Conceptual Foundations for Computer Documentation:
New Distinctions for a New Era

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Concepts are thoughts made clear and distinct by the distinctions we draw at their boundaries. The concept "conifer" comes about when we begin to make a specific distinction about the features of certain trees. If we cannot formulate such a distinction, we do not have the concept.

As the computer industry changes, much depends on our ability to formulate new and relevant distinctions and to thereby refocus old concepts and make new ones possible. Otherwise, our overall understanding of our field will diminish and our day-to-day work will in subtle ways become less effective.

As documentation specialists, our view of the computer industry is necessarily different from that of those who design systems, manufacture systems, or market systems. Thus, we need to carve up the universe in ways that are most useful for our work. At the same time, of course, we have to understand and use the distinctions made elsewhere in the industry.

The purpose of this paper is to point out four traditional distinctions within the computer industry that are not highly serviceable to those engaged in documentation and to describe refinements upon or alternatives to those distinctions. The distinctions are as follows:

(1) Computer systems and noncomputer systems

(2) Computer hardware and software

(3) Documentation and interface

(4) Print and online documentation

As we shall see, the distinction between computer hardware and software has always presented significant conceptual difficulties in the area of documentation. In the case of the other distinctions, the difficulties have come about or have been exacerbated by technological change.

COMPUTER SYSTEMS AND NON-COMPUTER SYSTEMS

For many years, the distinction between computers and other devices was sharp and obvious. There was no mistaking, in any respect, a computer for a radio or an oven. But the distinction between computers and noncomputer systems has blurred, as computers are now embedded routinely into appliances and many other devices.

Like the rest of the industry, documentors need new distinctions and concepts that reflect this change. We need means to discriminate in a meaningful and fine-grained way among computer systems; embedded systems such as radios, ovens, and photocopiers; and the full range of devices that are in no sense computerized.

The basis for these distinctions, I think, is the nature of the user interface. Specifically, we can establish a continuum reflecting the degree to which the use of a device is mediated by contrived, highly communicative interfaces rather than through direct physical action.

At one end of this continuum are "dumb" devices--an oil filter, a fountain pen, a collapsible easel--devices that people interact with directly. In the middle of the continuum are mechanically operated devices. These are controlled by knobs, switches, levers, and similar means, and typically report their state by means of dials and lights. One brand of electric wok has a knob that is used to select the cooking temperature and an indicator light that goes on when the wok has reached the selected temperature. An automobile is operated by means of mechanical controls and reports such measurements as speed, rpm, engine temperature, and fuel level, primarily through dials and lights. Toward the far end of the continuum are devices whose interface is dialogic. They accept complex, often linguistic input through a keyboard or some other input device and respond through language and often graphic images. Almost all computers designed to be operated by human beings are dialogic devices.

There are many gradations on this continuum. Those dumb devices with handles and other user-oriented features-- "affordances" in Donald Norman's terms [1]--have a more developed user interface and are more communicative than

other dumb devices. An automobile is a more communicative mechanically operated device than is an electric wok. A variety of devices such as microwave ovens and sophisticated photocopiers contain limited screens and partial keyboards through which they maintain two-way communication with the user that approaches complete dialogic communication.

There are also computers with interfaces that extend beyond the dialogic in certain ways. In direct manipulation interfaces, dialogic communication is extended through visual metaphors based upon direct physical actions [2]. So, instead of a print command, the user may place an icon representing a document over an icon representing a printer. In the case of highly experimental or as-yet-conceptual "virtual reality" interfaces [3], this more-than-dialogic communication can go still further. A surgeon, for instance, might at some future date manipulate fist-sized replicas of very small or fragile parts of a human body and in so doing direct a computer to perform comparable actions on the actual patient [4]. On one level, the surgeon's actions hark back to the manipulation of dumb devices, but the surgeon is in fact acting through a highly contrived, highly communicative user interface and one in which dialogic communication would be used to complement virtual reality manipulations.

The interface continuum, then, updates and enriches the simple binary distinction between computers and non-computers. It encompasses the full universe of devices, allows for unlimited gradations, and meets the needs of documentors by focusing on the interface, their primary concern. The interface continuum shows us, for instance, that for the purposes of user documentation a videocassette recorder is closer to a computer than an automobile. This is not because of the computer technology underlying a VCR--modern automobiles contain a variety of highly sophisticated on-board computers--but rather because the interface of a VCR is more dialogic than that of an automobile.

The interface continuum is not the full story, however. Documentors must still recognize and understand the technologies that underlie the systems they document. One reason for this is that even documentation focused on the user interface frequently includes some descriptive and conceptual information about the system's underlying technologies. Also, not all documentation is procedural. Some is conceptual and descriptive, and is concerned with the underlying technologies and not at all with the interface. For example, while the on-board computers that optimize an automobile's carburetion and braking are probably not of concern in the user documentation, these computers are relevant to the descriptive/conceptual documentation, including the marketing material.

SOFTWARE VS. HARDWARE DOCUMENTATION

The distinction between software and hardware has been fundamental to the computer industry. The distinction, moreover, is valid in certain contexts. Hardware, whether we are talking about a processor, a joystick, or a mainframe, is a manufactured product, and software is a "published" product in which the "manufacturing" aspect, imprinting the code on media, is incidental. This distinction, however, has never

served the documentation community very well, and we can do better with the same notion of an interface continuum that we used to distinguish among the full universe of devices.

Let's consider two hardware documentation tasks: instructions for fitting a circuit board in a slot within a microcomputer and instructions for operating an emulator. The first task entails fitting one dumb device into another. The dialogic capabilities of the computer system are irrelevant here. The writer deals entirely with the the vocabulary of physical manipulation--words such as "align," "push," "bend," "seat," and "engage." This is precisely the same vocabulary that you would use in explaining how to replace the air filter in a home furnace. The two sets of instructions would, in fact, be much alike. This is not to say that documenting dumb devices is easier or less sophisticated than documenting complex computer-human dialogs. Often, in fact, describing how to push or bend part of a physical device is more difficult than describing menu choices--the constrained actions of a keyboard or mouse work in favor of the documentor.

The second documentation task, the instructions for operating an emulator, is highly dialogic. Though the emulator is a piece of hardware, it has a keyboard and screen and computer code somewhere within it. The task of explaining the operation of the emulator, like many hardware documentation tasks, is actually very similar to documenting a piece of software.

Certainly these two tasks are very different from one another, and if both are regarded as "hardware documentation," the distinction between software and hardware is telling us very little indeed. In contrast, these two documentation tasks fall neatly on the interface continuum and are illuminated by their positions upon it. The same can be said if we choose to consider a third hardware documentation task, instructions for operating a mechanically operated piece of computer equipment, let us say a switchbox for connecting peripherals or else a back-up power supply. Clearly, then, a good alternative to classifying documentation tasks in terms of hardware and software is to consider the location of the device on the continuum that ranges from dumb devices to (and beyond) dialogic devices.

DOCUMENTATION AND INTERFACE

If an interface is the point of contact between two systems, the user interface of a device logically includes the documentation. The documentation, the displays on the screen, the keyboard, and other input and output devices function together to allow the user to understand and communicate with the device. This idea, however, seems counter-intuitive: many people reject the idea that a book can be part of a machine's interface.

This artificial separation between the concepts of documentation and interface causes difficulty, especially so now that online documentation has become more prevalent in dialogic devices. For instance, one can readily hear a software developer say, "If we invest more effort in the interface, we'll be able to print less documentation." This statement places online documentation in a state of

conceptual limbo and creates significant ambiguity. Does the developer intend to improve the menu structure of the program, reduce the number of commands, and add more consistency to the keyboard sequences? Or, does the developer intend to expand the size and improve the clarity of the online help files and make the system messages more complete and informative? The software developer's intentions will not be clear to a colleague and may not be clear to the developer either.

Also, the developer's statement implies a nonexistent chasm between print and online documentation. Is an online tutorial, as a part of the interface, fundamentally different from a print tutorial? If a piece of print documentation is moved on disk as a "read me" file, has there been a fundamental change in the nature of that piece?

A more contemporary and useful distinction can be drawn: the distinction between the functional and advisory interface. The functional interface consists of nothing beyond the small amount of information that the truly expert user needs to operate the device; the advisory interface consists of all the explanatory information that the less-than-expert user requires. The functional interface, therefore, consists of menu and icon labels, bare-bones system messages, and the like. The advisory interface includes online help and training as well as system messages that explain (rather than simply identify) what is going on and make suggestions as to what the user might want to do. The advisory interface, of course, also encompasses the printed user documentation.

This distinction is valuable because it distinguishes the functional and instructional aspects of the screen interface and, hence, clarifies the status of online documentation. Also, it is much easier for people to accept the idea that print documentation is part of the user interface when print documentation along with the on-screen documentation falls under the subcategory of advisory interface. Whereas the root word "document" tends to suggest that documentation is paper, thereby separating and confusing the concepts of print and online documentation, the idea of an advisory or instructional interface draws out the Latin etymology "docere"--to teach--and thereby helps unify print and online documentation. Our software developer can now make a clear and precise statement, "We will start working on both the functional interface and the on-screen advisory interface in order to reduce the size of the print documentation."

PRINT AND ONLINE DOCUMENTATION

Within the context of the advisory interface, we should examine more closely the distinction between print and online documentation. Using this distinction, we customarily divide the world of documentation into two broad categories, and in most instances, this proves to be a workable division. Certainly the border between print and online is sharp and evident, but there is conceptual difficulty at the far edges of the concepts. We are therefore better off if we divide the world of documentation into print and electronic documentation and use online documentation in a somewhat new sense.

The concept of print presents the lesser difficulty. Because it strongly connotes paper documents, it leads us to neglect one small but significant category of print documentation: documentation that appears and exploits its location on the surfaces of a product. This includes warnings and instructions stenciled on military equipment, explanatory labels affixed at strategic points inside appliances for the benefit of repairpersons, templates that show the functions of the keys they surround, and explanatory text molded in relief form on the back of computers and other equipment to identify certain sockets and ports. This form of documentation is both prevalent and functionally distinctive in its use of physical proximity as a means to connect the user to desired information. We should not, therefore, let the concept of print blind us to the existence of this form of documentation in either our speculative or applied thinking.

The larger problem comes with the term "online" as the complement to print. First of all, the term explicitly excludes videotape, an occasional medium for documentation. Consequently, the terms "print" and "online" do not collectively account for all forms of documentation, as the terms "print" and "electronic" documentation do. Furthermore, the term "online" presents ambiguities, ambiguities that will grow more apparent and more troublesome with technological changes that are taking place.

Much electronic documentation can be accessed from within an application (or language, or system), without terminating the work session. Help facilities, system messages, and many tutorials work this way. Other forms of online documentation are entirely independent of the work session or require that the work session be terminated. Many tutorials belong to this category, as do demos and tours. Also belonging to this category are simulators, an increasingly important means of documenting a broad range of dialogic devices. Some simulators require an actual re-creation of a cockpit or control panel, but with sophisticated computer graphics such physical re-creations are less often necessary. For example, Boeing's 7Mac7 system, now partly functional, allows the learner to "step through" an aircraft and examine, operate, and receive instructions on complex aviation equipment, while actually working at a PC [5].

The phrase "online" is often interpreted broadly as a synonym for "computerized" or "on-screen." At the same time, the phrase strongly suggests close integration with the system that is being used to perform the actual work. This is partly due to the origins of the term--it harks back to the era of mainframes and dumb terminals, when people "went online" with a computer system. Whereas a videotape is certainly not online documentation and a help facility certainly is, it is uncertain who might or might not regard a demo or a simulation as "online."

Once print and electronic documentation have become the umbrella concepts, we can elegantly resolve the conceptual difficulties surrounding online documentation by restricting the meaning of "online" to documentation that is used in conjunction with the work session. "Offline documentation" can then be used to refer to such forms of electronic documentation as tours, demos, tutorials used separately from the product, documentation delivered on videotape, and simulators.

Using this distinction, some potentially confused relationships sort themselves out cleanly. For example: An aircraft simulator is offline in regard to the aircraft itself, though the aircraft can contain systems with various kinds of online documentation. The simulator, however, may contain documentation that is online in regard to itself, including online information on the operation of the simulator and online information on the operation of an aircraft. The simulator may also contain its own offline documentation, such as an introductory tour explaining its operation.

The distinction can also be applied to how documentation is used. For example, one could say, "This tutorial can be accessed online, but we usually use it offline during training sessions."

It is very difficult, of course, to influence how people use language, and it is impossible to predict how terminology will change under the pressure of changes in the industry. But regardless of how terminology evolves, it is important for us to keep the concepts clear and logical in our minds.

CONCLUSION

This paper points out that, due largely to technological changes, some of our traditional distinctions are no longer serviceable. Unless these distinctions are revised, unless we establish new conceptual foundations for computer documentation, our understanding of the field and the effectiveness of our documentation will gradually diminish. Here, in summary form, are the new distinctions I present along with the older ones they may supplement or supplant.

1. Rather than the simple binary distinction between computers and noncomputers, we can distinguish, for the purposes of documentation, an interface continuum ranging from dumb devices, through mechanically operated devices, to near dialogic, fully dialogic, and more-than-dialogic devices. The nature of the underlying technology, however, is still relevant for some documentation tasks.

2. The traditional distinction between hardware and software is not very meaningful for documentors. Hardware documentation tasks encompass both instructions for installing a circuit board and instructions for operating a highly dialogic device, even though the second task is similar to documenting software. The traditional distinction can be usefully supplanted by the interface continuum.

3. The artificial separation between the concepts of documentation and user interface leads to confused thinking about documentation. We need to distinguish between the functional and the advisory aspects of the user interface and classify on-screen tutorials, help, and other explanatory information as well as print documentation as part of the advisory interface.

4. The distinction between print and online documentation does not logically divide up the world of documentation. A better distinction is that between print and electronic documentation. Furthermore, conceptual difficulties will be avoided if the term "online" is restricted to electronic documentation that can be used without terminating a work session. "Offline" can be used to refer to simulations and other forms of documentation that are not used within a work session.

These distinctions as well as others will provide the conceptual foundations for the new era in computer documentation.

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