Transforming Tribal Knowledge into Written Instructions

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I recently worked as a technical communicator in a manufacturing facility using software called *Sequence*™. It is designed to help manufacturing companies document assembly procedures and thus offers opportunities for technical communicators. There are other database-driven applications that help streamline the documentation process, such as *AuthorIT*, but as far as I know, *Sequence* is the first software specifically designed to document assembly instructions and work directly with a company's inventory-control system, so that changes in parts and assemblies are automatically updated in the output—written, pictorial instructions in HTML or PDF format. The software enabled me to document 539 pages of instructions—with 1,407 images and 530 parts—in twenty-four days.

In this article, I discuss using this software to transform "tribal knowledge" into written instructions by observing production workers as they assemble parts, recording in words what they do, and taking photographs to illustrate those words. I discuss the reasons for conducting such a project to arm technical communicators in manufacturing facilities with language that will enable them to convince their employers to undertake the transformation.

Tribal Knowledge in a Manufacturing Environment

What Is Tribal Knowledge?

According to iSixSigma (an information portal for business professionals), tribal knowledge is "any unwritten information that is not commonly known by others within a company. This term is used most when referencing information that may need to be known by others in order to produce quality product or service" (***www.isixsigma.com/dictionary/Tribal_Knowledge-488.htm***).

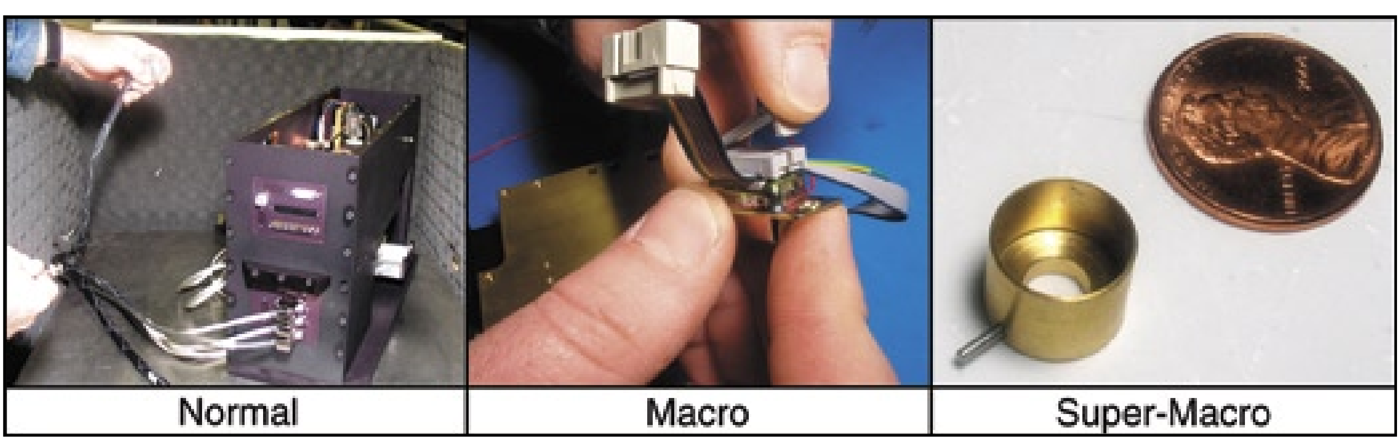
Some manufacturers rely on tribal knowledge and crude, informal, or ineffective documentation to carry out their operations and instruct new workers. To be sure, the mentoring part of this system is effective—that is, the more experienced workers imparting their knowledge to newer ones. However, the informal transfer of information from worker to worker is rife with problems, the most salient of which is the notorious unreliability of human memory.

The Problems with Tribal Knowledge

Human memory is both fallible and transient. The whisper game demonstrates the fallibility of our memories. In this game, people sit in a circle. One person has the original of a short narrative, which she whispers into the ear of the person to her left and so on around the circle. When the final version is compared to the original, the differences can be quite humorous, but in a manufacturing environment, the mouth-to-ear transmission of tribal knowledge can result in inefficiencies, unsafe practices, and inconsistent product quality.

An advertisement for the *Sequence* software demonstrates the transience of human memory. A person in a manufacturing environment smiles as he learns that he just won the lottery. In short order, he and all of his knowledge about the manufacturing process will be leaving the building forever. Illness, death,

Figure 1. Documentation Requires a Good Camera with Macro and Super-Macro Capabilities



retirement, relocation, job changes, and other events can result in a significant loss of information about manufacturing procedures.

The Solution: Written Instructions

Transforming tribal knowledge into written instructions benefits manufacturing companies in many ways:

- Worker turnover does not imperil the continuous operation of a business and the quality of its products. Although there is certainly a learning curve associated with preparing new production workers to take over the responsibilities of seasoned ones, written instructions ensure accuracy and consistency, and, in the case of a seasoned worker abruptly leaving the company, they make possible the transfer of *complete* information.
- Best practices are documented, distributed, and used by all workers. When someone discovers a better way to do something, instructions can be revised and workers can be formally notified of the change.
- During the documentation process, inconsistent or ineffective practices are discovered and, it is hoped, resolved.
- During the documentation process, problems with the company's bill of materials (the "BoM," as it's called, which is the list of parts used in an assembly) are revealed.
- Companies that obtain ISO 9000 registration are required to follow well-defined procedures for ensuring high-quality products. Written instructions for assembling products are absolutely necessary for such registration and are fixtures of any quality-management system (QMS).

Skills Required to Document Procedures

Transforming tribal knowledge into written, pictorial instructions requires a few basic skills. First, the author must be technically minded. Assembling parts usually requires sophisticated tools and fasteners. Understanding these tools and the basic concepts of fasteners is important. Understanding the basic concepts of the product is also important, but this understanding can be gained in the first stage of the project. Second, the author must have writing skills. The author must write quickly and clearly as she observes the activities of the production worker. Third, the author must perform basic editing during lulls, repairing the sentences that were hastily composed during the hurly-burly of real production. Finally, the author must master the digital camera (more on this later). Chances are, what I've just described is you, a technical communicator, and your skill set makes you the perfect candidate for this kind of work.

Setting up a Documentation Project

Get Buy-in

Getting buy-in from the production workers is key to a smooth relationship between the workers and the author. Management must explain to the workers that the project is best for the company and is not personal. It is not surprising that production workers may resent the documentation process because they may see it as a threat to their livelihood. After all, their undocumented knowledge makes them important to the company—but it also makes them a significant liability.

Work with Experts

The author should make sure that he or she works with a production worker who is an expert in the particular assembly being documented. Documentation of assembly procedures is no time for training employees. Before committing to the documentation process, the author should adopt a sound strategy for working with subject-matter experts (for a good article on this subject, see Jennifer Lambe's "Techniques for Successful SME Interviews" in the March 2000 issue of *Intercom*).

Figure 2. Ideal Photographic Setup for Documenting Assembly Procedures

Gather Equipment

The *Sequence* software operates on a client computer but requires a network connection so that it can store and retrieve information to and from a central database. Therefore, the author needs a laptop computer with networking capabilities.

If the author is going to document activity involving computer software, she will need Microsoft *Word* or other word processor to temporarily hold the screen captures and an image processor such as Adobe *Photoshop* to process them (to crop them and save them as discrete images in JPEG format). A USB flash drive comes in handy to transfer these screen captures from one computer to another.

The digital photographic equipment that the author uses must be capable of close-ups—called "macro" in the photographic world. When documenting the BoM, some parts are so small that a "super-macro" function is required. Figure 1 shows photographs taken in three different modes: a normal mode for large objects, a macro mode for small objects, and a super-macro mode for tiny objects.

A good flash is essential for proper exposure. However, an onboard flash or externally mounted flash does not work well when the author must photograph tiny objects because the flash does not point toward the object. To overcome this problem, I purchased a flash cord and external flash. The digital camera must have what is called a "hot shoe" to mount an external flash. External flashes of the same brand as the camera usually enable the digital camera's automatic-exposure function to operate just as it does with the onboard flash. The difference is that the photographer can connect the flash to the camera via a flash cord and pump light into the scene at any angle and at any distance, thus controlling light and shadows for better exposure. I also purchased a mini-bounce light deflector, shown in Figure 2, to soften the harsh light of the flash.

Using the Software

In the manufacturing world, things are divided into parts, assemblies, and products. Parts are assembled to form assemblies. Once formed, assemblies become parts used in other assemblies. The final product is an amalgam of parts and assemblies, sub-assemblies, sub-sub-assemblies, and so on. In *Sequence*, each assembly has associated with it a BoM, assembly tools, a set of instructions, references, calibration procedures, and best practices ("promiscuous" procedures that are used over and over again in different instruction sets).

The interface for the *Sequence* software is fairly straightforward. Figure 3 shows the "Instruction" tab, which is the main tab used during the recording of instructions. As the author observes a worker, discrete instructions are entered into the "Instruction Details" text box. As soon as the author clicks on the "Save" button, the text is transmitted to and stored in a database on the company's server (see Figure 4). The beauty of this database system is that information is centralized and can be easily retrieved and edited.

The author has many opportunities to incorporate photographs, illustrations, and screen captures into the instructional material. The parts, assembly tools, instructions, calibrations, and best practices can all have images tagged to them. The resulting HTML output or PDF file is rich with illustrative images.

Documenting Assembly Instructions

Nuts and Bolts

Before the documentation process begins, the author must print out the BoM from *Sequence* and photograph all of the parts used for the assembly. Any inconsistencies between what is listed and what is actually used must be recorded and later resolved.

Documenting a procedure requires the author to toggle between typing words into *Sequence* and taking photographs. Documentation is a highly verbal activity: The worker is required to explain every action performed, so the author must encourage the worker to speak. Snippets of narrative must be quickly clarified to stay on pace.

Opportunities for photographs are often self-evident, but sometimes the author must make a judgment about the efficacy of a photograph. Does the act of soldering really need to be captured? Or are words enough? The worker must be patient while the author takes photographs. Setting up the right camera angle, the right flash angle, the right mode (normal, macro, or super-macro), and the right composition may take only seconds, but those seconds can seem like a long time to a worker who must remain still while the photograph is set up and taken.

Figure 3. Instruction Tab in the* Sequence *Software

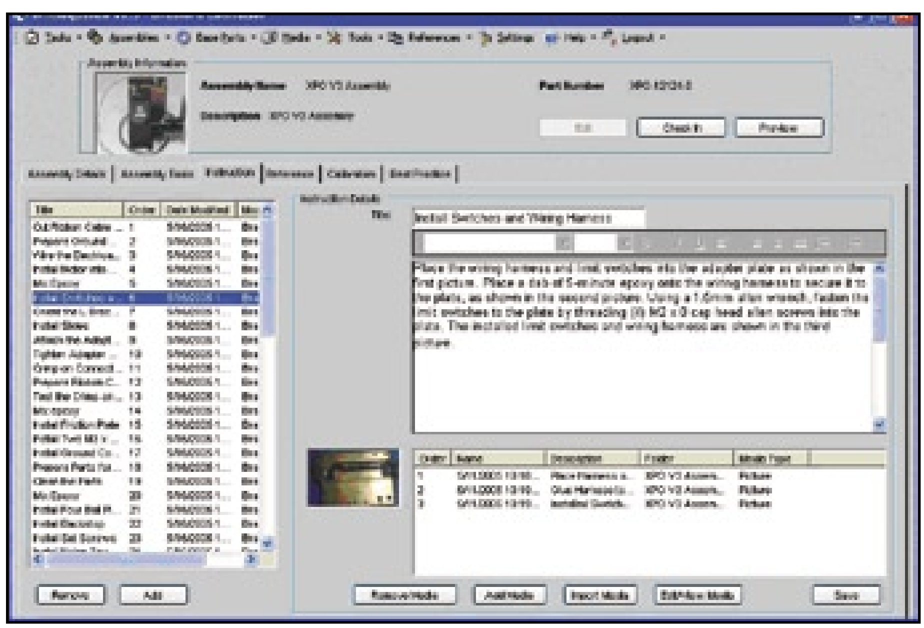
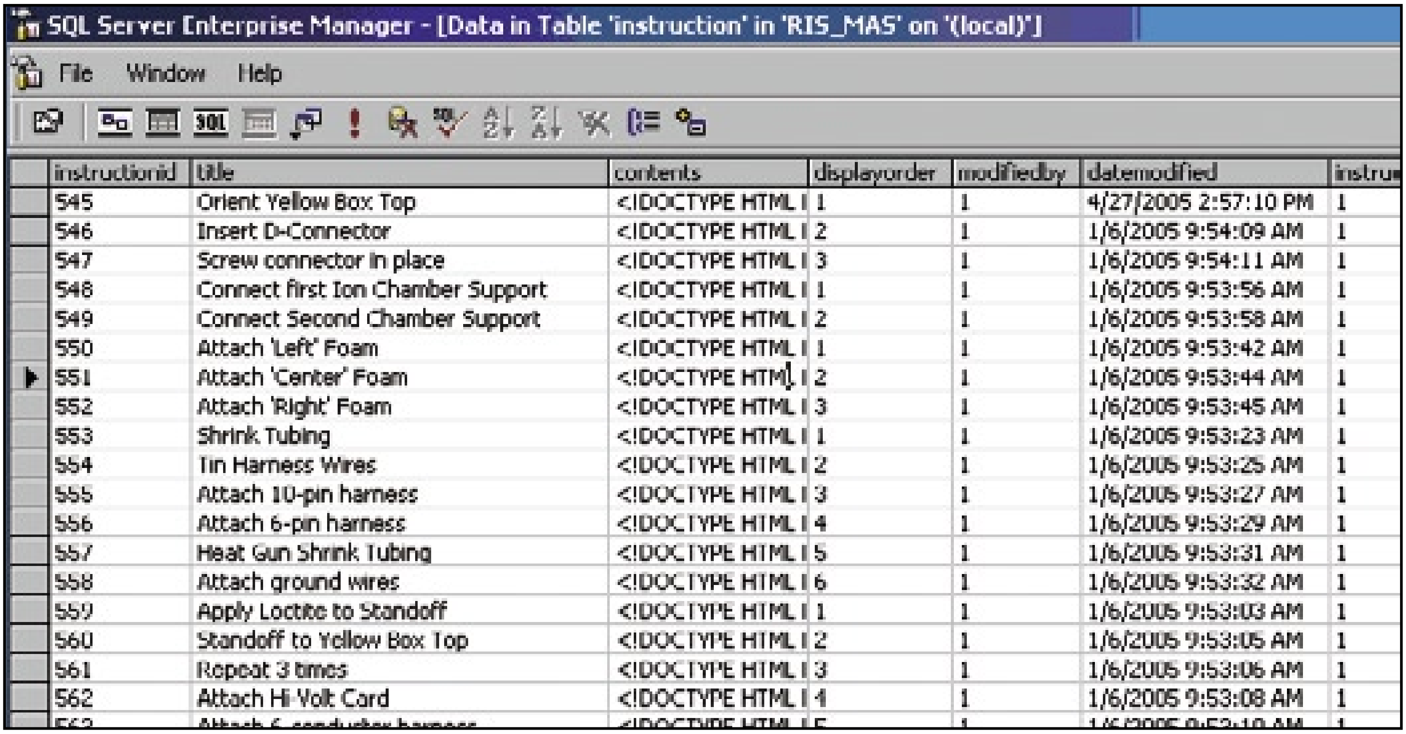


Figure 4. Information Typed in by the Author Gets Tagged and Stored in an SQL Database



instructionid	title	contents	displayorder	modifiedby	datemodified	instru
545	Orient Yellow Box Top	<!DOCTYPE HTML I	1	1	4/27/2005 2:57:10 PM	1
546	Insert D-Connector	<!DOCTYPE HTML I	2	1	1/6/2005 9:54:09 AM	1
547	Screw connector in place	<!DOCTYPE HTML I	3	1	1/6/2005 9:54:11 AM	1
548	Connect first Ion Chamber Support	<!DOCTYPE HTML I	1	1	1/6/2005 9:53:56 AM	1
549	Connect Second Chamber Support	<!DOCTYPE HTML I	2	1	1/6/2005 9:53:58 AM	1
550	Attach 'Left' Foam	<!DOCTYPE HTML I	1	1	1/6/2005 9:53:42 AM	1
551	Attach 'Center' Foam	<!DOCTYPE HTML I	2	1	1/6/2005 9:53:44 AM	1
552	Attach 'Right' Foam	<!DOCTYPE HTML I	3	1	1/6/2005 9:53:45 AM	1
553	Shrink Tubing	<!DOCTYPE HTML I	1	1	1/6/2005 9:53:23 AM	1
554	Tin Harness Wires	<!DOCTYPE HTML I	2	1	1/6/2005 9:53:25 AM	1
555	Attach 10-pin harness	<!DOCTYPE HTML I	3	1	1/6/2005 9:53:27 AM	1
556	Attach 6-pin harness	<!DOCTYPE HTML I	4	1	1/6/2005 9:53:29 AM	1
557	Heat Gun Shrink Tubing	<!DOCTYPE HTML I	5	1	1/6/2005 9:53:31 AM	1
558	Attach ground wires	<!DOCTYPE HTML I	6	1	1/6/2005 9:53:32 AM	1
559	Apply Loctite to Standoff	<!DOCTYPE HTML I	1	1	1/6/2005 9:53:03 AM	1
560	Standoff to Yellow Box Top	<!DOCTYPE HTML I	2	1	1/6/2005 9:53:05 AM	1
561	Repeat 3 times	<!DOCTYPE HTML I	3	1	1/6/2005 9:53:06 AM	1
562	Attach Hi-Volt Card	<!DOCTYPE HTML I	4	1	1/6/2005 9:53:08 AM	1

The author can photograph and record the names of the tools the workers use. *Sequence* enables the author to attach tools to a set of instructions, so the worker who reads the instructions knows what tools to gather before actually assembling parts.

Finally, the author must integrate the photos and screen captures taken during the procedure with the text. This is done by importing the images into *Sequence* and attaching them to an instruction. Then, the images can be manipulated in *Sequence*; the author can crop, rotate, adjust the brightness and contrast, and add text and arrows.

Pitfalls

In many companies, the industry is separated into multiple buildings—for example, engineering and production. This physical chasm may result in a communication chasm, despite the interconnectedness that high-speed networking provides. This communication gap may be manifested when, during the documentation process, conflicts arise between engineers who have certain ideas about the way things should be done and production workers who do things in a different way. It is not the author's place to resolve these conflicts—the goal is to document what *is* being done, not what *should be* done.

Making unwanted suggestions can get an author into trouble. On a few occasions, I offered suggestions about simplifying a procedure that upset the worker. Looking back, I now understand that this kind of kibitzing is inappropriate unless it is understood from the beginning that the author may, in some cases, team with workers to improve practices.

The biggest problem that I continually got sucked into was becoming hurried. Blurry photographs, missed steps, sloppy writing, and other problems are consequences of moving too fast. One production worker in particular constantly got ahead of me, and, despite my pleas for him to slow down, he would not change his pace. I felt such pressure to keep up that I omitted words and photographs that I later determined were necessary for completeness. Asking the worker to disassemble and then reassemble part of an assembly was a tough and humbling call that could have been avoided had I stood firmer.

Conclusion

The inertia of tradition is strong in a tribal environment, but tradition is no excuse for inefficiencies, unsafe practices, and inconsistent product quality. In a highly competitive marketplace, "documenting what you do and doing what you document" is important to ensure high-quality products and is a requirement for ISO 9000 registration. For some businesses, formally documenting procedures will be a paradigm shift in the way that they train new employees and ensure quality. If great numbers of businesses make this shift and software applications such as *Sequence* successfully enter the marketplace, technical communicators should be poised to take advantage of the resulting employment opportunities.

Bradford R. Connatser owns the consulting firm WriteNow Communication. He has taught technical writing, English composition, rhetoric, and journalism at Temple University in Philadelphia and Maryville College in Maryville, Tennessee. He has published award-winning articles and fiction in magazines, journals, and newsletters. His research includes applying cognitive psychology to technical writing. He can be reached at ***bconnatser@comcast.net****.*