

### **Developing the learning resource**

The overall outcome of the workshops was that the learning resource itself had functioned well but that it would benefit from a number of amendments to improve its usability. In particular, it indicated the need for a clearer connection between the video- and the paper-based resource so that the same angles and situations could be found in both.

A series of small revisions have been made to the paper-based resource to add clarity and make it easier to use, such as putting each key stage on a separate page. Also the connection between the instructions and the information panel was made clearer by colouring the keywords in the instructions the same colour as the information panel. The specific terms used in the instructions, such as post, sill and arris, have been put in the drawings to help readability and make a better connection between the instructions and drawings.

Unfortunately, it has not been possible to revise the instructional video within the time frame of this study but the main improvement needed is to show the final result, the finished joint and the timber frame that is to be built, so that learners can picture what the procedures are leading to. It is felt that it would be best to make a completely new video based on the revised paper-based resource, although not all additional information in the instruction panel of the paper needs to be shown in the video. This would mean that the

angles used in the illustrations, which have been selected as being particularly useful to the learners, can be recreated in the video to make a close connection between the two.

There are also many possibilities for expanding the resource. At present only one application of the method is discussed and it could show a number of different situations and the specific methods for solving the problems. It would also be good to show use of different kinds of material, to demonstrate the more complex situations arising when scribing braces and to discuss scribing different types of joints. There are also other methods of scribing that would benefit from being demonstrated in this type of multimedia learning resource.

However, this would mostly benefit the more experienced learners and for the purposes of this research it was considered important initially to keep the content simple. This enabled Lassen to focus on the fundamental principles needed to bridge the gap between the novice and master, and to assist the novices in the learning situation before considering expanding on the possibilities. This learning resource fulfilled the aim of capturing the fundamental knowledge of how to practice the skill of plumb line scribing.

## **Conclusion**

This study applied Wood's method of recording and transmitting craft skills to create a learning resource for plumb line scribing that enables novice craft practitioners to develop their skills of this craft in the absence of a master craftsman. The research built on Wood's elicitation strategy, which employs an expert learner to uncover the skilled knowledge of craftsmen, and on her transmission strategy, which is based on the concept of bridges for the design of learning resources for novices. In Wood's research (Wood et

al. 2009), the role of the observer/designer, master craftsmen, expert learner and novice learner were separate: Wood took the role of the observer and designer, recording the transfer of knowledge between the master craftsmen, expert learner and novice learners to identify useful bridges for creating and developing the learning resource.

In contrast, in this research, Lassen has taken the role of both, that of the observer/designer and that of the craft practitioner/expert learner, demonstrating that it is possible to act as both expert learner and observer/designer at the same time to record and transmit his own skill. Based on the investigation of timber framing working methods, which Lassen elicited from a combination of text sources and skilled craft practitioners, Lassen demonstrated that it was possible to apply Wood's method to identify suitable bridges to this knowledge for the purpose of creating a learning resource to record and transmit this skill.

Finally, the aim of the authors was not to imply that such learning resources should entirely replace traditional teaching in practical situations. Although these learning resources allow self-education to a great extent, support through practical workshops is still beneficial. Rather, the hope is that they will be used primarily to support this style of learning both in formal workshops and as a source of knowledge afterwards, and that make learning possible where experts are not accessible. This study can therefore be considered as an example of how traditional craft practitioners can create learning resources to preserve and promote their unique skills.

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### Captions

**Figure 1:** Bridges across the knowledge gap between novice and expert (Wood et al. 2009: 73). Copyright: Nicola Wood.

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**Figure 2:** Bridges across the knowledge gap between expert learner and novice learners (Wood et al. 2009: 73). Copyright: Nicola Wood.

**Figure 3:** The interior construction of the fifteenth-century timber-framed barn in Aclou, Normandy, France, 1 March 2007. Photo: Ulrik Hjort Lassen.

**Figure 4:** A still from the video, a three-dimensional and a two-dimensional line drawing showing the same situation in the scribing process. Video: Nicola Wood, 16 June 2011. Drawings: Ulrik Hjort Lassen, 2011.

**Figure 5:** Piqué des bois faces aplomb/Scribing of timbers with vertical faces (Mazerolle [1889] 1986: 67). Copyright: Mazerolle.

**Figure 6:** Translated sample of the layout of Lassen's paper-based learning resource. ~~(2012)~~. Copyright: Ulrik Hjort Lassen, 2012.

**Figure 7:** Learners at the workshop in Norway putting out and levelling the second layer of timbers (Part 5 in the video), 9 December 2011, Dokka, Norway. Photo: Ulrik Hjort Lassen.