# What makes a user's manual helpful to users?
# A report of a research study

Janice C. Redish and Joseph S. Dumas
(version from 1996, approved by HP)

*In this chapter, the authors describe a controlled usability study in which they varied the features of the manual for a new software product in systematic ways, based on the advice of expert document designers. Fifty potential users of the software did the same set of tasks, with ten participants for each of the five versions of the manual. Results indicated that combining all the features made a significant difference in users' performance both with the manual and with the software product. Users who had the "best" manual spent 15% less time overall and 20% less time working on the computer than users who had the "worst" manual. They also spent only half as much time in the table of contents and were 34% faster at the last three tasks. The authors also report more detailed results on how different aspects of the manuals contributed to users' success or failure in doing tasks. At the end of the chapter, the authors discuss issues that the research project could not resolve and that deserve further study. The features that were manipulated in the study are listed in an appendix.*

## Introduction

Does the quality of manuals matter? That is, are there differences in productivity and performance when similar users have different versions of the same manual?

Can we define at least some elements of "quality" in a user's manual? That is, are there specific factors and features of manuals that contribute to differences in users' productivity and performance? How do different factors (clusters of features) influence what users learn and do?

In the late 1980's, Hewlett-Packard (HP) funded the American Institutes for Research (AIR) to conduct a research project on these questions. The authors were the AIR project directors.

Of course, in any specific project to create a software or hardware product, iterative interactions with users are necessary to develop a successful manual (as well as the right functionality, a good interface, and successful communications in other media). Technical communicators, as well as developers and interface designers, must understand who the users are for a specific product, what those users know, what tasks they will want to do, what vocabulary they will use in looking up information, etc. Creating any and all the parts of a successful product requires a process in which many techniques are appropriate (Dumas and Redish, 1993). The goal of this research project was to support that process by providing information that could help technical communicators bring better draft manuals to interactions with users (for example, to usability testing) – manuals that already incorporate features that research shows make a difference in users' productivity and performance.

 

The rest of this chapter is organized by the stages of the project:

- asking experts what makes a manual usable
- testing the experts' opinions
- analyzing the data and reporting the results

We end the chapter with a discussion of the limitations of the study and suggestions for further research. Appendix A is a list of factors and features that were part of this research study.

## Asking experts what makes a manual usable

To study the effects of different aspects of manuals on users' productivity and performance, we had to decide what aspects to vary. Where would we find hypotheses for the study, the list of factors and features that might make a difference to users. We chose to ask a group of documentation experts, working independently, to tell us what they look for in evaluating manuals.

This approach allowed us to add another interesting question to the study: Would documentation experts, working independently, agree enough on what makes a manual work for users that we could confidently develop a model on which to do further research? As far as we know, before this project, no one had asked a group of experts how they evaluate user manuals.

### Who were the experts?

Ginny Redish, an AIR author, researcher, and documentation expert, participated in this part of the project. We also selected five researchers and practitioners outside of AIR who are recognized for their expertise in evaluating manuals. They were

- Dr. Thomas Duffy of Indiana University
- Dr. Stephanie Rosenbaum of Tec-Ed Corporation
- Dr. Jeffrey Rubin, then of UserVision Corporation, now of J. Rubin Associates
- Ms. Kathi Vian of Compage Corporation
- Dr. Patricia Wright of the Applied Psychology Unit, Medical Research Council, Cambridge University, Cambridge, England

### What did we ask the experts to do?

We asked the experts to consider separately each of these five types of print documentation for hardware or software:

- installation manual
- getting-started manual (short, task-oriented, fast-track, covering basic tasks)
- task-oriented user's manual to the entire product
- system reference guide
- quick reference guide

For each type of manual, we asked the experts to describe three to ten major *factors* that make that type of manual usable. We then asked them to describe the *features* that contribute to each

factor. A *factor* might be "ease of locating information." A *feature* might be "the quality of the table of contents" or "the presence of a good index."

For each feature, we also asked the experts to describe

- how they would tell someone who is not a documentation expert how to evaluate the feature – that is, what do these experts actually look at to decide if the table of contents is high quality or if the index is good

- how they think that good or poor implementation of the feature would affect users' behavior

We used the first type of information to develop the "high" and "low" versions of a manual to test with actual users. We used the second type of information to decide what to measure in the test.

To make the task concrete, we selected one example of each type of manual and sent a copy to each expert. The experts were told not to evaluate the specific manual but to use it as a sample to stimulate their thoughts about what makes manuals of that type easy to use.

### What did the experts say?

In general, the experts agreed on what makes each type of manual easy to use. There was also great overlap in the factors and features from one type of manual to another, but the experts' rank ordering of the importance of specific factors and features changed from one type of manual to another.

The experts said that the most important factor for task-oriented manuals is that they give users an overview or big picture of what they can do with the product and how the manual can help them understand how to perform tasks. For example, one expert said a user's manual should have "Conceptual familiarity – a familiar task domain – a well defined and consistent use of metaphor." Another said "the task information is organized around my goal as a user, such as a system administrator."

For quick reference guides, all of the experts described the most important factor as providing "easy access to familiar categories of information." For installation manuals, the most important factor for the experts was to have a "clear presentation of the steps needed to install" and an extensive use of graphics.

All of the experts listed "ease of finding information" and "ease of understanding how to perform a task" as factors for all types of manuals. The importance of these factors, however, varied with the type of manual

The features that the experts included within each factor also were similar. For example, under the factor "ease of understanding how to perform a task" all of the experts mentioned features such as effective illustrations and a cluster of features that have to do with clear English – using the active voice, writing in short sentences, and using clear language rather than developers' jargon.

Here are the experts' factors in order of importance for each type of manual

**Installation Manual**
- Organized for installation
- Ease of understanding the information
- Ease of finding out about my configuration
- Ease of reading the information
- Ease of recovery from mistakes

**Getting-Started Manual**
- Help in building a mental model of the product and how to use it
- Ease of finding a specific section
- Ease of understanding the information
- Ease of finding information on a page
- Ease of recovery from mistakes

**Task-Oriented User's Manual**
- Help in building a mental model of the product and how to use it
- Ease of finding task instructions
- Ease of understanding the information
- Ease of finding information on a page
- Ease of recovery from mistakes

**System Reference Guide**
- Organized for reference
- Ease of finding information
- Ease of finding information on a page
- Ease of understanding the information
- Completeness of the information

**Quick Reference Guide**
- Ease of finding information
- Ease of finding information on a page
- Ease of understanding the information
- Ease of use with the equipment

The experts also agreed on the features that contribute to the factors. For example, all the experts mentioned the importance of a task-oriented table of contents and task-oriented headings as features that contribute to the ease of finding information in a user's manual.

## Testing the experts' opinions

Given the high level of agreement among the documentation experts on what makes a manual usable, we went on to the second phase of the research project. We asked the question: Would the experts' opinions hold up in a research study with actual users? Do the factors and features that the experts say will make a difference actually predict differences in users' behavior in a real situation? How much difference does each factor predict?

Time and resources only allowed us to test the experts' factors and features for one of the five types of documentation. For obvious reasons, we chose to study the task-oriented user's manual, which most people think of as the key print document for using either hardware or software.

We conducted the research in AIR's usability laboratory in Bedford, Massachusetts. To set up the study, we

- selected a specific product and manual to use as the stimulus
- wrote five versions of the manual
- recruited 50 appropriate participants

## Selecting a specific product and manual

As our experimental case, we used *SoftBench Debugger*, a Hewlett-Packard workstation product that is a tool within *SoftBench*, a UNIX-based programming environment. It met our criteria of

- **a manual of moderate size**
  A manual of less than 50 pages would not give us enough material to manipulate the factors and features. A manual of more than 200 pages would require too much time to change into five carefully varied versions. At 178 pages, the existing manual for *SoftBench Debugger* worked well.

- **a product of moderate difficulty**
  If the product were too easy to learn, participants might never go to the manual. If the product were so poorly designed that it was too difficult to use, we might not be able to write a good manual for it.

- **a product that we could easily set up in the usability laboratory**
  *SoftBench Debugger* runs on a UNIX workstation that could be set up easily in the laboratory.

- **a product with a substantial potential user base who had never worked with the product or manual**
  Any programmer working in C is a potential user of *SoftBench Debugger*. Because the product was not yet released, none of the programmers we might recruit for the study would have used the product or manual before.

## Writing five versions of the manual

To test the experts' model, we created different versions of a user's manual, systematically varying the experts' factors and features across the versions. We used the existing draft manual to help us understand the product, but we did not use it in the test.

The experts' model for the usability of task-oriented user's manuals had five factors:

Help in building a mental model of the product and how to use it
Ease of finding task instructions
Ease of understanding the information
Ease of finding information on a page
Ease of recovery from mistakes

We did not vary the fourth factor on page layout. All the versions used the same page layout, the vendor's recently introduced standard.

We varied the remaining four factors across five versions of the manual according to this table:

*Table 1. Varying the factors across five versions of the same users manual*

| Factor | Manual 1 | Manual 2 | Manual 3 | Manual 4 | Manual 5 |
|---|---|---|---|---|---|
| 1 | High | Low | High | Low | Low |
| 2 | High | High | Low | High | Low |
| 3 | High | High | Low | Low | Low |
| 4 | High | High | High | Low | Low |

This test design assesses the overall effect of the four factors together by comparing a "totally good" document (Manual 1) with a "totally poor" document (Manual 5). It also provides some balance in that there are at least two manuals that are high and at least two that are low on each factor.

Because we wanted a realistic test of a user's manual, we did not make the low levels of each factor as poor as we probably could have. Our Manual 5, which is low on all four factors, is still better than some of the worst manuals we have seen. Moreover, our Manual 1, which is high on all factors, is not perfect. We did not do separate, iterative usability tests to ensure that it was excellent before using it in the research study.

For each feature on the experts' list, we created a solution that is high on usability and a solution that is low on usability. Here are some examples of how we varied the different features:

> A table of contents that organizes the manual around users' tasks is a feature within Factor 2: "Ease of finding task instructions." The manuals that were high on Factor 2 had a two–level table of contents at the front of the manual and a one or two–level table of contents at the beginning of each chapter. All the headings related to user's tasks. Most began with a gerund, while a few set up different situations and began with "If you..." For example, here is part of the initial table of contents for manuals that were high on Factor 2:
>
> Chapter 3: Starting and ending your work in Debug
> Starting SoftBench
> Starting Debug
> Looking at the parts of the Debug window
> Debugging more than one program at a time
> Ending your work in Debug
>
> At the beginning of Chapter 3, there is another two-level table of contents that elaborates on the items in the initial table of contents. Here is the list of headings for the *Starting Debug* entry:

Starting Debug from the Development Manager
Starting Debug from Tool Manager
If you start Debug without specifying a file
If you see a message
If you don't see your source code

The manuals that were low on "Ease of finding task information" had only one table of contents and it was organized around the product's commands and actions. For example, within the chapter "Information about Debug," the entries are

Start
Development Manager startup
Tool Manager startup
Program Builder startup
Command or Message startup
Remote System startup

An effective glossary is a feature within Factor 3: "Understanding task information." Both the high and low versions of the manual had glossaries. The low version's glossary was two pages in length and included product-related terms expressed in computer jargon. For example, the entry for PC is "Program Counter; also called Instruction Pointer." The entry for the high version is "Program Counter; it points to the next line to be executed in a program you are debugging."

## Recruiting 50 appropriate participants

Each participant in the research study did the same tasks with the same product and one of the five versions of the manual. We had ten participants for each version of the manual; 50 people in all. Participants were assigned to the manuals in cyclical order; that is, the first participant in the study got Manual 1, the second got Manual 2, and so on.

We required that the participants have these qualifications:

- at least two years of experience programming in C in a UNIX environment
- at least one year of experience with debuggers
- at least some experience using a windowing environment
- all three types of experience within the last five years

Most of the participants in the study were recruited by a temporary agency; a few came through personal networks. All were paid for participating.

## Collecting data

The participants in the study each attempted 11 tasks for which we had written typical usability testing scenarios. The participants all filled out a questionnaire about their background, and filled out questionnaires after each task and after the entire test.

The participants were not told that this was a research study. They thought that AIR was conducting a usability test of the manual. The vendor's name did not appear on the version of the product or manual that was used in the study in order to remove any bias (positive or negative) that the participants might have had towards the company.

Each participant thought that the one manual that he or she saw was the actual draft manual for the product. We did not tell participants that there were other versions of the manual.

The participants were explicitly told they were helping to evaluate the manual. Our previous experience in testing documentation had shown us that when we do not tell participants that we are testing the manual, some do not use it at all. Because the focus of this study was on the manual itself and not on the question of how often people go to manuals, we gave the participants instructions that may have biased them toward using the manual.

For each participant in each task, we collected data on

- time for the task
- time spent working on the computer
- uses of and time in the table of contents
- uses of and time in the index
- uses of and time spent flipping pages
- time spent reading concepts
- time spend reading procedures
- time spent looking at illustrations
- errors and time recovering from them
- time spent reading information to recover from an error
- assists

Immediately following each task, we had the participants rate the difficulty of the task and how easy it was to find and understand information in the manual for that task.

At the end of the test session, we had the participants rate the manual on a number of characteristics, including

- overall ease of use
- ease of finding information
- ease of understanding information
- ease of recovering from errors
- completeness
- ability to help grasp the scope of capabilities of the debugger

Many of the differences in the performance results were statistically significant. The differences in the subjective measures, in participants' ratings of the manuals, were not statistically significant. This interesting difference between the performance results and the ratings, which usability testers often find, deserves further study.

## Analyzing the data and reporting the results

### Comparing Manual 1 ("all high") and Manual 5 ("all low")

When we took into account differences in the participants' backgrounds, we found many significant differences in what participants who used Manual 1, which was high on all factors, did compared to what participants who used Manual 5, which was low on all factors, did. Table 2 shows a few of these significant differences.[1]

*Table 2. Comparing Manual 1 and Manual 5: Some basic measures*

| Measure | Manual 1 HHHH | Manual 5 LLLL | F-value | P-value |
|---|---|---|---|---|
| Total time | 1:14:43 | 1:27:06 | 7.67 | .02 |
| Time spent working on the computer | 51:53 | 1:04:42 | 17.21 | .01 |
| Time spent working on the computer +5-minute penalty for each assist | 1:16.83 | 1:40:72 | 17.73 | .01 |
| Time spent reading conceptual information | 7:29 | 1:41 | 10.89 | .01 |
| Time for last 5 tasks | 27:05 | 32:41 | 7.45 | .03 |
| Time for last 3 tasks | 8:06 | 12:32 | 5.55 | .04 |
| Time in table of contents | 3:36 | 6:06 | 4.78 | .05 |
| Time reading task information | 14:52 | 23:49 | 5.42 | .04 |

Participants who used Manual 1 completed the entire test significantly faster than those who used Manual 5. They spent significantly less time actually doing the tasks (working on the computer). They spent more time reading conceptual information probably because their manual contained more effective conceptual information. They were faster performing the last few tasks. They needed fewer assists (times when they could not go on without help from us). They were able to use the table of contents faster and needed less time to make sense of the instructions for procedures (task information) in the manual. All of these results were statistically significant.

**The overall combination of factors that differentiate Manual 1 from Manual 5 enabled the people with the good manual to use both the manual and the program more efficiently and effectively.**

What contribution did each of the four factors make to the overall result? Let's look at the comparisons that show the impact of each of the four factors.

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[1] The F-value measures statistical differences between means. (See Shavelson, 1981.)
The P-value shows the probability that the size of the F value could have happened by chance.
A P-value of .01 shows that there is only a 1 in 100 probability that an F value this large could have happened by chance. P-values were obtained from a table of F-values and probabilities. (See Shavelson, 1981, Table E.)

## Looking at the factors: Factor 1: Mental model

Factor 1 was helping the user to build a mental model of the product and how to use it. Manuals that were high on Factor 1 had some questions and answers at the beginning of the manual and at relevant places elsewhere in the manual. They also had *brief* overviews at the beginning of chapters and some sections, with short, active sentences or lists, and sometimes pictures. Versions that were low on Factor 1 did not have the questions and answers. They either had no overviews or a few overviews with single noun headings, paragraphs instead of lists, and passive sentences.

To judge the contribution of Factor 1, we compare Manual 1 with Manual 2 because they differ only on that factor. The overviews were entirely eliminated in Manual 2. Table 3 shows the relevant performance measures.

*Table 3: Comparing Manual 1 and Manual 2, which differ only on Factor 1*

| **Measure** | **Manual 1 HHHH** | **Manual 2 LHHH** |
|---|---|---|
| Total time | 1:14:43 | 1:14:23 |
| Time for last 5 tasks | 27:05 | 30:04 |
| Time for last 3 tasks | 8:06 | 13:53 |

Total task time did not differ for the two groups. The time that participants who used Manual 1 saved in doing tasks overall was balanced by the extra time they spent reading the "mental model" information that was in Manual 1 but was not in Manual 2. However, when we look at the times for the last tasks, we see a substantial time savings for participants who used Manual 1. The entire test was 11 tasks, so we looked at the last five to measure the second half of the set of tasks. When we saw the trend there, we looked at the last three tasks to see if the difference increased as participants went on.

Participants who had Manual 1 saved an average of 5 minutes, 47 seconds in doing the last three tasks compared with participants who had Manual 2. In percentages, that's 37% faster for those three tasks.

When we look at all the manuals, we see that this difference is consistent across the manuals. Table 4 shows times for the last tasks for all five manuals.

*Table 4. Comparing all manuals on Factor 1*

| **Measure** | **Manual 1 H...HHH** | **Manual 3 H...LLH** | **Manual 2 L...HHH** | **Manual 4 L...HLL** | **Manual 5 L...LLL** |
|---|---|---|---|---|---|
| Time for last 5 tasks | 27:05 | 27:09 | 30:04 | 42:12 | 32:41 |
| Time for last 3 tasks | 8:06 | 8:07 | 13:53 | 14:54 | 12:32 |

This difference is consistent with a hypothesis that the value of developing a manual that is high on Factor 1 grows over time. The authors conclude that **a good mental model helps the learning curve.**

### Looking at the factors: Factor 2: Ease of finding task instructions

We should see the contribution of Factor 2, ease of finding task instructions, by comparing Manual 4 and Manual 5, because they differ only on that factor. However, the results were not what we might expect.

Participants who used Manual 4 did spend less time looking in the table of contents than those who used Manual 5 (an average time of 4:14 compared to 6:06), but, on all other major measures, participants who used Manual 4 had the worst performance of all the groups, worse than those who had the "all low" Manual 5. Table 5 shows the key performance measures for all the manuals.

*Table 5. Key performance measures for all manuals*

| **Measure** | **Manual 1 HHHH** | **Manual 2 LHHH** | **Manual 3 HLLH** | **Manual 4 LHLL** | **Manual 5 LLLL** |
|---|---|---|---|---|---|
| Total time | 1:14:43 | 1:14:23 | 1:22:23 | 1:37:03 | 1:27:06 |
| Total time – time reading conceptual information | 1:07:14 | 1:14:07 | 1:07:40 | 1:34:54 | 1:25:25 |
| Time spent working on the computer | 51:53 | 48:05 | 52:50 | 1:12:15 | 1:04:42 |
| Time for last 5 tasks | 27:05 | 30:04 | 27:09 | 42:12 | 32:41 |
| Time for last 3 tasks | 8:06 | 13:53 | 8:07 | 14:54 | 12:32 |
| Time in table of contents | 3:36 | 3:31 | 3:31 | 4:14 | 6:06 |
| Number of assists | 5.7 | 6.2 | 6.0 | 9.8 | 7.3 |

When we looked more deeply into the logs and tapes, we found a likely explanation for the poor performance of the participants who used Manual 4. Manual 4 is high **only** on Factor 2. It is low on all the other factors. Participants who had Manual 4 went to the table of contents and quickly found the heading they needed. When they got to the text, however, the tasks were often so poorly described that they were not sure they had the right section. They went back to the table of contents and tried again, sometimes several times. Because the chapters also did not have good introductions (low on Factor 1), these participants could get no help there either.

The authors conclude that **making information easy to locate is not enough**. If the information itself is difficult to understand, users will not be sure they have found what they need. **You cannot independently insert or remove key features without having an impact on the remaining features**.

When we compare the two manuals that were high on both Factor 2 and Factor 3 (on both finding **and** understanding information) with the three manuals that were low on at least one of those two factors, we find that, on average, participants with manuals that were high on both factors spent 14 minutes, 16 seconds less overall and 11 minutes, 15 seconds less time working on the computer. Therefore, the authors conclude that **combining the two factors of ease of finding task instructions and ease of understanding task instructions helped people.**

## Looking at the factors: Factor 3: Ease of understanding

The formula that we need to isolate Factor 3, ease of understanding how to do a task, is complicated because no two manuals differ only on Factor 3. Manual 1 differs from Manual 3 on both Factors 2 and 3:

| | |
|---|---|
| Manual 1: | H H H H |
| Manual 3: | H L L H |

Manual 4 differs from Manual 5 only on Factor 2:

| | |
|---|---|
| Manual 4: | L H L L |
| Manual 5: | L L L L |

We, therefore, use this formula to isolate Factor 3:

$$(M1 - M3) - (M4 - M5) = F3$$

Using this formula, and taking total time as the measure, we find that, in this test, Factor 3 saved users an average of 17 minutes, 45 seconds. Thus, in this test, **ease of understanding the information contributed most to participants' time savings**. Focusing on tasks in the text, putting procedures in numbered steps rather than prose paragraphs, chunking procedures into groups of seven or fewer steps, using the imperative for instructions, making the instructions easy to see on the page, and including illustrations with the text made the greatest difference in this study. The effect of Factor 3 compared to Factor 2, however, is exaggerated here because of the problem in isolating Factor 2 that we described in the previous section.

## Looking at the factors: Factor 4: Ease of recovering from errors

The fourth factor in the model that we tested was error recovery. However, we could not estimate a value for it in the final model for two reasons:

- We recorded few errors.
- Participants did not use the manuals to recover from errors. When they made an error, they either looked for online help or began exploring alternative strategies.

Our finding that **these technical users expected error recovery information to be embedded in the product** is an important one for both software engineers and technical writers. These users expected to be able to get online help for resolving errors even more than they expected to find online help for procedures.

The fact that these participants did not use the manuals to recover from errors does not mean that error recovery information is never useful to users. Participants in this study were programmers. Less technically skilled users may be more likely to go to manuals for help. In addition, it seems likely that programmers would have a history of not finding useful error recovery information in manuals. Other groups of users with different histories may be more willing to look in manuals for help.

## Summarizing the results of the research

- Putting in information to help users develop an appropriate mental model may make users take more time for the first few tasks but saves time in doing later tasks.

- Making it easy to find information does reduce the time that users spend with the table of contents but may not save time overall if the information that the users find is difficult to understand.

- Making it easy to understand the task procedures may be the most important part of creating a useful task-oriented user's manual.

- Including information about recovering from errors may be useful, but experienced programmers look for such information in the product and on the screen, not in the manual.

- Combining all the factors that the experts identified significantly reduces the time that users spend in completing tasks.

## Conclusions and Issues for Further Research

The results of this research project should make documentation experts feel more confident about their knowledge of what makes a user's manual easy to use. In this study, we found both that experts agreed on what makes a good user's manual and that the factors and features that the experts gave us did in fact make a difference in users' performance.

In this research project, we focused on paper manuals, specifically on task-oriented user's guides. We do not know to what extent the results and questions would be valid for other types of documentation. However, the methodology could be used to do a similar study of other documents or other media. (See Duffy, Palmer, and Mehlenbacher, 1992, for a report of a research project on online help.)

As with all research projects, this study also leaves us with interesting issues for further research, such as these:

1. **How important are each of the features that make up the factors?** In this study, we manipulated factors that were each a combination of several features. It would have taken hundreds of manuals and thousands of participants to investigate the relationships

among all the features. We do not know how the individual features influence performance. For example, how important are illustrations to understanding information easily? How much do tabs contribute to finding information easily? Further research is needed to tease out the relative importance of the specific features within each factor.

2. **How important is the overview at the beginning of a manual and the overviews in each chapter?** The experts who participated in this research project said that a manual has to help people develop a good mental model and that overviews were the way to help users. The results support these experts on this factor. Participants who had manuals that were high on Factor 1 were much faster doing the last few tasks in the test. The AIR researchers interpret that result to mean that these users gained a mental model of the product over time that users who did not have the overviews did not get. These were *brief* overviews, done as questions and answers, lists, *short* paragraphs, often with an illustration. However, other experts suggest minimizing or even eliminating overviews (Carroll, 1990). We need more research to determine the value of different types of overviews and the most appropriate content, organization, style, placement, and length of overviews.

3. **How important are page layout features and to which factors do they contribute?** Appendix A includes all the factors and features that were part of this research project. It also includes a factor for "finding information easily on the page." Within this factor, we list features for page layout that the experts named and that are consistent with standards that the vendor was using at the time of the study. We did not vary these features because of limitations on how many versions of the manual we could test. Further research would be needed to validate the value of these design features against other designs for manuals.

4. **How generalizable are the results?** This study should be relevant for many technical communicators who are developing print manuals for many types of software. The results are probably also applicable to manuals for hardware. However, the product that we worked with was quite technical – a debugger – and the users were skilled programmers. Would the results be the same for a less technical product and less technically-sophisticated users? Our hypothesis is that most of the results would hold. The possible exception is the result on information about error recognition and recovery. The programmers expected information about errors to be on the screen or in online help. They did not go looking for it in the manual. We suspect, however, that keeping error recognition and recovery information in the manual may be important for other types of users.

This research study clearly demonstrated that there is a direct relationship between the quality of a user's manual and the productivity of the people who use it. Moreover, it demonstrated the different contributions that specific factors and features make to the overall quality of manuals. Technical communicators should be able to use the results of the research to improve the effectiveness of their user's manuals.

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## Acknowledgments

A special acknowledgment goes to Dr. Anna Wichansky, now of Oracle, who was the original project monitor in the Human Factors Group at Hewlett-Packard. Dr. Wichansky made significant contributions to many aspects of the project, from making it happen to helping to shape the research design and analysis. We also thank Jan Stambaugh, Joe Schneider, Bob Silvey, and Margot Fuchs of Hewlett-Packard who helped see the project through to conclusion.

At AIR, we thank Ken Keiser for work on the manuals, Kendall Robinson for work on the manuals and on collecting the data, Brian Philips for collecting data, and Dr. Laurise Wise for helping with the research design and statistical analyses.

## Appendix A. A list of factors and features

### Factor 1: Getting the big picture (building a useful mental model)

- The user's guide has a brief introduction that describes the product in terms of users' tasks.
  - It tells how this product relates to other products.
  - It tells how this guide relates to other documentation.
  - It describes the intended audience.
  - It tells what tasks the product helps users do
    - from the users' point of view (task-oriented)
    - in plain English, not jargon

- Each chapter or section has a brief introduction (signpost that tells what the procedures in that section will accomplish)
  - from the users' point of view (task-oriented)
  - in plain English, not jargon

### Factor 2: Finding information quickly

- The user's guide has hard tabs
  - with words that describe the contents
  - in words that relate to users' tasks

- The user's guide has a table of contents
  - with two to four levels
  - with entries that relate to users' tasks
  - where most of the entries at a given level use the same sentence structure

- The user's guide has an index
  - with entries that relate to actions (users' tasks) as well as to objects
  - where the same topic can be reached from multiple index entries

- The pages have headers and footers
  - on each page
  - that include no more than two levels of detail

- The chapters and sections have headings that
  - relate to users' tasks
  - are in plain English, not jargon

- Procedures stand out on a page so users can see them quickly.

- Highlighting (bold, color, italic) is used to make specific types of information stand out.
  - The meaning of each type of highlighting is obvious.
  - Each type of highlighting is used consistently.

### Factor 3: Understanding how to do tasks easily

- Procedures are given as instructions

  - using "you" or the imperative
  - in numbered steps
  - with the verbs in the present tense

- Most procedures have seven or fewer steps or are broken into subgroups with seven or fewer steps.

- The steps that users take are visually distinct on the page from explanations, notes, or the system's response.

- Conditionals and branches are set out as separate steps not embedded in one instruction.

- Users understand what to do at each step after reading the instruction only once.

- Illustrations accompany the procedures where appropriate.
  - There are illustrations on at least every three to four pages.
  - Each illustration is on the same page as the relevant text.
  - Illustrations have call-outs where appropriate.
  - The call-outs are meaningful and understandable without looking elsewhere for an explanation.

### Factor 4: Recovering from errors

- The procedures include information on notes, cautions, warnings, how to avoid errors, and what to do if an error occurs.

- Information about errors is specific enough to help users avoid making the error.

- Information about errors is specific enough to help users correct the problem if it occurs.

- The user's guide also has a chapter or section on troubleshooting or that lists all error messages that users might see.

- The messages are in logical order.

- Each includes the message, likely causes, and ways to solve it.

### Factor 5: Finding information easily on a page.

- The text line is short (does not go all the way across the page).
- There is very little prose text (compared to lists, tables, graphics)
- The typeface is easily readable.
- The page has white space around and within the text.
- The information is in clearly discernible chunks.
- The headings stand out visually on the page (separate from the text).
- The level of each heading is visually obvious.
- The page numbers are easy to find and big enough to read easily.