Usability of Vaisala's Customer Documentation

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1. Introduction

The purpose of this Pro Gradu Thesis is to investigate the usability of Vaisala's customer documentation, and to discover whether or not it satisfies the needs of its users. The motivation behind this study is an effort to improve the quality of Vaisala's customer documentation. Several improvements in the way the documentation is created have already been implemented, but none of these have yet been tested. The purpose of this study is to test whether that these improvements are going in the right direction.

Since most of the products that Vaisala manufactures and sells are very technical, it is very important to ensure that the customers get the best possible documentation to be able to use the products in a safe and an efficient way. Vaisala's customers should be able use the manuals that are provided to get the help they need when they need it; the manuals should thus enable customers to successfully perform the tasks that they wish to perform. Consequently, the aim of this study is to evaluate the current usability level of Vaisala's customer documentation and to improve it if necessary, to ensure that the documentation actually adds value to the products.

This study is a case study. Since it is impossible to examine all Vaisala's manuals currently in use, this study will concentrate on one particular product and the set of manuals that deal with this product. As all Vaisala's manuals are written according to a well-defined documentation process and several sets of internal instructions, it should be possible to apply the results of this study to all Vaisala's customer documents at least to some extent. In other words, the results of this study can be used to modify the documentation process and the internal instructions, if this is deemed necessary. Furthermore, this study is intended as a basis for similar studies on the usability of other sets of documentation in the future.

The main theme in this study is the concept of usability. Usability can be defined in many different ways. A usable manual, for example, can be defined as a manual that helps the users to complete the tasks they wish to complete by including the information they need and presenting it in a clear and understandable way (e.g. Van Laan & Julian, 2001: 54-55). To make this usability study more thorough, the concept of usability is approached through the concept of accessibility. The concept of accessibility can be defined in terms of what it is that makes a text easy or difficult to understand (e.g. Nyyssönen, 1997: 111). As the concepts of usability and accessibility seem closely related, it makes sense to link them together in this study. Both theoretical approaches seem to share similar components, and in fact, the concept of accessibility actually seems to be a part of the larger concept of usability.

This study involves two phases. The first phase includes selecting several extracts of text from the selected manual set and analyzing them for accessibility. Based on the results of this analysis, a hypothesis of the usability of the text extracts is formulated. The second phase includes testing this hypothesis by arranging a usability test in which several test users are asked to perform a set of predefined test tasks with the help of the text extracts that were used in the accessibility analysis. The initial hypothesis is that if a text is accessible then it is also very likely to be usable.

2. Theoretical Background

As it focuses on the usability of a company's customer documentation, this study touches simultaneously on three different theoretical backgrounds. These are the theories of technical communication, usability, and accessibility.

As the object of the study is a set of manuals, a typical product of technical communication, the theory of technical communication naturally forms the main theoretical basis for the entire study. As the usability evaluation of the manuals is the other important component of the study, the theory of usability is also employed. The theory of accessibility comes into play as the text that makes up the manuals is studied to detect which features might have an effect on the usability of the manuals.

A general description of the theories of technical communication, usability, and accessibility is given in the following sections. For a more detailed description of how the theories of usability and accessibility were employed in this study, see chapter 5. Methods on page 51.

2.1. Technical Communication Theory

This section introduces the theory of technical communication. This introduction begins with some definitions of technical communication. In addition to this, some important components of technical communication are briefly described. These components include the professionals in the field, the products of technical communication, the technical communication process, and the proper style of technical communication.

2.1.1. Definitions of Technical Communication

This section reviews some definitions of technical communication with the aim of selecting or formulating a definition which is best suited for the purpose of this study. Another purpose of this section is to look at the different terms used for technical communication and decide which of them is the most suitable to be used for the remainder of this study.

Although technical communication can be defined in many ways, there is no official definition for it. This is unfortunate, as one would be useful for several reasons. A clear definition might, for example, strengthen the identity of the professionals in the field, it might also have a positive effect on their salary, and give the profession the prestige it deserves. A clear definition might also save technical communicators some time and energy as they would not have to explain to everyone they meet what it is that they do for a living. (Jones, 1996: 3.)

One of the classic definitions of technical communication is the "conveyor belt" definition, which defines technical communication as passing information from technical personnel to lay readers. This definition, however, is no longer very acceptable now that technical communicators are believed to be more than passive conveyor belts of information. Nowadays technical communicators are rather deemed active and creative participants in the entire product development process. (Jones, 1996: 3.) As Roger Grice puts it, the job description of technical communicators nowadays involves "working with product developers during development to produce descriptions of how to use products", instead of simply documenting the features of finished products, as it was done in the early days (Grice, 1997: 211).

Although reader-centeredness is nowadays emphasized over writer- or product-centeredness in the technical communication process (Jones, 1996: 21), some

remainders of the conveyor belt definition still persist. Kenneth T. Rainey, for example, defines technical communication as “the transfer of information from those who have it to those who require it”. But instead of seeing this transfer as a passive thing, he describes the average technical communicator as an “information architect who orders, designs, and presents information”. The term information architect also refers to the expansion in the role of technical communicators, which has made it necessary for them to broaden their professional capabilities to more than just working with the text. (Rainey, 1997: 232.)

Krista Van Laan and Catherine Julian also see technical communication as bridging “that gap [--] between how the expert says something and what [the] reader needs to hear” (2001: 19). They further define technical communication as “conveying information about a technical subject, directed at a specific audience for a specific purpose” (2001: 4). This process involves collecting, organizing, and presenting information “in such a way that it is understandable and useful to the defined audience” (Van Laan & Julian, 2001: 6). This emphasis on the audience clearly indicates that Van Laan and Julian see technical communication as more than simply transferring information.

Charles E. Beck has also attempted to rewrite some previous definitions, or metaphors as he calls them, for technical communication. These definitions include, for example, the “transmitter metaphor” and the “channel of communication metaphor”. According to the transmitter metaphor, for example, the technical communicator’s task is to transmit “information from the source to the user”. The channel of communication metaphor, on the other hand, features the technical communicator as “the carrier of communication, the link between sender and receiver”. Beck rejects these definitions or metaphors mainly for their passivity. He feels that the transmitter metaphor is

misleading, as mere transmission of information does not guarantee that the message also gets through. The channel metaphor, on the other hand, simply seems too passive with its one-way communication. (Beck, 1991: 48.)

Discouraged with these outdated metaphors, Beck tries to formulate a new one. He is finally satisfied with a metaphor, which he calls the orchestrator metaphor. In accordance with this metaphor, Beck defines technical communication as "the process of orchestrating linguistic, visual, and auditory codes to accommodate information to the user". The idea behind this metaphor comes from music, from the way one musician can perform another musician's music by arranging it to fit his or her own style. Similarly this metaphor sees the technical communicator as arranging the information. (Beck, 1991: 51.)

The definitions already mentioned define technical communication on the basis of its function, that is, based on what technical communicators do and what their roles are. There are, however, also other ways to define technical communication. One way is to compare technical communication with other types of writing.

John A. Walter, for example, defines technical communication by comparing it with expository writing. He distinguishes the following four principles that make these two types of writing different from each other: "the writer-reader relationship, function and purpose, style and form, and organization". (Walter, 1977: 28.)

The writer-reader relationship refers to the concrete and specific knowledge that the technical communicator has of the intended audience of the text. The technical communicator should know who the audience is and what their purpose for reading the text is. The function and purpose of the text refers to the fact that technical communication is usually created for some specific purpose and that it usually is intended to "provide a basis for some sort of immediate action". The style and form of

technical communication should, in Walter's opinion, be "clear, simple and precise". The organization of the text, on the other hand, should take into consideration not only logical aspects but also psychological patterns. (Walter, 1977: 29.)

As thorough as Walter is in his description of technical communication, he seems to over-emphasize the purpose and style of the communication. This leads to a somewhat shallow definition in which any communication with the aim of "conveying [--] factual information for a specific purpose" is technical communication (Walter, 1977: 28). In other words, Walter makes no distinction between technical manuals and scientific articles, but rather lumps them both together as technical communication of equal worth.

Similarly to Walter, Gerson and Gerson also compare technical communication with expository writing. They state that although technical communication is similar to expository writing in the way that it explains different phenomina, it also differs from it in a way that it expects a certain "audience response or action". In other words, Gerson and Gerson imply that technical writing creates a different kind of dialog between the text and the user than other kinds of texts. In their opinion this is evident from the way that an e-mail message requires an answer, or from the way instructions are usually read to perform some action. (Gerson & Gerson, 1997: 2.)

Gerson and Gerson also have another way of defining technical communication. They define it as "includ[ing] many different types of correspondence, written by different types of people, in different professions, for different reasons" (1997: 1). This is also similar to Walter's way of defining technical communication, in a sense that it seems to include technical manuals in the same group with memorandums and e-mail messages. Even though Gerson and Gerson include everything from e-mail messages to technical manuals into technical communication, they seem to have different terms for

different types of technical communication. While everything else is plain technical communication, they use the term technical documentation to refer to user manuals and other similar technical communication (Gerson & Gerson, 1997: 3, 10).

Yet another way to define technical communication is to define it by its products. According to Nancy L. Hoft, for example, technical communication can be defined as creating information products. Her list of information products includes both more traditional items such as "printed user guides, technical reference manuals, online manuals", but also more exotic items such as "multimedia presentations (audio, video, animation, imaging, text), training materials, the user interface (icons, menus, dialog boxes), [and] error messages". (Hoft, 1995: x.) This broad definition can be compared to those of Walter and Gerson and Gerson, in the way that it includes any kind of communication that involves conveying information as technical communication.

The most commonly used terms for technical communication are technical communication and technical writing. The term technical communication is mostly used by those who wish to emphasize that technical communication is more than simply writing. Most people who use the term technical writing, on the other hand, use it because it is more concrete, even if it might seem somewhat narrow (Van Laan & Julian, 2001: 6, 8). These are, however, not the only possible terms.

Elizabeth R. Turpin and Judith Gunn Bronson use the term technical editing. They define technical editing as "an art and a skill with which a document is improved so that it better serves the needs of its defined users" (1997: 221). They also add that the main features in technical editing are the concentration on the needs of the users, accuracy, precision, and also usability. With the term *technical*, they refer to both "the depth of

expertise" of the document and also to its subject matter. Thus in their view, any piece of writing with the subject matter described thoroughly enough, is counted as a piece of technical communication. (Turpin & Gunn Bronson, 1997: 221.)

The list of documents that a technical editor can work on, according to Turpin and Gunn Bronson, is quite exotic. Although it includes some familiar items such as "instructional and service support manuals", "operational guides", and "installation instructions", it also includes some quite unfamiliar ones such as "corporate and government reports", "new drug applications", and "journal articles" (Turpin & Gunn Bronson, 1997: 222).

The way Turpin and Gunn Bronson list the responsibilities of technical editors makes one think that they are not really talking about technical communicators when they use the term technical editor, or then they have a different opinion of the technical communicators job description. In their article Turpin and Bronson also describe how technical editors help authors with their texts and how they nowadays more and more teach writers "how to edit their own work" (1997: 222, 225). If the term technical editing is understood to merely incorporate the editing aspects of technical communications, then it is clearly not suitable for the purpose of this study.

The most suitable term for this study seems thus to be the term technical communication itself, as it seems to be the most comprehensive one. A suitable definition of technical communication would be one that takes into account all the aspects of technical communication, as the technical communicators in Vaisala are concerned with all the aspects of the manual creating process. In other words, technical communication could be defined as transfer of information from those who have it to those who need it, but in such a way that a technical communicator is an active participant in creating and organizing this information.

2.1.2. Technical Communication Professionals

This section gives a brief overview of the kinds of skills the professionals in the field of technical communication are generally expected to have. This section also intends to cover the types of tasks technical communicators are usually expected to perform. However, one has to keep in mind that the overview provided in this section is only a general one and that in reality the job descriptions of technical communicators, as well as their job titles, vary from company to company (Van Laan & Julian, 2001: 8).

Already in the 1960's some people realized that the profession of the technical communicator includes more than mere writing. As early as in 1961, Robert Hays (1961: 33) stated that a technical communicator should, in addition to being a master in the use of language, also be able work with formulas and create graphics.

Nowadays technical communicators need to acquire more and more different skills due to the "advances in media technology and [the] diversification of audiences" (Grice, 1997: 210). When in the early days writing and editing were the main skills needed, a technical communicator today should be familiar with aspects such as "audience analysis, text management, graphic design, testing for accuracy and usability, [and] planning" (Grice, 1997: 211). Technical communicators are often also asked to design the layout and graphics for their documents, produce online documentation, and do a wide variety of other similar tasks (Van Laan & Julian, 2001: 6).

Technical communicators also need social skills, especially when working in organizations. These skills include, for example, "interaction, listening, negotiation, conflict resolution, and consensus building" (Subbiah, 1997: 61). These skills refer to the social aspect of technical communicators' work, the aspect that involves working with other technical communicators, product developers, and other technical people. This aspect is indeed important, since technical communicators receive at least a part of

their source material from “discussions and interviews with technical experts” (Grice, 1997: 211), the rest coming from various written sources and from using the product itself.

Another important part of the skills required of a technical communicator is knowledge of the products he or she is documenting. This is necessary not only because it makes documenting the products easier, but also because it is often left for the technical communicators to decide what information should be included in the documentation. (Van Laan & Julian, 2001: 20.)

2.1.3. Products of Technical Communication

This section gives a brief overview of the products of technical communication. It concentrates on the more narrow definition of technical communication and focuses on technical manuals, instead of describing all the technical text that are sometimes classified as technical communication.

On a general level, the products of technical communication can be referred to as technical documentation, which can be further defined “as any reference material that supports something else” (Van Laan & Julian, 2001: 49). Technical documentation can appear in many forms “from reminders on a pocket card to multiple-volume manuals or hundreds of virtual pages on a web site” (Van Laan & Julian, 2001: 15). Thus a technical manual is another subtype of technical communication products. There can be several types of technical manuals such as user manuals, tutorials, training manuals, operator’s manuals, service manuals, repair manuals, special-purpose manuals, and safety manuals (Alfred, 1993: 576).

Technical manuals can be described as something that “help[s] technical specialists and customers use and maintain products” (Alfred, 1993: 575). Some also claim that “if a manual makes equipment easy to operate or repair, consumers are more likely to buy

it" (Alfred, 1993: 575). Similarly, it has been said that it is the task of the manual to "help users make most of technological devices" (Barker, 1998: 8). This means that the manual should aid the users in learning to use the product by giving thorough descriptions of the different parts of the product, and also by providing task-oriented procedures. In other words, concentrating on the specific tasks central to the user can make both the manual and the product easier to use, and thus motivate the users in using the product (Barker, 1998: 9).

Technical documentation can consist of several levels. Different levels of users and uses of technical documentation may cause a technical communicator to create "as many as three different levels of documentation". These might include "short reference cards, tutorials and/or introductory manuals, and traditional reference manuals". (Nielsen, 1993: 153.)

There are, however, people who make a distinction between user documentation and reference documentation (e.g. Van Laan & Julian, 2001: 174, 180), or actually between user documentation and the more detailed documentation intended for more technical people. According to Van Laan and Julian (2001: 174), for example, user documentation refers to the documentation intended for the end user, the documentation that "cover[s] everything the user needs to know" about the product. The more detailed documentation, on the other hand, is often called expert documentation and includes different kinds of specifications (Van Laan & Julian, 2001: 180). Another difference between these two types of documentation, besides the difference in the information needs of the audience, is the difference in form and function. To Van Laan and Julian user documentation is task-based, procedural documentation which gives out instructions, whereas expert documentation is nonprocedural, descriptive documentation used for reference purposes (Van Laan & Julian, 2001: 104-107).

2.1.4. Technical Communication Process

This section describes what is generally included in the process of creating technical communication. A more specific aim is to introduce, as well as compare and contrast, three separate documentation processes (those outlined by Joann Hackos, Krista Van Laan & Catherine Julian, and Sharon & Steven Gerson) to arrive at an idea of what kind of aspects need to be looked into when creating effective technical documentation.

All of the three documentation processes mentioned above have several steps. The processes are very similar although they do emphasize slightly different things. The documentation process introduced by Joann Hackos (1994: 28), for example, includes the following five steps:

1. Information planning
2. Content specification
3. Implementation
4. Production
5. Evaluation

The documentation process outlined by Van Laan and Julian (2001: 64-66) contains five similar steps, listed below:

1. Gather information
2. Plan
3. Write
4. Verify
5. Redo

The documentation process created by Gerson and Gerson (1997: 11), on the other hand, is much shorter with only the following three steps:

1. Prewrite
2. Write
3. Rewrite

Although at a glance the three documentation processes look somewhat different, the general organization of each is mainly the same. Despite the number of individual steps, all these processes include the three main stages of planning, writing, and finalizing.

This is most obvious in the process of Gerson and Gerson, which only has these three steps. These stages can, however, also be identified in the other two processes as the following analysis indicates.

The first two steps, information planning and content specification, in the process of Hackos (1994: 28), for example, constitute the planning stage as they include deciding what goes into the manual, and later specifying this content more precisely. The third step, implementation, includes the process of writing, whereas the fourth step, production, which also includes shipping the finished documents to the customer, contains the finalizing part (1994: 36). The final step of Hackos' process, evaluation, includes evaluating the entire documentation process, not just the finished documents (1994: 37).

Also in Van Laan and Julian's process the first two steps, gathering information and planning, constitute the planning stage (2001: 64-65). As the name implies, the third step, writing, involves the writing part (2001: 65). In the process of Van Laan and Julian, the last two steps constitute to the stage of finalizing. Step four, verifying, refers to different reviews and checks that are used to test the documentation, whereas step five, redoing, refers to the process of correcting the documents according to the results of these tests (2001: 66).

When divided into the three stages of planning, writing, and finalizing, these three documentation processes look even more similar than before. However, there still are differences in how important these stages are considered in each of these processes. According to Gerson and Gerson's process, 25% of the time allotted for creating technical communication should be spent in planning, 50% in writing, and another 25% in finalizing the documentation (Gerson & Gerson, 1997: 12). According to the process outlined by Hackos, however, planning should take up approximately 30% of the time

(information planning 10% and content specification 20%), writing 50%, and finalizing 20% (with 19% for production and 1% for evaluation) (Hackos, 1994: 29). In the opinion of Van Laan and Julian, on the other hand, planning should take up about 60% of the time (gathering information 50% and planning 10%), writing about 20%, and finalizing another 20% (with 10% for both verifying and redoing) (Van Laan and Julian, 2001: 65).

This comparison of the three documentation processes shows clear differences on the emphasis of each process. Whereas Gerson and Gerson and Hackos stress the importance of the writing, Van Laan and Julian rely on the importance of planning. They all, however, seem to agree more or less on the amount of finalizing work necessary.

By comparing the documentation processes of Hackos, Gerson and Gerson, and Van Laan and Julian, one can draw the conclusion that a documentation process should at least include the stages of planning, writing, and finalizing, each of which can be further divided into smaller steps or sub-processes. By comparing the emphasis that Hackos, Gerson and Gerson, and Van Laan and Julian place on each of these phases, one can estimate an average emphasis. According to this average emphasis, approximately 35% of the time allotted for creating technical documentation should be spent in planning, 45% in writing, and 20% in finalizing the documentation.

2.1.5. Style of Technical Communication

This section describes the style of technical communication. Van Laan and Julian, for example, distinguish six characteristics that define good technical communication. These characteristics include accuracy, completeness, consistency, clarity, usefulness, and attractiveness (Van Laan & Julian, 2001: 49-50). Accuracy refers to the correctness of information. Completeness, on the other hand, is a concept very much related to

accuracy. A complete manual is properly finalized, tested, and proofread. It includes all the necessary procedures and all the necessary steps for these procedures. (Van Laan & Julian, 2001: 51-52.)

Consistency refers to consistent use of language, iconography, and typographical conventions, whereas clarity simply refers to good writing (Van Laan & Julian, 2001: 52-53). The characteristic of usefulness refers to usability, which will be discussed in further detail later. The concept of attractiveness refers to the general appearance and design of the documentation. (Van Laan & Julian, 2001: 53, 56.)

Gerson and Gerson have identified similar characteristics that affect the quality of technical communication. Their list includes the following five features: clarity, conciseness, accuracy, organization, and ethics (Gerson & Gerson, 1997: 25). Of these five characteristics clarity and accuracy are defined similarly as the corresponding characteristics of Van Laan and Julian. Conciseness, on the other hand, is defined as a way of writing which can save time for both the writer and the reader and also create clarity. Conciseness, according to Gerson and Gerson, refers to expressing things with simpler words and shorter sentences and paragraphs. (Gerson & Gerson, 1997: 32-33.)

Organization refers to arranging the text in a way that makes it easy for others to understand and follow the writer's train of thought. Ethics refers to the fact that a good technical communicator should never deceive his or her audience. This includes aspects such as using precise language, especially with safety issues, and not deliberately exaggerating the qualities of the product. (Gerson & Gerson, 1997: 40.)

Another important feature in the style of technical communication is objectivity. Objectivity comes from the fact that in technical communication the subject matter is

more important than the writer's opinions. In other words, the language of technical communication needs to be "utilitarian - emphasizing exactness rather than elegance for its own sake". (Alfred, 1993: 577.)

What is also important to keep in mind while considering the style, organization, and physical appearance of a technical document, is that the technical document is very often a reflection of the company it is written for. Therefore, one should take care of how to design the technical document and what to put into it so that it can reflect the image that best describes the company. (Gerson & Gerson, 1997: 94.)

2.2. Usability Theory

This section describes what is generally meant by the concept of usability and what aspects it involves. Besides usability in general, this section also aims to discuss usability in relation to technical communication. Different methods for measuring usability will also be briefly introduced.

2.2.1. Definitions of Usability

This section aims to introduce different definitions of usability. It also attempts to briefly describe what kind of a technical document is generally considered usable. Another aim is to establish why usability is considered important and especially why it should be measured.

Jenny Preece (1993: 7), for example, associates usability with four aspects, namely health, safety, efficiency, and enjoyment. In her opinion usable products ensure a safe, effective, efficient, and enjoyable completion of different tasks (Preece, 1993: 14). Further, according to Preece, planning for usability requires looking into at least four things. One needs to determine who the users of the product are, what are the expected tasks of the users, and what is the environment in which they will use the product.

Besides these factors, it is also important to be aware of the possible limitations that might effect the usability effort. These limitations can include aspects such as budgets and schedules. (Preece, 1993: 15.)

According to Jakob Nielsen (1993: 25), on the other hand, the usability of a product is dependent on the user's ability to use the product. In other words, if the user for whom the product is intended is able to use it without difficulties, the product can be considered to be usable.

Similarly to Preece, Nielsen also (1993: 26) stresses that "usability is not a single, one-dimensional property" but one that consists of five measurable components, which include learnability, efficiency, memorability, errors, and satisfaction (see also Preece, 1993: 47). Other researchers have also discovered similar components. For example, Van Laan and Julian (2001: 53) have used such components to create a step list for technical communicators to help them check their technical documents for usability. This checklist includes the following questions concerning the document:

- Is it easy to learn?
- Is it efficient to use?
- Can the user recover quickly from errors?
- Is it easy to remember what to do?
- Is it fun to use?

Otherwise Van Laan and Julian (2001: 6) define usability as "the practice of taking human physical and psychological requirements into account when designing programs and documents". In their opinion, the purpose of usability is to improve products and make them "more intuitive for the user". This intuitiveness also includes easy and effective use of products. (Van Laan & Julian, 2001: 53.)

Most usability experts employ the same category for the usability of products and the usability of technical documents. There are still, however, some researchers who have different categories for both and who deem that usability in the context of technical

communication mainly refers to the "readability of the documentation and its suitability to the task" (Barker, 1998: 40). In this context, the concept of suitability includes aspects such as accuracy and appropriateness of information.

Usable Technical Documentation

According to Nielsen a usable technical document should "be focused on the user's task, list concrete steps to be carried out, and not be too large". In addition to this, the information should be presented in a way that it is easy to find. (Nielsen, 1993: 20.) Further according to Nielsen it is important that the sections in a manual are fairly self-contained, as users are usually in the habit of jumping from one part of the text to another (Nielsen, 1993: 152).

Sinkkonen et al add to this that usable procedural instructions should clearly indicate the beginning and the end of the procedure. The instructions should also clearly explain what the user is expected to do and contain all the steps involved in the procedure, including the simple steps. (Sinkkonen et al, 2002: 75.)

Van Laan and Julian (2001: 168) have formulated another step list to help technical communicators check the usability of their technical communication. This step list consists of the following six conditions, which need to be fulfilled for the technical document to be usable:

- The user is able to find the information quickly.
- Instructions are clear and easily followed.
- The instructions work correctly.
- The user can find his or her place quickly on the page after glancing away.
- The user's questions are answered within the document.
- The index is thorough and contains sensible entries.

As these conditions seem to take everything into account very thoroughly, they are indeed very likely to guarantee usability for technical documents. Of these six conditions, Van Laan and Julian (2001: 55) consider the first the most important one.

This is of course very logical, because it does not really matter how clear, accurate, or well-organized the instructions are if the users cannot find them. A logical manual structure is clearly an important factor in the efficient use of technical documentation.

The Importance of Usability

Striving for usability is important for many reasons. In addition to developing usable products, usability is also an important part of "build[ing] a trusting relationship with [the] users" (Coe, 1996: 61). Constructing a relationship with users actually requires active building, since it is often not likely that users automatically provide usability-related feedback (Coe, 1996: 61). Having a relationship with users is vital as it is not possible to produce usable technical documentation "without having an ongoing, dynamic relationship with users" (Coe, 1996: 177).

The main purpose of measuring usability is to test the suitability of the products before they reach the customers. This is to ensure that the products actually meet the needs of the users, instead of merely reflecting what the product developers see as the users' needs. (Preece, 1993: 108.) Thus, it is important to test documentation because without it "the document's usability, clarity, and usefulness to the reader are based entirely on speculation" (Van Laan & Julian, 2001: 167).

Usability statistics are collected to gather data, which can be used to either improve or assess products. This means that the data can be gathered either before the product is released in order to improve the product before it reaches the customers, or it can be gathered after the release in which case the information can be used to improve the next version of the product, if this is deemed necessary. These evaluation methods are referred to as formative evaluation and summative evaluation, respectively. (Preece, 1993: 108.)

2.2.2. Measuring Usability

There are several different ways for measuring usability. Jenny Preece, for example, lists five possible methods. These include analytic, expert, observational, survey, and experimental evaluation. The first two methods are employed by the product developers with the help of experts, whereas the last three methods elicit the help of actual users. (Preece, 1993: 109.)

According to Preece, analytic evaluation is a method where an idea or an early version of the product being developed is analyzed by experts from the perspective of users (Preece, 1993: 109). This method employs task analysis and user interface definition to predict the performance of the users. Expert evaluation, on the other hand, involves usability or other experts taking the role of inexperienced users in using the product to find out its weak points. (Preece, 1993: 111.)

As the name suggests, observational evaluation is concerned with observing the users and seeing how they use the product in question or a similar one (Preece, 1993: 112). There are different methods for observation ranging from videotaping and software logging to observing the users and asking questions (Preece, 1993: 113). The survey evaluation method, on the other hand, uses interviews and questionnaires to seek out the users' subjective opinions about the product (Preece, 1993: 115), whereas experimental evaluation refers to more scientific usability tests where hypotheses are being made and tested as well as statistical results collected (Preece, 1993:117).

Jakob Nielsen, on the other hand, lists nine methods for evaluating usability. These include heuristic evaluation, performance measurement, thinking aloud, observation, questionnaires, interviews, focus groups, logging actual use, and user feedback, some of

which are the same or similar to the methods listed by Preece. These methods can be applied at different phases of the product development cycle, and they can also be combined. (Nielsen, 1993: 224.)

Nielsen's concept of heuristic evaluation is similar to what Preece called expert evaluation. It involves a group of experts inspecting the product for possible usability problems that need to be fixed before releasing the product (Nielsen, 1993: 155). The performance measurement method, on the other hand, involves measuring the performance of test users as they use the product to complete a set of preselected tasks. The performance of the users can be measured by, for example, timing them or counting errors. (Nielsen, 1993: 192.)

The thinking aloud method is usually combined with some other method such as the performance measurement. With this method, users perform several previously selected tasks and talk aloud while doing so. This allows the experimenters and the product developers a deeper understanding of why the users use the product the way they do. (Nielsen, 1993: 195.) With the observation method, users are merely observed doing what they normally do with the product to determine how they use it (Nielsen, 1993: 207).

The questionnaire and interview methods involve asking the users for their opinions either verbally or through the use of paper or e-mail questionnaires (Nielsen, 1993: 209). The focus group technique involves a group of users discussing the product either before it is designed or after having used it. The purpose of the focus group is to discover the reactions and ideas that future users may have concerning the product. (Nielsen, 1993: 214.)

The logging method can be used to test how the (software) product works in the field after it has been released, or it can be used as a part of performance measurement to

collect additional data on the usability of the product. This method involves setting the user's computer to gather data on how the user uses the product. (Nielsen, 1993: 217.) The user feedback method refers to an ongoing process which usually involves feedback initiated by the users themselves. Collecting feedback in this way does not have to involve an active effort with questionnaires or interviews, it might be sufficient, for example, to simply provide the users with a feedback mailing address. (Nielsen, 1993: 221-2.)

2.2.3. Testing Usability

As usability testing, the method which Preece referred to as experimental evaluation and Nielsen as performance measurement, is an important part of this study, it deserves to be discussed more thoroughly than the other methods for measuring usability. Usability testing can be defined as "having a number of test users [--] use the system to perform a prespecified set of tasks" (Nielsen, 1993: 27). Usability should always be "measured relative to certain users and certain tasks" (Nielsen, 1993: 27). This means that test users should be representative of the real users of the products and that test tasks should also be as authentic as possible.

When testing usability, it is important to define early on what one wants to measure during the usability test, and what is the level of usability one hopes to achieve (Nielsen 1993: 27). If one goes into a test situation not quite knowing what to observe or measure, the results are bound to be more or less vague. Therefore the "abstract concept of 'usability'" must be defined with "more precise and measurable components" to be able to systematically measure the actual usability (Nielsen, 1993: 26). These measurable components, or usability metrics as they are also called, can be derived from the five usability components mentioned earlier; learnability, efficiency, memorability, errors, and satisfaction (Nielsen, 1993: 26).

Usability metrics can be looked at in many different ways. One possible way is to organize them under the following three categories: effectiveness, efficiency, and user satisfaction (Rhodes, 2000, WebWord.com). In a usability test situation the category of effectiveness can include, for example, measuring the "percent of tasks completed, ratio of success to failures, workload, number of features and commands used". The category of efficiency, on the other hand, can include measuring the "time to complete a task, time to learn, time spent on errors, percent or number of errors, frequency of help or documentation use, number of repetition or failed commands". The last category, user satisfaction, can include, for example, establishing rating scales for determining the "usefulness of the product or service" and the "satisfaction with functions and features". It can also include measuring the "number of times user expresses frustration or anger" and determining the extent to which the technology supports (instead of controlling) the completion of the tasks. (Rhodes, 2000, WebWord.com.)

In addition to the general usability metrics, there are a few aspects that are particularly important when considering the usability of technical documentation. These include testing how the information is found, understood, and finally employed. Broadly speaking, these aspects relate to knowing what to look for, understanding the medium used, and being able to apply the instructions in practice. (Coe, 1996: 193.)

There are even separate test plans for testing the usability of technical documents. They usually include the following steps: scheduling the test, deciding what to test, deciding how to test, defining "performance objectives" (i.e. the usability metrics discussed above), selecting test users and evaluators, getting the materials ready, preparing the testing location, accurately collecting the data, interpreting it, and making sure that the results are also applied. (Barker, 1998: 198.)

With any usability testing it is important to organize pilot testing before the actual tests and also to arrange the tests as objectively as possible. Usability testing for documentation should also be tied to the document goals, which generally means that whenever any new design ideas are to be introduced to the documentation, they should be tested before implementing. (Barker, 1998: 206-207.)

In addition to the ordinary usability test, there are at least three different usability testing methods particularly planned for testing the usability of technical documentation. These include performance, understandability, and read-and-locate testing. As the name implies, the performance test is used to test different procedures by asking the test user to perform different tasks. The understandability test, on the other hand, is designed to test the suitability of terminology and it involves the test users reading the document and afterwards preparing a summary or defining some of the terms used. Finally, the read-and-locate test focuses on the design and structure of the document. In the read-and-locate test, the users are asked to find certain pieces of information. (Barker, 1998: 200.)

These tests can be performed in the field, in laboratory conditions, or by using a combination of these two. A combination might involve, for example, having the pilot tests in a laboratory and then the actual tests in the field. (Barker 1998: 205.)

A proper usability test can be divided into four stages. These include preparation, introduction, the actual test, and a debriefing stage (Nielsen, 1993: 187). The idea of the preparation stage is naturally to get everything, the test room and the materials for example, ready before the user arrives. The introduction involves introducing the test and the equipment used to the test user. The user must also be made to feel relaxed by explaining that the purpose of the test is not to test the user but the usability of the manuals. The debriefing situation is arranged after the test situation so that the user and

the experimenter can talk about the test. The user can ask questions about the test or the manuals and the experimenter can ask questions about the user's behavior during the test. (Nielsen, 1993: 187.)

Test Users

The purpose of this section is to discover what kinds of test users would be the best for a standard usability test and how many would be enough. As for the type of test users, most usability experts would recommend testing with real users, that is, with current or potential future users of the product (Nielsen, 1993: 165). This is very important since without the participation of real users there is no way of knowing whether the document actually fulfils its intended purpose. It is always possible to test documents with people other than the actual users but it is never quite as effective. (Van Laan & Julian, 2001: 167.)

The use of real users, however, is not entirely unproblematic. With real users there can be a problem of how to get a hold of them. Then there are issues about the level of expertise. (Nielsen, 1993: 165.) When one is testing the existing manuals of an existing system, most of the real users may turn out to be specialists who have no use for manuals. This may create a problem. Even if the expert users are asked to use manuals while performing tasks, the results may still not be realistic. The users may simply give up on searching for the information if it seems too frustrating, and just perform the tasks.

Testing with complete novice users who have no experience with the product might be a good and productive way to study the mechanical usability of the manuals, but this type of testing still does not necessarily reveal whether the needs of the actual users are satisfied by the manuals. Besides, complete novice users may not be the best possible test user group, as they will probably require more information than the actual, real

users. In addition to this, the test situation is made more realistic if the test users have something at stake, and if they have some previous knowledge of the product, if they, for example, know what it is used for.

An ideal test user group would be a group of new users who know what the product is about but who are not yet experts in using it. One way to compromise would be to use several different kinds of test users, ranging from complete novices to expert users. This is usually a very realistic approach as, in many cases, there is only one manual set which attempts to accommodate the information needs of all users in spite of their different levels of expertise.

Besides deciding what kinds of test users to use in a usability test, one has to determine how many test users are necessary. When considering the number of test users, it is important not to confuse the usability of a product with the opinions of the users. Although their opinions of the product may vary greatly and may be difficult to categorize, it only takes a few test users to objectively discover the functional usability problems of the product. (Sinkkonen et al, 2002: 296.) Sinkkonen et al (2002: 306), for example, recommend using three to six test users for ordinary product usability tests, but state that the most critical usability problems can usually be found with three to four test users.

Test Tasks

This section attempts to describe the length and number of test tasks, and other test-related features. According to Marlana Coe, when planning a usability test it is important to keep in mind that one should not try to test the entire product or manual. This is rarely possible, nor is it necessarily even useful. One should rather approach testing on the task level and select tasks “that span the spectrum of interface and functionality”. (Coe, 1996: 193.)

A suitable length for one usability test session would be approximately one hour, and the test tasks should be selected accordingly (Sinkkonen et al, 2002: 298). It is also recommended that test tasks should include both easy basic tasks and more complex advanced tasks (Sinkkonen et al, 2002: 308).

It is often also emphasized that to make the test session more realistic and useful, the test tasks selected should be as close to actual tasks as possible (Nielsen, 1993: 185). The test tasks should also "provide reasonable coverage of the most important parts of the user interface" (Nielsen, 1993: 185) or the manual being tested. In addition to this, the tasks should not be too long, but also not too short either. The task descriptions for the tasks should be clear and they should be handed to the users in writing. (Nielsen, 1993: 186.)

Thinking Aloud

The thinking aloud method (also referred to as think-aloud method or thinking aloud protocol, TAP) is often a very important part of usability testing, in fact, it is usually one of the main methods used. According to Nielsen using this method "involves having one test user at a time use the system for a given set of tasks while being asked to 'think out loud'" (1993: 18). Further according to Nielsen, the thinking aloud method is useful because it not only reveals what the users do with the system but also offers an explanation of why they do what they do. This is especially helpful in determining what kind of problems or misconceptions the users might have concerning the product. (Nielsen, 1993: 18.)

According to Nielsen, there are two versions of the thinking-aloud method, the traditional and the simplified version. The traditional version is more formal and includes "detailed protocol analysis", that is, transcribing and further analyzing every

speech act of the test users. The simplified version only includes making notes and possibly videotaping test sessions and getting the necessary information with these methods. (Nielsen, 1993: 19.)

The thinking aloud method is fairly easy and cheap to use, not to mention that it can produce large amounts of qualitative data from only a few test sessions (Nielsen, 1993: 195). The method, however, also has its downside, as many people find it difficult or even uncomfortable to voice their thoughts while using a product. The thinking aloud method may also have some influence on the test results by slowing down the users. (Nielsen, 1993: 196.)

2.3. Accessibility Theory

This section focuses on the main features of the accessibility theory. It attempts to define what is generally meant by accessibility and accessible texts. Another purpose for this section is also to describe how accessibility can be measured.

2.3.1. Definitions of Accessibility

This section attempts to introduce several definitions of accessibility and as far as possible come to a conclusion as to which of these definitions is the most suitable for the purpose of this study.

Most sources on the subject seem to agree that "[a]n accessible text is one which is easy to understand" (Cook, 1995: 9, see also Nyyssönen, 1997: 111). The idea of easiness comes across in most definitions of accessibility, the *Microsoft Manual of Style for Technical Publications* (1998: 4) even defines the term *accessible* as referring "to things that all people, including to those with disabilities, can easily use". As the definition of accessibility is mostly presented in the form of a question, such as "what is

it that makes a text easy or difficult to use and understand" (from the foreword of Nyyssönen, 1995), it is evident that most researchers do not agree on what kind of features the concept of accessibility actually encloses.

Guy Cook, for example, sees text accessibility not only as a feature of the text, but rather as a larger concept that involves the text, the reader, and also the context of reading. The features of text that have an effect on accessibility include the choice of words and the structure and length of sentences. Also cohesion and "sentence perspectives" referring to the "grammatical means of ordering and focusing upon information" can create accessibility. (Cook, 1995: 13.)

The features of the reader include his or her background knowledge, that is, his or her familiarity with the language and the subject matter. Also cultural background and previous experience with the text type have an influence on the accessibility of a text. According to Cook, in addition to the features of the text and the features of the reader, also the features of the situation have an effect on the accessibility of a text. The features of the situation, in other words the context, can include such aspects as the moment when the text is being read, the location where the reading occurs, and the nature of the situation, whether it is an emergency, for example. (Cook, 1995: 13.)

Heikki Nyyssönen, on the other hand, feels that the key aspects in accessibility are not only the text or the reader, but the interaction between these two. According to Nyyssönen, the reader should be familiar enough with the subject matter of the text, and the text in turn should help the reader grasp its meaning. In other words, an accessible text should provide clues that suggest which reader roles are necessary in interpreting the text. Distinguishing and adopting these roles should then make the processing of the text easier for the reader. (Nyyssönen, 1997: 111.) These clues can present themselves

in details such as the sentence structure (Nyyssönen, 1997: 111), but they can also appear in larger components such as layout and visual design (Nyyssönen, 1997: 116).

Nyyssönen also suggests that a text that follows the rules of its intended genre is likely to be more accessible than a text that does not follow the rules. This is based on the assumption that recognizing the genre helps the readers in processing the text. Recognizing a text as a technical manual, for example, can make it easier for the readers to read and use the text, especially if they have used a technical manual before and know what it generally consists of and how it is generally structured. (Nyyssönen, 1995: 30.)

Further according to Nyyssönen accessible texts are also structured in such a way that the necessary information is easy to find and the intended tasks easy to complete (Nyyssönen, 1995: 20). Accessible technical documentation is also reader-based, in a way that it focuses on the users and the tasks that they need to accomplish, rather than describing the information for its own sake (Nyyssönen, 1995: 25-26).

Nyyssönen also distinguishes three textual parameters that, when applied correctly, can improve the accessibility of a text. These are clarity, economy, and processibility. In this context clarity refers to the "relationship between the intended meaning and the linguistic structure", in other words, the meaning of the text should be reflected in its linguistic structure. An economic text, on the other hand, is as short and yet as simple as possible, while a processible text is one that can be easily and efficiently understood. (Nyyssönen, 1995: 32.)

The concept of accessible documentation expressed in the *Microsoft Manual of Style for Technical Publications* (1998: 4) focuses on four guidelines. According to these guidelines, for example, web sites should be created according to accepted guidelines, writing should be concise and clear, the design of text and graphics should add to the

readability of the documentation, and finally, the terminology used should be sensitive (1998: 4). Most of these guidelines are intended for creating accessibility in the sense of creating texts for people with disabilities, but the guidelines for producing clear and concise writing also apply to creating accessible texts in the sense that they are discussed in this study.

The *Microsoft Manual of Style for Technical Publications* (1998: 5-6) provides separate guidelines for writing accessible documentation, in other words, documentation that is clear and concise. But these guidelines are very general including, for example, the following recommendations: product descriptions should be clear and concise, sentence structures should be kept simple, and step lists for procedures, paragraphs, and other text groups should be kept short (1998: 5-6).

As has already been established, there are many factors that can have an effect on the accessibility of texts. Tuija Isomursu sums it up by stating that the accessibility of texts is influenced by three key factors, namely the text, the reader, and the context of reading. The text-related features include aspects such as "vocabulary, clause structure and cohesion", whereas the features that influence the reader's understanding of texts include the linguistic and background knowledge of the reader. (Isomursu, 1997: 86.)

2.3.2. Accessibility Components

As the definitions above suggest, accessibility entails a large number of features which can affect the understanding of texts, making it easy or difficult. As it would be impossible to describe all these features in detail, this study will concentrate on those key features of accessibility that are central for its purposes.

The features that this study concentrates on include terminology, the structure of the language, and the structure of the text. The role of terminology in accessibility is emphasized by, for example, Isomursu (1997: 86). The structure of the language, which

in this study equals the aspect of clear writing, is mentioned in most of the definitions. This feature of accessibility is in this study approached through the concept of Simplified English. The structure of text in this study refers to the structure of procedures. This aspect is approached through the concept of authenticity, which, for example, Henry Widdowson (1997: 14) identifies as a feature that increases the accessibility of texts.

The concepts of terminology, Simplified English, and authenticity of procedures will be described in more detail in the following sections.

Terminology

According to Tuija Rapakko (1995: 59) difficult terminology is claimed to be one of the major causes of inaccessibility in technical texts. Other researchers seem to agree with her, Nyyssönen (1995: 118), for example, states that " [i]t is a common complaint of users of instructions that the language is too technical" adding, however, that technical terminology is "an inevitable feature of the register of computer software instructions". Similarly Inger Lassen (1997: 35) states that even if they are difficult, "technical terms of a text are indispensable carriers of information".

Isomursu (1997: 96) further notes that it only takes a few technical terms in a text to slow the readers down tremendously. She feels, however, that the readers do not necessarily need to understand all the words in a text, they should rather "be able to [--] decide which terms are vital and which words they can more or less ignore" (Isomursu, 1997: 97). Nyyssönen similarly feels that novice users who are not familiar with the terminology should use the context to arrive at an approximate or "a good-enough understanding" of the text (Nyyssönen, 1995: 118).

According to Rapakko the difficulty of terminology can be analyzed, for example, "by considering word frequency, word familiarity, word length, association value, and

the concrete/abstract dimension of word meaning" (Rapakko, 1995: 59). A common way to assess the technicality of terminology is to divide the terminology used into core and non-core vocabulary. Rapakko defines core vocabulary as the "most central items in the lexicon" (Rapakko, 1995: 62). Isomursu, on the other hand, sees core vocabulary as "lexical items that have greater degrees of structural, semantic and pragmatic coreness", but also as "words that are not restricted to be used in a specific field of discourse" (Isomursu, 1997: 87). Another definition for core vocabulary is "words that are central to everyday English", whereas non-core vocabulary could be defined to include "words that are not necessarily in everyday use or are restricted to be used in particular contexts or fields only" (Rapakko, 1995: 65).

The technicality of terminology is, of course, not the only terminology issue that can cause problems. According to Isomursu (1997: 97), for example, also the everyday core words can be difficult because, as they are not restricted to be used within a particular field, they can have of a wide "variety of meanings". William Horton (1994: 263) also feels that when one invents a new entity one should also invent a new word to describe it, since borrowing a word from the core vocabulary is only likely to confuse the readers.

Another problem with terminology is usually its consistency or lack thereof. Van Laan and Julian, for example, consider consistency a very important characteristic in a text. They feel that using different terms to describe concepts or actions when they are referred to for the second time can be very confusing to readers as seeing a new term will automatically make the users suspect that they are reading about a new concept. Even if the readers are not confused by the new term, they will most likely at least spend some time thinking about it. (Van Laan & Julian, 2001: 52.) Further according to

Van Laan and Julian, consistency should also work the other way around and one term should only be used to refer to one particular item (Van Laan & Julian, 2001: 204).

According to Van Laan and Julian (2001: 53) consistency is not only a matter of terminology, rather the entire document, including its language, iconography, and typography, should be designed to be as consistent as possible. Nielsen (1993: 90) develops this idea further by adding that also the product should be consistent in its use of language, and that the documentation should of course also be consistent with the product.

Simplified English

What relates Simplified English to technical communication is that at least the experimental test (conducted by Shubert et al) that tested the Boeing instructions written in Simplified English against the Boeing instructions written in ordinary technical English proved that the use of Simplified English does increase the accessibility of complex texts (Lassen, 1997: 39). This section contains a brief description of the main points of Simplified English.

Simplified English is a way of writing that "was developed so that documents written in English could be understood by people who speak little English" (Brown, 2001: 1). What makes Simplified English different from traditional English is the fact that its vocabulary is strictly limited and it has its own specific rules of writing (Brown, 2001: 1).

Simplified English has its own list of approved words, sometimes called the Dictionary of Simplified English (Lassen, 1997: 38), which lists not only the approved words but also their approved usage, that is, whether they should be used as verbs or adverbs, for example (Brown, 2001: 1). This list of approved words contains the necessary basic words, each of which has only one definition and one possible usage.

The verb *follow*, for example, should only be used with the meaning "to come after", and not with the meaning "to do what the rules tell you". Thus, one should not write phrases such as "Follow the safety instructions", instead one should write "Obey the safety instructions" (Brown, 2001: 1).

Simplified English also allows the use of technical names but only according to specific rules. (Brown, 2001: 1.) One additional word-related rule restricts the number of consecutive nouns to less than four (e.g. Brown, 2001: 3) since long clusters of nouns can make sentences extremely confusing.

The strict writing rules include the demand for writing short sentences. According to Lassen (1997: 38) instructive sentences should not be longer than 20 words and descriptive sentences should not exceed 25 words. Similarly Brown (2001: 3) sets the maximum length for sentences at 20 words adding that " [a]n average of one sentence in ten can be up to 25 words long". Rubens (1992: 215), however, is a bit more strict by stating that "no more that one sentence in 10 on a page should exceed 16 words in length". He nonetheless agrees with Lassen and Brown that 20 words is otherwise a suitable maximum length.

Other rules besides sentence length include the fact that sentences should only have one topic per sentence, or rather that descriptive sentences should include only one topic per sentence, whereas instructive sentences should only include one instruction per sentence (Lassen, 1997: 38). According to Brown (2001: 1) Simplified English should employ the active voice as much as possible, especially with instructions. Lassen (1997: 38) also adds that in instructive sentences the verb should be in the imperative mood.

Many of the rules of Simplified English are adapted to creating technical documentation. In fact it is a very common rule that the use of passive, for example, should be avoided as it can cause the sentences to be unclear and wordy by requiring the use of auxiliary verbs and prepositions (Gerson & Gerson, 1997: 31). It has also been stated that passive sentences can be more difficult to process and remember than active sentences (Horton, 1994: 266).

Authenticity of Procedures

The authenticity of procedures simply refers to the fact that for users to be able to follow any written instructions the instructions should be as representative of the actual procedures that they describe as possible. According to Widdowson (1997: 14), for example, "the 'natural' or mimetic correspondence of linguistic sequence with the procedures to be followed" makes the understanding and following of these procedures much easier, therefore increasing the accessibility of the instructions describing these procedures.

The authenticity of procedures is one of the key concepts in technical communication. As was already mentioned in the context of technical communication above, accuracy and completeness are important characteristics in good technical communication (Van Laan & Julian, 2001: 49). To be truly authentic, procedural instructions need to be accurate, in other words, all the information included should be correct (Van Laan & Julian, 2001: 50). This alone, however, is not enough, authentic procedures should also be described in full, that is, any missing steps or details are likely to confuse the readers and decrease the quality and accessibility of the instructions (Van Laan & Julian, 2001: 51).

2.3.3. Measuring Accessibility

There are at least two ways to measure the accessibility of texts. One can analyze the textual features of the text or one can arrange an accessibility test where also the features of the users and the situation can be assessed. A third alternative is to combine these two methods.

Textual analysis is a relatively simple method for measuring accessibility, as it involves analyzing textual features such as the "word frequency and number" and sentence structures and lengths which are much easier to estimate than, for example, the features of the readers (Cook, 1995: 14). To measure the features of the reader or to assess the interaction between the reader and the text, one most likely needs to set up an accessibility test, as only "the actual context of reading" can shed light on these aspects (Pilto & Rapakko, 1995: 37).

An accessibility test is very similar to a usability test. Similarly to a usability test, an accessibility test involves asking a set of test users to perform a predefined set of tasks (Piilto & Rapakko, 1995: 37). The test users in an accessibility test can also be videotaped and interviewed after the test. Also similarly to a usability study, the thinking aloud method is also very commonly used in accessibility studies. The only major difference between these two test types is the fact that, whereas the usability test concentrates on the product that the tasks are performed with, the accessibility test is more concerned with the documentation used in the test situation. A further distinction might be the fact that the test users in an accessibility study may be specifically encouraged to use the provided documentation, as it happens to be the object of the study.

According to Heikki Nyyssönen, a proper accessibility study is a qualitative study which includes both textual analysis and accessibility testing. The first step in this type of study is to perform a text analysis which leads to a “preliminary assessments of accessibility”. After these assessments the texts should then be rewritten according to the results of the assessments. The rewritten versions of the texts should then be tested by arranging an accessibility test where the new versions of the text can be compared with the old ones. (Nyyssönen, 1995: 30.)

3. Vaisala as a Company

Vaisala is a global company that "develops, manufactures and markets products and services for environmental and industrial measurement" (Vaisala Group 2001 brochure). Vaisala has 22 offices in 11 countries including the head office in Helsinki. Vaisala employs more than 1100 people. In 2001 Vaisala's net sales reached EUR 183,5 million. Due to the company's international clientel, 96% of these net sales came from exports. (Vaisala Group 2001 brochure.)

Vaisala's business objective is to concentrate on the areas in which the company can achieve global product leadership. Vaisala is already the global market leader in its core businesses which include, for example, upper air, airport, and road weather observation. (Vaisala Group 2001 brochure.)

Vaisala is divided into four divisions according to the company's key business areas. These divisions include the Upper Air Division (UAD), the Surface Weather Division (SWD), the Remote Sensing Division (RSD), and the Sensor Systems Division (SSD). UAD concentrates on products that are intended for "observing the weather in the upper atmosphere", such as radiosondes and related ground equipment. SWD develops products that "observe weather conditions near and on the Earth's surface", such as automatic weather stations and meteorology sensors. RSD manufactures wind profilers and lightning detection systems which employ remote sensing technology. SSD concentrates on instruments that measure, for example, relative humidity and dew point. (Vaisala Group 2001 brochure.)

3.1. Technical Documentation in Vaisala

Vaisala's customer documentation team is based in the Helsinki office and it consists of some ten technical communicators. These technical communicators produce technical documentation for the Surface Weather and Upper Air divisions. Each communicator concentrates on a specific division and product family. The Sensor Systems Division in Helsinki currently has its own technical communicators, as do some of the global offices around the world. However, most of the same writing practices and tools are applied to all customer documentation composed within the company.

As the name implies, Vaisala's customer documentation team is only responsible for customer or end-user documentation, that is, different types of user manuals. All the other documentation, such as different specifications, marketing materials, and internal documentation, is produced by other teams or departments in the company.

All of Vaisala's technical documentation is written in English. As Vaisala does not produce consumer products, the user manuals are rarely translated to other languages. When they are translated, this is done by a subcontractor.

3.1.1. Manuals in Vaisala

The customer documentation team produces three types of user manuals. These are base document, derivative documents, and optional documents. The base document is the User's Guide, which is the basic manual written for every product released in Vaisala. (vintra.vaisala.com.)

If the product or system requires more information than can be fitted into the User's Guide, additional derivative documents are produced. These derivative documents include Maintenance Manual and Installation Manual, which consist of maintenance

and troubleshooting information and installation information, respectively. These manuals, or either of them, are only created if the product generates enough information to warrant separate manuals concerning these issues.

If it is decided that a product might benefit from other kind of documents besides the basic and derivative documents, optional documents are created. These include the Quick Reference Guide and Technical Reference manuals. The Quick Reference Guide is a small pamphlet-type manual that can include some basic instructions that do not require an entire manual. Installation or some basic operating instructions are good examples of the kind of information that can be placed into a Quick Reference Guide.

The Technical Reference manual is created for detailed technical information that is not necessarily relevant for the User's Guide or any of the derivative manuals, but is still useful enough to deserve a separate manual. One product may need several Technical Reference manuals, each for different kind of information.

Vaisala's user manuals are written on specific Vaisala templates that are designed to unify and improve the appearance of Vaisala's customer documentation. The purpose of these templates is to make all the manuals look the same; it also makes it easier for the customers to use the manuals if all the manuals are organized in the same manner. The current documentation templates are based on Microsoft Word, but in the future the documentation team will start to produce Frame Maker -based modular XML documentation. This is one more reason to use templates, as they make it easier to convert manuals from one format to another when the team switches from one documentation tool to the next.

3.1.2. Documentation Process in Vaisala

The documentation process of the customer documentation team is an integral part of Vaisala's product development process. The purpose of this arrangement is to make user manuals an important part of the products. It also enables the simultaneous release of both products and manuals. An established documentation process also makes it easier to create and update manuals. The documentation process currently in use in Vaisala is illustrated in the following figure (taken from the Customer Documentation Home Page at vintra.vaisala.com).

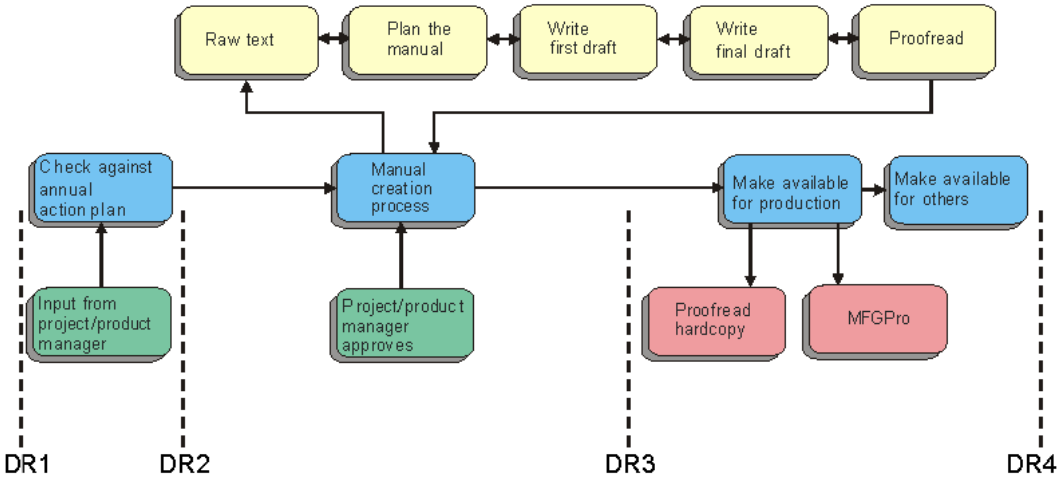

Figure 1 Documentation Process in Vaisala

The documentation process describes the actions and responsibilities of the technical writers. In Vaisala technical writers not only write the manuals, they also plan their content and to some extent their layout and organization. In addition to this they also create the necessary graphics, publish the manuals, manage them, and proofread other writer's manuals. As the technical writers in Vaisala have several responsibilities, it is important to have a clear documentation process, which they can easily follow.

The documentation process consists of several steps, which are concerned with planning the manual, writing different drafts, proofreading, and finally publishing the finished manual. All these steps include several separate sub-steps and specific, internal

documentation instructions. These include instructions on writing, proofreading, layout, and graphics design to mention a few. The purpose of these instructions is to ensure accuracy and also make the documentation look and feel consistent. To further aid in this attempt for conciseness, the customer documentation team has created its own Style Guide.

4. Materials

The material for this study included the documentation for the MW21 DigiCORA III Sounding System. The function of the MW21 DigiCORA III Sounding System (which is from hereon referred to simply as DigiCORA III) is to collect weather data via a radiosonde attached to a balloon which is sent up to the sky. An overview of the DigiCORA III system is presented in the following figure (Figure 2), which is from the MW21 DigiCORA III User's Guide.

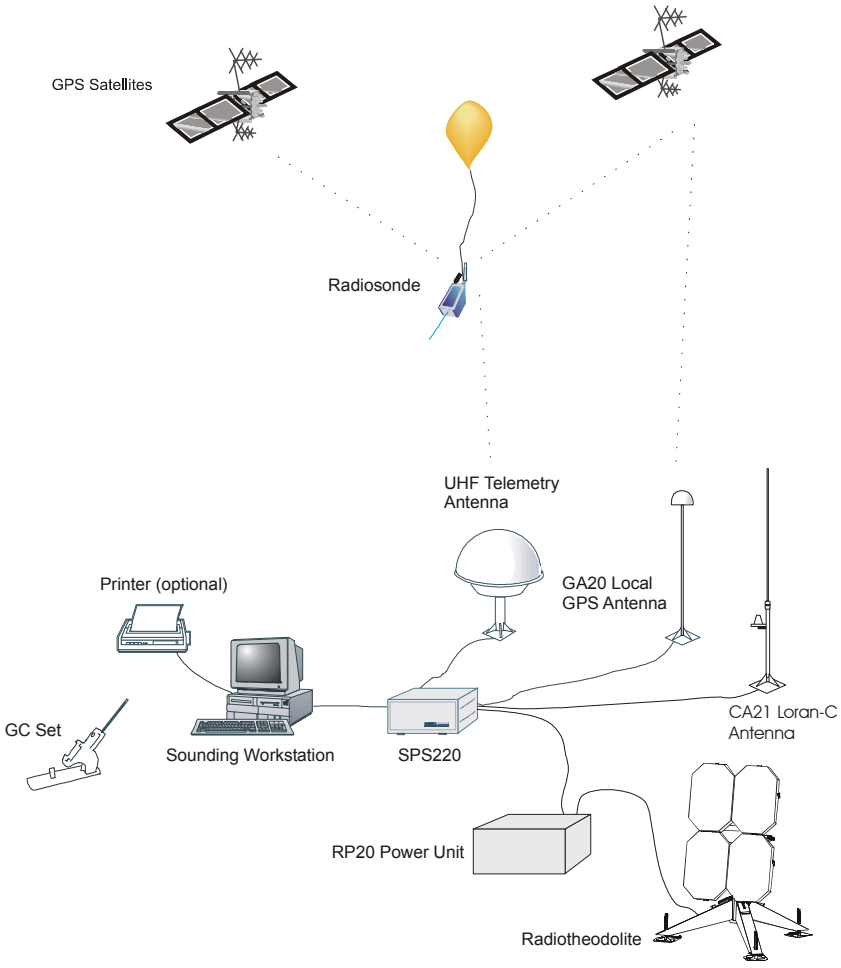

Figure 2 Overview of the DigiCORA III System

The DigiCORA III system consists of a PC computer connected to a sounding processor, which contains different cards and is in turn connected to antennas. An

integral part of the DigiCORA III system is the DigiCORA III Sounding Software which is used for analyzing, archiving, and relaying radiosounding data. (MW21 DigiCORA III User's Guide.)

The documentation for DigiCORA III was chosen as material for this project because DigiCORA III is one of Vaisala's most popular products and one that is used all over the world. It seemed more useful to study the documentation of a product that is actually being used than to study the documentation of a new system that is still being developed or a product that is no longer in use. Also the DigiCORA III manual set is a fairly representative sample of Vaisala's customer documentation.

The DigiCORA III manual set altogether includes seven manuals. Not all of these manuals were analyzed, but they were all included in the study since the average user of the DigiCORA III system will most likely have all the manuals of this set. One of the aims of this study was to examine the logic in the structure of the manual set by investigating whether the users can actually find the correct manual where to search for the necessary information.

The DigiCORA III manual set contains a User's Guide, an Installation Manual, a Maintenance Manual, and a Technical Reference, which include operating instructions, installation, maintenance, and technical information, respectively. The manual set also contains User's Guides for Metgraph, Special Sensor, and Radiotheodolite, which are additional applications of the DigiCORA III software.

Rather than analyzing one entire manual or all seven manuals, this study on the usability of the manual set was conducted by selecting four text extracts from three different manuals. Two of these extracts were rather short (taking up about one page and consisting of approximately 100 words) and two somewhat longer (taking up about five pages and consisting of approximately 300 words). These extracts included

instructions for certain procedures that involve working with the DigiCORA III software. The chosen text extracts were first analyzed for accessibility. After that the same extracts were used as test tasks in the usability test. These text extracts and the procedures that they contain are discussed in more detail in sections 5.2.4. Test Tasks on page 58 and 6.1. Accessibility Analysis Results starting on page 61.

The rest of the material for this study came from the aforementioned accessibility analysis and usability test. The usability test also included a brief semi-structured interview (see appendix for questionnaire), which provided more useful data on the usability of the manual set. The accessibility analysis, the usability study, and the interview are all discussed in more detail in chapter 5. Methods on page 51.

5. Methods

As has already been mentioned, the aim of this study was to examine the usability of Vaisala's customer documentation. This enabled me to formulate the research question as follows: Does the usability of Vaisala's customer documentation satisfy the needs of its users?

This study employed two main research methods. First, the selected sections of the manuals were analyzed, in order to form a hypothesis on the accessibility of the texts. After this, a usability test was conducted asking the test users to perform the procedures described in the analyzed manual sections. The results from the analysis and the test were finally compared. Both of these methods are discussed in more detail in the following sections.

5.1. Accessibility Analysis

As the concepts of accessibility and usability are closely related and even include some of the same components, such as the accuracy and organization of texts, for example, it seemed logical to link them together. The preliminary hypothesis for this study was that if a manual is accessible, there is a strong likelihood that it is also usable. In other words, if the information is easy to find and the users can easily understand it, they should also be able to successfully apply the information in practice. Thus, the accessibility of the DigiCORA III manuals was assessed by analyzing the selected extracts from the manuals.

The accessibility analysis concentrated on the textual aspects that affect accessibility. To what extent the features of the reader and the context have an effect on the accessibility of the manuals was also investigated during the usability test. The accessibility analysis was based on three selected aspects. These aspects included

terminology, the structure of language, and the structure of text. While analyzing these aspects the overall structure of the manuals was also briefly assessed, as the finding of information is an important aspect for both accessibility and usability.

5.1.1. Terminology

The aspects of terminology that were analyzed included the consistency of terminology and the technicality of the terms used. According to Widdowson (1997: 16), for example, the use of several different terms to refer to the same entity is likely to be very confusing to the reader. The consistency of terminology is especially crucial in user manuals where the point of the communication is to help the users instead of misleading them. Therefore the selected extracts of text were analyzed to see how consistently the terminology was used in the DigiCORA III manual set.

The other terminology-related aspect involved assessing the technicality or, in other words, the difficulty of the terminology. To find out how easy or difficult the terminology in these manuals is, the percentage of core and non-core vocabulary used in these manual extracts was determined.

As the study concentrated on technical manuals which were as such likely to include a large percentage of computer-related non-core vocabulary, the degree of coreness of the terminology was also assessed. This was accomplished by dividing the non-core vocabulary into computer-core and field-specific vocabulary.

Computer-core vocabulary is a term that was coined for the purpose of this study to describe the average computer vocabulary, which is not exactly a part of the core vocabulary, but which is not really field-specific vocabulary either. To be more exact, the terms included in the category of computer-core, such as *window* or *button*, were in fact mostly everyday words, but this study included them into the category of computer-core vocabulary as they were used in a very different sense from the corresponding

everyday words. The category of field-specific vocabulary, on the other hand, included the technical terminology particularly related to the DigiCORA III software and its operation.

The reason for evaluating the degree of coreness of the terminology was the idea that the presence of a large percentage of non-core vocabulary does not in itself necessarily make the manuals very technical of difficult. It is usually the high frequency of complicated field-specific terms that has a negative impact on the accessibility of the terminology.

5.1.2. Simplified English

As has already been mentioned, the structure of the language of these manuals was approached through the concept of Simplified English. There were two reasons for this. Firstly, the general instructions for writing good technical documentation are very similar to the rules of Simplified English, and secondly, some of the rules of Simplified English coincide with the internal manual writing instructions currently in use in Vaisala. The aspects of Simplified English analyzed in this study included the ones that are summarized by Lassen (1997: 38) as follows: One should use short sentences with only one topic per sentence, and one should avoid the use of complex noun groups. Instructive sections of text should be written with imperative verbs and they should include only one instruction per sentence, whereas descriptive sections should be written in active voice.

The language of the manuals was compared with the rules listed above to determine whether the manuals actually employed Simplified English and whether they were thus one step closer to accessibility. For measuring sentence length the boundary was set at

twenty words, in other words, a sentence that had more than twenty words was estimated to be a long sentence. Another boundary of ten words was used to detect sentences that were particularly short.

5.1.3. Authenticity of Procedures

The final aspect in the accessibility analysis was to analyze the structure of the text, or in other words the structure or authenticity of the procedures in the manual extracts. This was done by performing the selected procedures to find out whether the instructions in the manuals actually followed the procedures that they described.

The analysis of the procedures was meant only as a sort of preliminary analysis before the actual accessibility/usability test, as it was difficult to measure authenticity in a situation which in itself was not authentic. As the context can have a significant effect on the meaning of the text (Raudaskoski, 1995: 126), the final estimation of authenticity was saved until after the usability test, that is, until real users were given a chance to use the texts in real situations.

5.2. Usability Test

To find out whether the manuals that were analyzed for accessibility actually were usable and whether there was a connection between the accessibility and usability of texts, a usability test (acting simultaneously as an accessibility test) was set up. The purpose of the usability test was to verify that users can actually perform the tasks that they wish to perform by using the manuals.

5.2.1. Key Features

As has already been established, “usability is not a single, one-dimensional property”, (Nielsen, 1993: 26) but one that can be looked at from several different angles. The main angles or features chosen for this study included the finding of information, the

general usage of manuals, and the satisfaction of the users with the manuals. As this is a qualitative usability study on manuals, the main interest was on observing the actions of the users rather than on measuring features.

As has already been mentioned, one of the key aspects of this study was to find out whether the information in the manuals is logically organized. This was determined by observing how easy it was for the users to find the information, which according to Coe is one of the key aspects of usability in technical communication (Coe, 1996: 193). For this reason all the manuals of the set were laid out on the table next to the users, who got to choose which manuals to search the information from.

Besides observing how the users used the manuals and searched for information, the time it took for them to find the information they needed, and also the time it took for them to complete the tasks were recorded. In addition to this, the times that the users spent searching for the information in the wrong place or even in the wrong manual were also counted.

In addition to the general observation of how users got along with performing the tasks, the accessibility issues mentioned earlier were also looked into. When the users seemed to have problems, it was estimated whether the problem could have been caused by difficult terminology, complex sentence structure, or by the fact that the procedure in the manual did not follow the one on the screen.

5.2.2. User Comments

To get more information out of the test situation, the test was conducted using the thinking aloud method (see for example Nielsen 1993: 195) where the users make observations, and comment on their progress aloud as they perform the tasks. This

method was selected because it can give valuable information on the users' insights as well as being cheaper and easier to organize than some mechanical methods for collecting information on the users' activities.

During the test sessions, the users were reminded to think aloud, if they seemed to forget to do so. This was accomplished with short comments or questions which either encouraged the test users to think aloud or simply asked them what they are doing, or what they thought they should be doing next. In a similar way, the users were also offered small hints on how to proceed if they seemed stuck and unaware of what to do next.

Additional user comments, also concerning the satisfaction of the users with the manuals, were received during the debriefing stage of the test which included a brief semi-structured interview with each of the test users. For this purpose a questionnaire (see appendix) had been formulated to form a good starting point for a discussion-like interview. The questions in the questionnaire were read out loud to the test users and their answers were written down for them.

5.2.3. Test Users

The usability test was arranged as a part of two customer training sessions and therefore involved testing with actual users. The eight test users came from three different user groups. There were the pilot test users (2), Danish customers (2), and Swiss customers (4). The usability test consisted of altogether seven test sessions, as all the test users (except two Swiss customers who wished to do the test in pairs) took part in one test session.

The two customer user groups involved, the Danish and the Swiss customers, had some similarities as well as some differencies. Both groups have similar Western cultural background, which usually entails good education and relatively good foreign

language skills. Neither group has English as their native language, but they should have relatively similar English skills. Both groups represent Vaisala's military customers, which suggests that they are likely to have a heightened sense of responsibility which leads to careful following of instructions. This seemed very useful for the purpose of this test, and in general makes the usability of the manuals a high priority.

The only difference between these user groups was in their expertise with the system. The Danish customers had already had their basic training and had been using the system for about six months before the tests. Their tests were arranged as a part of an upgrade training. The Swiss customers, on the other hand, performed the test as a part of their basic training. The Swiss customers had used similar systems before but never this particular product.

The difference in experience was not considered to have a significant effect on the reliability of the results. Besides, its influence was thought to be easy to detect as it was the only major variable with the cultural backgrounds being very similar. Having two slightly different test groups was considered to make the test results more reliable than having only one group, two almost identical groups, or two entirely different groups.

Due to the test users' difference in expertise, it seemed practical to plan the test to include some basic tasks and some more advanced tasks, to ensure that both groups were able to perform the same test, and to ensure that the results would be comparable. In the end, the difference in expertise was seen as a positive thing from the point of view of usability, as Vaisala's customers include both experts and novices, who all have to use the same manual set.

An important point to consider was the applicability of the results. From the beginning it was kept in mind that the results of this test might not be applicable to all

users of this system and manual set. However, it was estimated that they might be fairly applicable to most western military users of this product, as these two test groups seemed to form a rather representative sample of this customer section.

Before the actual usability tests there was also a pilot test, the results of which were also included in the other results. The fact that the pilot test users differed from the other test users suggested that the results of the pilot tests might slightly add to the general applicability of the overall results.

5.2.4. Test Tasks

The usability test consisted of six test tasks. As there was the transfer time from one task to another and the two other stages of the usability test besides the actual test stage to consider, the time frame of one hour left two choices. These were either to select one or two long test tasks or then several short ones. Selecting short tasks made finally more sense, as it gave the opportunity to include several different kinds of test tasks. The use of several tasks also allowed the use of several manuals instead of only one or two.

In addition to having four actual tasks, the usability test also included two practice tasks. These practice tasks included searching information from the manuals without actually applying it in practice. The purpose of these tasks was to help the test users into the correct frame of mind. Furthermore, they were good practice for using the thinking aloud method, not to mention for searching information from the manuals.

The four actual test tasks consisted of two slightly shorter tasks and two slightly longer ones. The order of these tasks was designed to be as logical as possible to ease the transfer from one task to another. Also, the test started with relatively easy tasks to make the test users feel good about themselves.

All the test tasks are listed below. The first two tasks represent the practice tasks, which included no procedure to perform.

- Find out how many types of helplines you can add to a Metgraph graph.
- Find the default parameters for the Ozone Sensor.
- Start a new sounding importing calibration coefficients from file. (Then after importing the coefficients abort the sounding with the **Cmd** button.)
- Export an archived sounding file (EDT data table) to another location in ASCII format.
- Working as an administrator, change your settings to allow operators to start soundings manually or automatically.
- Restore the backup copy of the parameter database and the registry settings, and start a sounding. (Aborting it again with the **Cmd** button).

5.2.5. Pilot Testing

A pilot usability test was arranged in preparation for the actual usability test. The pilot test user group consisted of two people from within Vaisala. The two pilot test users were familiar with both the system and the manuals used in the test. They have been involved in either testing the system or writing the manuals, or both.

The pilot test situation was arranged to be as authentic as possible. The pilot test users went through all the stages of the actual test, the introduction, the test, and the debriefing stage with the semi-structured interview. The test sessions went very smoothly and produced a lot of useful comments about the test itself and about the manuals. They also provided some actual results which are discussed in chapter 6. Results on page 61 together with the actual test results.

Setting up the pilot tests proved to be a very educational experience. It served as an introduction to the testing method and also clarified what generally happened in a test

situation and what kind of behavior was expected of the experimenter. The pilot test also confirmed that the test tasks were rather well selected, although some of the task descriptions seemed to require some re-wording. The test situation also supported the previous decision of what kinds of things to observe and write down during the test, and confirmed that it was possible to take so many notes that the video camera could be reserved for backup and timing purposes. The semi-structured interview, however, revealed the necessity for a tape recorder, since it was not possible to write down all the things that the pilot test users were saying. It was also established that when the test users received a copy of the questions, their answers were more accurately to the point.

During the pilot test, it also became apparent that not all the test users appreciated the hints that had been prepared in case the test users should have problems. Some users seemed to fear that receiving hints might make them look incompetent in some way. This was something that had not even been considered. The pilot tests also gave clues as to which tasks might be difficult to perform even with the instructions, and what kind of assistance or advice the test users might possibly need. The pilot tests also gave clues as to what kind of results one could possibly expect from the actual usability tests.

6. Results

This section contains the results of both the accessibility analysis and the usability test. There is also a separate section for the results of the short interview which was conducted as a part of the usability test.

6.1. Accessibility Analysis Results

The manual extracts that contained the instructions for the four test tasks were analyzed for their accessibility. The features that were analyzed included the aspects of Simplified English discussed above, the consistency and technicality of terminology, and the authenticity of procedures. The structure of both the entire manuals and the individual text extracts were also examined to some extent, with special emphasis on how easy or difficult it was to locate the text extracts in question. The two practice tasks were not analyzed as thoroughly as the actual test tasks. With the practice tasks, the only relevant aspect was the finding of information.

6.1.1. Practice Task 1

The task description for the first practice task asked the users to find out how many types of helplines can be added to a Metgraph graph. This text extract is relatively easy to find[1], since the word Metgraph is mentioned in both the task description and on the cover of the manual. There is no index in this manual, but the relevant manual extract can be found on the second page of the table of contents. It may take some time, as the relevant text extract has a level four heading, but it can be found if one reads the table of contents carefully enough. The answer to this task can be found in the first sentence of the correct text extract.

[1] The text extract relevant to this task is located in the *MW21 DigiCORA III Metgraph User's Guide*, in its *Operation* chapter, on page 41.

6.1.2. Practice Task 2

The task description for the second practice task asked the users to find the default parameters for the Ozone Sensor. The relevant text extract for this second practice task may be more difficult to locate[2]. The task description talks about an ozone sensor which is not mentioned on any of the manual covers. The manual set, however, includes a manual titled *MW21 DigiCORA III Special Sensor User's Guide*, which is the only manual with the word *sensor* in its name.

Finding the correct text extract may take some time since the entire table of contents of the manual does not mention the term *ozone sensor*. But it does mention the word *parameter* which is also mentioned in the task description. This could act as a lead of some kind. Once the users open the *Entering Special Sensor Parameters* section, the correct information can be found in a table on the same page.

6.1.3. Task 1

The procedure in Task 1 includes starting a sounding with the DigiCORA III system. According to the task description, the calibration coefficients are to be imported from a file, rather than from the paper tape of a radiosonde as is usually the case.

Finding the Information

This text extract should be easy to find[3] as performing a sounding is one of the very basic and most important procedures related to the DigiCORA III software, and the instructions are logically placed in the User's Guide along with the instructions for other basic procedures. Although this manual does not contain an index, the text extract is easy to find from the table of contents, as the heading for the section is named after the

[2] The relevant text extract is located in the *Operation* chapter of *MW21 DigiCORA III Special Sensor User's Guide*, under the sub-heading *Entering Special Sensor Parameters*, on page 17.
[3] The instructions for this procedure are located in the *MW21 DigiCORA III User's Guide*, in the beginning of the *Operation* chapter, under the heading *Starting a Sounding*, on pages 23 to 28.

procedure (*Starting a Sounding*). Also the heading is a level two heading which is easy to notice, and the extract is located in the very beginning of the *Operation* chapter.

Structure of the Text

The entire *Starting a Sounding* section is about thirteen pages long and consists of thirteen steps, eighteen figures, five note boxes, and two small sub-sections. Instead of merely describing how to start a sounding, it actually goes through almost the entire sounding process. Since the task description only asks the users to start the sounding and abort it after entering the calibration coefficients, this analysis has been limited to only include the first three steps of the procedure. The sounding procedure is cut short in the task description to avoid having to launch an actual sonde into the air, which is not reasonable (or even possible) in the test situation.

The text extract included in the analysis covers approximately five pages from the beginning of the *Starting a Sounding* section. It consists of three steps, seven figures, and the two small sub-sections. The first two steps are relatively short consisting of three sentences each. The third step takes up the remaining four pages, being quite long and somewhat confusingly organized. It also includes the two sub-sections and six of the figures. It certainly could use some reorganization for the sake of clarity.

The two sub-sections in this text extract describe the two possible ways of entering the calibration coefficients needed for performing a sounding. When starting to perform this task, the user will have to realize that only one of these sub-sections is truly relevant for this procedure. Another thing to realize is the fact that the method for entering the calibration coefficients is selected as late as in the third step of the procedure and not before the procedure is started. The preferred method to enter the calibration coefficients is clearly indicated in the task description.

Aspects of Simplified English

The aspects of Simplified English include assessing the sentence length, discovering whether the instructions and other sentences only have one instruction or topic per sentence, and whether the instructions are written in the imperative mood and the descriptive parts in the active voice. This part of the analysis also includes a search for complex noun phrases, that is, noun sequences that contain more than three consecutive nouns.

The preferred sentence length in this study is under twenty words per sentence. According to this criterion, the sentence lengths in Task 1 are excellent. The percentage of sentences that consists of less than twenty words is as high as 92%. And moreover, 36% of these sentences consist of less than ten words. However, short sentences alone are not necessarily enough to make a text easy to understand. Sentences that are too short can have a negative effect on text cohesion, especially if these sentences lack connective elements.

As an example, the following piece of text with the four relatively short sentences, although it is to some extent cohesive, still leaves something to be desired. *Enter sonde coefficients. The default way to enter sonde coefficients is to read them from paper tape by using Paper Tape reader SPT11A. Coefficients can also be read from file. Which way is default, is decided during the DigiCORA III setup.* There are plenty of ways to rewrite this text. One possible example with slightly longer sentences and more cohesive elements is as follows. *Enter the sonde coefficients. You can do this either by using a paper tape with the SPT11A Paper Tape Reader, or by entering them from a file. You can determine the default way to enter the sonde coefficients during the DigiCORA III setup.*

Another seemingly good result is the fact that 75% of the instructive sentences in the text include only one instruction per sentence. Some of the sentences with two or more instructions are OK as the actions have to be performed more or less simultaneously, as in the sentence *Select the desired calibration coefficient and click **Next***. As for the rest, although they are not necessarily too difficult or too long, most of the sentences could fairly easily be separated in such a way that they would only include one instruction per sentence. This process would shorten the sentences considerably, and it could also have a positive effect on the general understandability of the sentences. For example, the sentence *Click on the **Start** button and select **Programs - DigiCORA III - DigiCORA III** or click the **DigiCORA III** icon on the desktop*, could be separated into the following two sentences: *Click on the **Start** button and select **Programs - DigiCORA III - DigiCORA III**. Alternatively, click the **DigiCORA III** icon on the desktop.*

As to the instructions in this text extract, only 50% of the instructive sentences are written in the imperative mood. The remaining 50% of the instructive sentences are written in the declarative mood. Most of these sentences describe the actions to be performed in the passive voice, such as the instruction *Coefficients can also be read from file*. As this manual extract selected for the analysis consists solely of three steps, there are no descriptive sections to analyze.

There are no complex noun groups in this text extract. There are a few noun groups that consist of three consecutive nouns, such as the *sonde serial number*, but none that include more than three nouns.

Terminology

The terminology was first divided into core and non-core vocabulary. The non-core vocabulary was then divided into computer-core vocabulary, which consisted of general computer terms that were yet not actual core vocabulary, and field-specific vocabulary, which consisted of DigiCORA III and sounding specific terminology.

Of the total vocabulary as much as 72% is core vocabulary, which is quite a good result. Of the non-core vocabulary as much as 62% is computer-core which should be understood by most computer-literate users. Only 38% of the non-core vocabulary (11% of the total vocabulary) is field-specific vocabulary. Even this vocabulary is not very difficult as it mostly consists of the names of different equipment.

There are, however, some minor consistency issues. For example, the following three terms s*onde coefficient*, *coefficient*, and *calibration coefficient* are used for the same entity. Also different verbs, apparently to create variation, are used to describe the same action. These include pairs such as *read* and *import*, and *show* and *indicate*. This minor lack of consistency may not, however, cause problems with the users of this text, as the variation is so slight that the users may not even notice it while they are performing the procedure.

Authenticity of Procedures

Based on brief experiments with the system, the procedure in Task 1 seems to be fairly authentically described in the manual. The procedure itself is somewhat confusing but this is due to the complicated software design. After all, no matter how complicated the product may be, the descriptions in the manual must be consistent with it, and this has been achieved here.

Overall Accessibility

In the light of the results of the analysis, the text extract for Task 1 seems fairly accessible. The Simplified English aspects seem fine, and there are no major problems with structure, terminology, or authenticity. Also the information is fairly easy to find.

6.1.4. Task 2

The procedure in Task 2 consists of exporting an archived sounding file converted in ASCII from one location to another by using the instructions in the manual set.

Finding the Information

Since exporting a sounding is one of the basic operations, which are usually included in the User's Guide, users should have no problem finding the correct manual[4]. As this manual does not have an index, the user once again has to turn to the table of contents, where the instructions for this task can be located near the end of the second page. If one merely glances at the table of contents, the sub-heading *Advanced User Operations* that precedes the correct section may be somewhat misleading, but if one reads carefully enough, the correct sub-section should be found.

After finding the correct place in the table of contents, the user has to be careful not to select the wrong set of instructions. The manual contains two very similar sections, which are both relevant to this procedure. The difference between these sections is that the first section (*Exporting Sounding Data*) only instructs how to export soundings, whereas the second one (*Converting Sounding Data*) also includes instructions for conversion, which according to the task description is an important part of this task.

[4] The instructions for this task are located in the *MW21 DigiCORA III User's Guide*, in the *Operation* chapter, under the sub-headings *Advanced User Operations* and *Converting Sounding Data*, on pages 43 to 44.

Structure of the Text

The *Converting Sounding Data* section is less than one page long. It consists of a short introductory paragraph, seven steps, and one note box. The steps are fairly short and the entire text seems very clear and straightforward.

Aspects of Simplified English

A total of 83% of all the sentences in this text extract consists of less than twenty words. This is a very good result, especially since as many as 50% of these sentences consist of less than ten words. Unfortunately, the short sentences cause the same kind of choppiness in this text as they do in the previous one. This is evident, for example, in the first step of the procedure, which goes as follows: *Select **File - Open**. The Archive Manager window opens.* This step could be made more clear and cohesive in several ways. Possible alternatives could be, for example, *Select **File - Open**. This will open the Archive Manager window.* or *Select **File - Open** to open the Archive Manager window.* This text cohesion factor may not be very significant, as there are no major defects in the cohesion of this text extract.

Each of the few descriptive sentences in this text contain only one topic, as in the following sentence: *Not all data can be converted to SPF Binary format*. The same does not, however, apply to the instructive sentences, of which only 67% contain only one instruction. Some of the sentences with two or more instructions are OK as the actions have to be performed simultaneously, as in the following example: *Right-click the file you want to convert and select **Export - Convert** from the appearing popup menu.* Several of the sentences with two or more instructions could still easily be divided into separate sentences. As an example, the instruction *Select the data table you want to*

export and click the button of the format you want to convert the sounding data to, e.g. ***ASCII.*** might be clearer or at least shorter in the following format: *Select the data table you want to export. After this, click the button of the format you want to convert the sounding data to, for example,* ***ASCII****.*

Only 33% of the few descriptive sentences are in the active voice, such as the following sentence from the introductory paragraph: *If you want to convert an archived sounding data table to be used with another data processing system, do as follows*. The other 67% of the descriptive sentences are mostly in the passive voice, like the following example: *Before exporting, the sounding file can be converted to another format*. This use of the passive voice does not necessarily make the text any more difficult, but the use of active voice might bring the text a bit closer to the user. The sentence mentioned above, for example, would also work in the following format: *Before exporting a sounding file, you can convert it to another format*, or *Before you export a sounding file, you can convert it to another format*.

Of the instructive sentences in the text as much as 78% are written in the imperative mood. Most examples of these would also serve as examples of short (and perhaps not so cohesive) sentences, as the instructions in step three *Select* ***Convert***, or the instructions in step seven, *Click* ***Save****.*

This text extract contains no complex noun groups. All the noun groups are shorter than four consecutive nouns, such as *sounding data table*, for example.

Terminology

Of the total vocabulary for this text extract, 68% is core vocabulary. Although this does not initially seem particularly good, one has to take into account that only 19% of the non-core vocabulary is actually field-specific. Therefore although the text consists of a

high percentage of computer-core vocabulary, namely 81% of the non-core and 26% of total vocabulary, only 6% of the total vocabulary belongs to the potentially more difficult, field-specific vocabulary.

There are some minor consistency issues in the terminology of this text extract. The terms *sounding file*, *sounding data table*, *data table*, and *sounding data*, for example, are not in any way defined or distinguished from each other. Furthermore, they are used more or less as if they refer to the same thing. Whereas the terms *sounding file* and *sounding data* almost mean the same, the terms *sounding data table* and *data table*, which actually are the same thing, are a part of a *sounding file*. This slight inconsistency of terminology might not, however, cause problems for the users, as the text itself is very short and the instructions are otherwise extremely clear. Still, this is one of those issues that cannot really be verified until the users take part in the usability test.

Authenticity of Procedures

The procedure in Task 2 is very thoroughly described. It is also quite authentic. There are only two minor details in the instructions that differ from the actual procedure. In the second step, one does not have to click on the entire file list although it reads so in the instructions, it is enough only to click on the sounding file that one wishes to export. Also the third step could be eliminated from the list as the function in question is already performed in step two. These slight oversights are not likely to affect the completion of the procedure.

Overall Accessibility

Overall, the instructions for Task 2 are quite accessible. The Simplified English aspects should not cause any problems. Also the structure and terminology seem to be of an acceptable level. Even the minor authenticity issues do not lower the overall accessibility of the text.

6.1.5. Task 3

Task 3 is one of the more advanced test tasks entailing an action usually reserved for administrative users. According to the task description, the task is to make sure that sounding operators are able to start soundings both manually and automatically.

Finding the Information

Before they start selecting the correct manual, users will first have to figure out what it is that they are expected to do. Although it may seem like the purpose of this task is to confuse the users, this task is actually a good test to the accessibility of the manual set. In real life, users do not always know what they are expected to do before they pick up the manual, rather they often seek answers to problems. This is the only one of the four test tasks that actually presents the users with a problem to solve, instead of simply pointing out a procedure to perform with the help of the manuals.

This task has to do with user rights, and the test users will have to change or at least check certain parameter database settings to give the sounding operators the privileges they need to start the kind of soundings they wish. As the task description for this task does not name the expected procedure, the users may need some hints to lead them to search for the correct instructions.[5]

The *Database Key Management* section, which contains the correct instructions, includes two sub-sections, which are both very important for this task. As a matter of fact, when the users realize that they are dealing with user privileges, they may notice the sub-section *PRIVILEGES* in the table of contents before the *Database Key Management* section.

[5] The instructions for this task are located in the *MW21 DigiCORA III Technical Reference*, in a chapter titled *Technical Reference* [sic], under the sub-heading *Database Key Management*, on pages 18 to 22.

Finding the correct manual may take some time. The word *sounding* in the task description may mislead the users to first look into the User's Guide, or maybe even into the Installation Manual. Once the users find the correct manual, they may still not be able to find the correct instructions, if they are not sure of what they are supposed to be looking for.

Structure of the Text

The *Database Key Management* section includes two sub-sections. These are the *Viewing and Changing Key Values* section and the *PRIVILEGES* section. The *Database Key Management* section describes how to enter the Database Manager, which is a window where the necessary settings can be changed. The *Viewing and Changing Key Values* section describes how to change the actual settings, whereas the *PRIVILEGES* section, constructed mostly in a table format, lists all the parameter keys that can be changed, their possible settings, and the consequences of the changes.

The entire text extract (the three sections mentioned earlier) included in this analysis consists of approximately four and a half pages. The *Database Key Management* section takes up approximately one and a half pages of the extract. It consists of a few paragraphs of text, one figure, one caution box, and three two-step step lists. Two of these step lists are bulleted lists, whereas the third one is an alphabetical list. At a glance this section seems very confusing. The *Viewing and Changing Key Values* section consists of one figure and three numbered steps, and takes up about one page. The *PRIVILEGES* section takes up about two pages and consists of two rather long tables and a short introductory paragraph.

Although it may seem logical at first, the structure of the *Database Key Management* section and its two sub-sections are really rather confusing. When one has to change the privileges, one might easily jump straight to the *PRIVILEGES* section. This might

complicate the procedure, if the user does not realize that the actual step-by-step instructions on how to change the necessary parameter keys are in the two previous sections. These three sections might work better if they were somehow merged or the flow of information was in some way reversed.

As such the *Viewing and Changing Key Values* and *PRIVILEGES* sections are rather clear and accessible. It is the *Database Key Management* section that may cause problems. The three step lists in this section are somewhat confusing, especially since they are not really step lists, rather they describe different ways of performing the same procedure. The first list describes the two different ways of opening the DBManager, which one needs to do to be able to change the parameters. The other two lists describe how to proceed once you are in the DBManager. Yet the other two lists are not really lists at all, the first step describes what you can do in the DBManager, and the second one gives instructions on how to do this. This section definitely seems to require some reorganization.

Aspects of Simplified English

All the three sections discussed above are included in the analysis, except for the tables and the figures, which are markedly different from the rest of the text. As far as sentence length is concerned, the results are very good. A total of 88% of the sentences in these three sections consist of less than twenty words. Furthermore, as many as 50% of these sentences are extra short consisting of less than ten words.

A total of 87% of the descriptive sentences include only one topic per sentence, such as the descriptive sentence *DBManager is the tool for Vaisala DBMS Database maintenance*. The percentage of instructive sentences that include only one instruction per sentence is 59%. Although most of these sentences with two or more instructions are not too difficult or too long, it might further improve the text if they were cut into

short, separate sentences. The following sentence: *Changes you make here will be saved to this sounding data file and will affect this sounding only.*, for example, might work better as the following two sentences: *Changes you make here will be saved to this sounding data file. These changes will only affect this sounding*. Some instructive sentences could even be separated into their own steps, as is the case with the following sentence which in itself contains an introductory sentence and four instructions: *To open an archived sounding: on DBManager select **File - Open**, browse the file you want, select it, and click **Open**.*

A total of 69% of the descriptive sentences in this text extract are in the active voice, leaving only 31% in the passive voice. Once again there is no clear reason why these passive sentences should be in the passive voice, rather they could easily be converted into the active voice. For example, the sentence *These keys should not be modified.* could also be expressed as *You should not modify these keys*. Similarly the sentence *There are two ways to start DBManager*. could be expressed as *You can start the DBManager in two ways.*

Of the instructive sentences, only 59% are written in the imperative mood. Usually a step includes an imperative instruction followed by a declarative sentence, as in the following example: *Double-click the value name in the right pane. A window showing the key's properties opens*. Although having declarative sentences does not necessarily make the instructions more difficult, they are fairly easy to get rid of. The above two sentences, for example, could simply be united into the following imperative sentence: *To open a window showing the key's properties, double-click the value name in the right pane.* This change makes the action and its consequence somehow more clear. It does make the sentence slightly longer, but it is still shorter than twenty words.

This text includes several noun phrases with three nouns, such as *system internal values*, but there is only one so-called complex noun phrase with four consecutive nouns, namely, *Vaisala DBMS Database maintenance*.

Terminology

Terminologically this text is one of the simplest. The percentage of core vocabulary is as high as 75%, leaving the percentage of non-core vocabulary as low as 25%. Of the non-core vocabulary 66% is computer-core and only 34% field-specific vocabulary. Following this, the percentage of field-specific vocabulary of the entire vocabulary is as low as 9%.

There are again some minor issues with the consistency of terminology. Some expressions are spelled differently in different places, such as *user-editable* and *user editable*. Also slightly different terms are used to refer to the same entity, such as *keys* and *DigiCORA III keys*, *Administrators user group* and *Sounding Administrators*, or *DBManager* and *DigiCORA III database*. As this inconsistency is not very frequent, it is not likely to cause problems for the users.

Authenticity of Procedures

On the whole the procedure in Task 3 is relatively authentically described, in the sense that it is possible to complete the task following the instructions in the manual. The biggest problem is likely to be that it takes a while for the user to figure out how to use the instructions. In other words, although the content of the instructions is correct, their presentation is more than confusing. In short, the instructions are somewhat difficult to follow. As was already discussed in the section Structure of the Text on page 72, there is something weird about the order of the different manual sections, it almost seems like they are arranged the wrong way around. Also the organization of the *Database Key Management* section may cause some problems with the completion of this task.

Overall Accessibility

Based on the results of the analysis, this text extract seems somewhat less accessible than the two previous ones. Although the terminology and the Simplified English aspects seem fine, there are some problems with the structure of the text that can make the description of the procedure somehow less authentic. Also, as the text extract may prove difficult to find, its location in the manual set may need some rethinking.

6.1.6. Task 4

Task 4 is the second more advanced task. In its task description the user is asked to restore the registry settings and a backup copy of the parameter database. After this, the test user is asked to start a new sounding.

Finding the Information

The fact that the procedure to be performed is actually named in the task description of this task is likely to help the test users to find the correct information[6], although this does not necessarily make the instructions easy to find. Especially selecting the correct manual may be difficult. The basic terms *backup* and *settings* in the task description may lead the test users to pick up the User's Guide. Once the correct manual is found, however, also the text extract should be easy to locate. The manual has no index, but the table of contents is only one page long. The chapter heading *Advanced Troubleshooting* may be somewhat misleading, however, the third, level two sub-heading *System Backup* is likely to lead the test users to the correct procedure.

[6] The instructions for this procedure are located in the *MW21 DigiCORA III Maintenance Manual*, in the *Advanced Troubleshooting* chapter, under the sub-section *System Backup*, on pages 10 to 11.

Structure of the Text

The *System Backup* section is approximately one page long. It consists of one paragraph of text and a sub-section titled *Restoring Settings*. Whereas the *System Backup* section gives some basic background information about the system backups, the *Restoring Settings* section describes how these backups can be restored. The *Restoring Settings* section consists of an introductory sentence and four numbered steps.

At a glance the structure of this text extract seems fine, but when one starts to perform the procedure it becomes obvious that the text may need some reorganization to be completely accessible. Some users may be tempted to start this procedure straight from the *Restoring Settings* section. This, however, is not as easy as it sounds, since the *System Backup* section contains some crucial information that is needed while performing the procedure, information that is not included in the *Restoring Settings* section. These two sections obviously need some kind of reorganization, they could be, for example, merged, alternatively the important information could be included in both of the sections.

Aspects of Simplified English

Once again the results of the sentence length analysis are excellent. A total of 80% of all the sentences in these two sections consist of less than twenty words per sentence. A total of 38% of these sentences include less than ten words. Moreover, most of the short sentences occur in the step list, which should make the procedure simpler to follow. In spite of these promising figures, however, there is once again a certain lack of cohesiveness present in the text. For example in the first step: *Stop the DigiCORA III core processes. Go to the command prompt, type "net stop se_serv", and press Enter*. For the most part this lack of cohesiveness is not so noticeable that it would have an effect on the accessibility of the text.

Of the descriptive sentences 67% have only one topic per sentence, leaving 33% of the sentences with two or more topics. These sentences with several topics would be easy to separate into their own sentences. This would make the sentences much shorter and possibly more clear. For example, the sentence *These files are created in the <DigiCORA III setup folder>\backup\ folder, and are small enough to be saved to a floppy disk.* which even looks complicated, could be made a bit simpler by rewriting it in the following way: *These files are created in the <DigiCORA III setup folder>\backup\ folder. The files are small enough to be saved to a floppy disk.*

Of the instructive sentences, as many as 57% have more than one instruction per sentence. It is true that some of these sentences are appropriate as the actions have to be performed more or less simultaneously as in the instruction *Browse the backup copy and click* ***Open***. Still some of the instructive sentences with as many as three or more instructions per sentence would benefit if the instructions were separated into their own sentences, if not even their own steps in the step list. This might give the users more perspective, which might be needed in the long instructive sentences such as *Run this registry editor by clicking the* ***Start*** *button, selecting* ***Run****, typing* ***regedt32*** *and clicking* ***OK***. This could be separated into the following two steps: *Run the registry editor by clicking the* ***Start*** *button and selecting* ***Run***. and *Type* ***regedt32*** *and click* ***OK***. Depending on what one sees as happening simultaneously, the example sentence could even be separated into four steps.

As to the active voice aspect of the sentences, only 33% of the descriptive sentences are written in active voice. The rest of the descriptive sentences are written in the passive voice, as the previously mentioned example (*These files are created in the <DigiCORA III setup folder>\backup\ folder, and are small enough to be saved to a floppy disk.*) indicates.

As to the instructive sentences, as many as 86% are written in the imperative mood. The remaining 14% of the instructive sentences were in the declarative mood. Most of these declarative sentences were also in the passive voice, as the following example indicates: *The registry branch is restored with Regedt32 program*.

The text extract included some difficult sounding terms and folder names, but there were no complex noun groups. In fact, there were only a few noun groups with three consecutive nouns.

Terminology

Terminologically this text is clearly more difficult than any of the other texts. Only 58% of the total vocabulary of this text extract is core vocabulary. Luckily, of the non-core vocabulary, as much as 77% is computer-core and only 23% field-specific vocabulary. In other words, the amount of field-specific vocabulary takes up only 10% of the entire vocabulary. The vocabulary in this text extract may be somewhat more difficult than the vocabulary in the other text extracts, but for a computer-literate user this text should not be too difficult.

There are minor consistency issues in this text. The terms *Regedt32 program* and *registry editor*, for example, are used for the same program. The text extract also includes other similar examples, which should clearly be altered in some way. The best way would be to simply pick one expression and use it consistently across the text (and the manual set).

The text also mentions two very different backup files, the *parameter database* and the *registry settings*, which are not really distinguished from each other. Also they are both later referred to by the same terms *copy*, *backup copy*, and *file* which are also not

distinguished from each other. As the different backup files are a very important part of this procedure, this type of inconsistency is likely to cause great confusion with the users.

Authenticity of Procedures

When the completion of this procedure was attempted, some major problems with the authenticity of these instructions were detected. The procedure is possible to accomplish following the instructions but it is likely to take more time than anticipated unless one is a real expert with the system. It is true that the Maintenance Manual is generally intended for slightly more experienced users than the more basic User's Guide, but this seems like an important procedure that anyone should be able to perform.

Most of the authenticity problems had to do with a lack of details. In the first step of the actual instructions, the user is asked to go to the command prompt without explaining how this is done. In the second step, the user has to copy a backup file from one location to another. Although the instruction states where the file is to be copied, it neglects to mention where the original file can be located, which information can be found from the previous section. The fourth step instructs the user how to restore the backup file without mentioning which of the two files should be restored. Furthermore, the instructions lack one step entirely. In the first step the user is instructed to turn the DigiCORA III services off, but nowhere in the instructions is the user asked to turn them back on. This information should clearly be included in the instructions as one cannot use the system unless the services are on.

Overall Accessibility

Although most of the Simplified English, structure, and terminology issues seem fine, this text extract is still not as accessible as it could be. Some users can probably work with the instructions without any difficulties, but an average user or at least those users with less experience with the system or more complicated procedures will most likely experience at least some kind of problems due to the authenticity issues.

6.1.7. Summary of the Accessibility Analysis Results

This section summarizes the results of the accessibility analysis of all the manual extracts. In other words, in this section all the results of the analysis of the selected tasks are added up to gain some sort of understanding of the overall accessibility of the individual manuals and the entire manual set.

In this section, the results are mostly shown in table format. The results that could not be presented as percentages were analyzed using different criteria. Properties such as the finding of information, structure, and authenticity of procedures were assessed on a scale of one to five. For example, if a procedure was very authentically described, it received the value *five*. If, on the other hand, the description of the procedure was not authentic at all, it received the value *one*. If the description was not very authentic but yet authentic enough for the procedure to be eventually completed, it received the value *three*.

To make the estimation of accessibility easier, some limits have been set based on which the results can be categorized. The limit for *satisfactory* accessibility, for example, has been set at 50% in percentages and *three* in estimated values. Similarly the limit for *excellent* accessibility has been set at 80% in percentages and *five* in estimated values.

Aspects of Simplified English

This section describes the results of the Simplified English analysis. Table 1 below includes the results of the sentence length analysis. It contains both the results of the individual tasks and the results off all the tasks put together. As one can see from the *All Tasks* column of Table 1 (below), the total of short sentences in all the extracts was excellent (86%), leaving the total of long sentences as low as 14%. Of the short sentences as many as 44% were extra short consisting of less than ten words per sentence. Of all the sentences, the percentage of these extra short sentences was as high as 37%.

As the results of the sentence length analysis are excellent they suggest that the users should not experience difficulties with the sentence length of the test tasks.

Table 1 Sentence Length

No. of Words	Task 1	Task 2	Task 3	Task 4	All Tasks
<20	83%	92%	88%	80%	**86%**
>20	17%	8%	12%	10%	**12%**
<10 of short	50%	36%	50%	38%	**44%**
<10 of total	42%	33%	44%	30%	**37%**

The results of the analysis of how many topics and instructions were present in each descriptive and instructive sentence are presented in Table 2 on page 83. It contains the results for each task, as well as the results for all the tasks added up. According to the *All Tasks* column of Table 2, the results on the number of topics in descriptive sentences were also excellent, as only 14% of the descriptive sentences had more than one topic, and as many as 86% had only one. Of all the instructive sentences, 35% had more than one instruction, which means that only 65% of the instructive sentences had one instruction per sentence. Although this result is over the satisfactory limit, it is hardly excellent.

Table 2 Number of Topics or Instructions per Sentence

No. of Topics	Task 1	Task 2	Task 3	Task 4	All Tasks
Desc. with 1	100%	-	87%	67%	**85%**
Desc. with >1	0%	-	13%	33%	**15%**
Inst. with 1	67%	75%	59%	43%	**61%**
Inst. with >1	33%	25%	41%	57%	**39%**

Further results of the descriptive and instructive sentences are presented in Table 3 below. These results concern the voice of the descriptive sentences and the mood of the instructions. As can be seen from the *All Tasks* column of the Table 2, the total of descriptive sentences in active voice in all the extracts was 59%. The total of instructive sentences in the imperative mood was 61%.

These results both barely exceed the limit of satisfactory accessibility and as such they can be considered fairly average. The usability test will tell whether these features actually cause problems to the users, or whether satisfactory accessibility is enough for successful completion of tasks.

Table 3 The Voice of Descriptions and the Mood of Instructions

Voice / Mood	Task 1	Task 2	Task 3	Task 4	All Tasks
Desc. active	33%	-	69%	33%	**45%**
not	67%	-	31%	67%	**55%**
Inst. imper.	78%	50%	59%	86%	**68%**
not	22%	50%	41%	14%	**32%**

Terminology

This section describes the results of the terminology analysis. Table 4 on page 84 includes separate columns for the individual tasks as well as a column where the results of all the tasks have been added up. The rows that report the values of computer-core and field-specific vocabulary include two values. The first value describes their percentage of the non-core vocabulary, whereas the value in parenthesis describes their percentage of the total vocabulary.

According to the *All Tasks* column of Table 4, in all the extracts the total of core vocabulary was 68% and the total of non-core vocabulary was 32%. Of this 32%, as much as 72% (23% of total vocabulary) was computer-core vocabulary and only 29% (9% of total vocabulary) was field-specific vocabulary.

Table 4 Coreness of Terminology

Term Type	**Task 1**	**Task 2**	**Task 3**	**Task 4**	**All Tasks**
Core	68%	72%	75%	58%	**68%**
Non-core	32%	28%	25%	42%	**32%**
↓					
Computer core (% of total)	81% (t: 26%)	62% (t: 17%)	66% (t: 16%)	77% (t: 32%)	**72% (t: 23%)**
Field-specific (% of total)	19% (t: 6%)	38% (t: 11%)	34% (t: 9%)	23% (t: 10%)	**29% (t: 9%)**

The results of the terminology analysis are very close to excellent. As only 9% of the vocabulary of the texts consist of field-specific vocabulary and another 20% of more or less common computer language, the users should not be expected to have any major problems with the vocabulary of the test tasks. Of course, with terminology one can never be sure of what will cause problems and what will not. According to Tuija Isomursu (1997: 96), for example, even one or two technical terms can be enough to confuse readers and to lead them away from the main issues, even if the task at hand does not require a full understanding of these terms.

Structure and Finding of Information

This section summarizes the results of the structure analysis of the manual extracts. This analysis includes the feature of finding information, which is an important part of structure. The numeric results of these aspects were estimated rather than counted.

These estimations are based on the analyses conducted in the previous sections. The results of this estimation are presented in Table 5 below.

Table 5 Finding of Information and Structure on a Scale of 1 to 5[7]

Property	Task 1	Task 2	Task 3	Task 4	Average
FINDING	5	5	3	4	4.3
STRUCTURE	4	5	2	3	3.5

According to Table 5 above the first two manual extracts were very well structured. Only the last two extracts seemed somewhat more problematic, especially the extract of Task 3 with its three sections. The same applies for the finding of information. The instructions for the first two test tasks were fairly easy to find. The instructions for the last two test tasks proved more difficult to find, especially in Task 3.

As presented in the *Average* column of Table 5, the overall organization and structure of the manuals was slightly above satisfactory, although the manuals might benefit if the structure of both the individual manuals and the entire set were given some additional thought. Notably, the fact that there are no indexes in the manuals is very likely to dissatisfy, if not confuse, the users (Van Laan & Julian, 2001: 149).

Authenticity

This section describes the findings of the authenticity analysis. The results of this analysis were arrived at, and are represented in, a similar fashion as the results of the structure analysis above. The authenticity estimations are presented in Table 6 below.

Table 6 Authenticity on a Scale of 1 to 5[9]

Property	Task 1	Task 2	Task 3	Task 4	Average
AUTHENTICITY	5	5	4	2	4

The authenticity of the first two manual extracts was excellent (both received the value of *five*). Task 3 had some minor authenticity issues (mostly caused by the

[7] On this scale, 5 is the highest possible value, whereas 1 is the lowest possible.

structure of the manual extract) but still remained more than satisfactorily accessible. Task 4 had slightly more severe authenticity problems (mainly caused by the lack of details) which made it accessibility-wise somewhat less than satisfactory. Despite of these problems, both Task 3 and Task 4 could still be completed with the instructions provided.

Overall Accessibility

To make further comparisons and hypothesis easier, the estimated tables of the previous sections have been combined to a longer table, which also includes the estimated effects of Simplified English and terminology. Table 7 below lists the results of the individual tasks along with the average results of all the tasks.

Table 7 Results from Accessibility Analysis on a Scale of 1 to 5[8]

Property	**Task 1**	**Task 2**	**Task 3**	**Task 4**	**Average**
FINDING	5	5	3	4	**4.3**
STRUCTURE	4	5	2	3	**3.5**
SIMPL. ENGL.	5	5	5	5	**5**
TERMINOLOGY	5	5	5	5	**5**
AUTHENTICITY	5	5	4	2	**4**
Average	**4.8**	**5**	**3.8**	**3.8**	

To summarize the accessibility analysis, one can state that the overall accessibility of these manual extracts is fairly good. According to Table 7 above, all the analyzed aspects, as well as all the tasks, were above the satisfactory limit. There were no major problems with the Simplified English or terminology issues. The only real problems to be expected with these manual extracts are most likely to concern structure and authenticity. Also the finding of information (which of course is partly a structure issue) may turn out be somewhat problematic.

[8] On this scale, 5 is the highest possible value, whereas 1 is the lowest possible.

As the issues listed in Table 7 on page 86 are the main points of interest in the accessibility analysis results, they will also be the points that the usability test will concentrate on. It is finally the usability test that will indicate which features make a user manual usable and accessible.

6.2. Usability Test Results

During the usability tests the following aspects received specific attention: the general usage of the manuals, the ease or difficulty of finding information (especially with Task 3), the effects of text structure (especially with Task 3 and Task 4), Simplified English, and terminology, and the authenticity of procedures (especially with Task 4).

The usability test was conducted in three different stages. These stages included the pilot test, the tests with the more experienced Danish customers, and the tests with the more novice Swiss customers. Altogether eight people took part in the tests, but as one test was performed in pairs, the test consisted of only seven test sessions. The combined results of all three test stages and all seven test sessions will be presented in the following sections.

6.2.1. Practice Tasks 1 and 2

For the most part the practice tasks were accomplished fairly smoothly. For the first practice task, 42% of the test users located the information very quickly. At the same time 29% of the test users had slight problems, whereas another 29% did not quite understand what it was that they were expected to find, and so had quite serious problems in finding the necessary information.

As for the second practice task, 42% of the test users had some trouble finding the information. The other 58% of the test users found the information rather quickly and without difficulties. The information finding times, the longest, shortest and average times, for the practice tasks are presented in Table 8 on page 88.

Table 8 Information Finding Times for Tasks P1 & P2

Task	Longest Time	Shortest Time	Average Time
TASK P1	8 min 32 s	58 s	3 min 15 s
TASK P2	10 min 14 s	39 s	4 min 59 s

The two practice tasks gave an excellent opportunity to observe the search methods of the test users. They seemed to search for the correct manual based on some sort of a 'gut feeling'. Once they picked up a manual, nearly all of them started their search from the table of contents (TOC), and only when this failed, resorted to browsing the manuals. Most of the test users also indicated that they would have liked the manuals to have indexes in them.

6.2.2. Task 1

The first actual test task was also performed fairly well by all the test users. It did not take most of them more than a couple of minutes to find the correct information, as only 28% of the test users had slight problems and only 14% had more serious problems with locating the relevant manual extract. The information finding times for this task can be found in Table 10 on page 89.

Although people have generally accused the documentation for this procedure of being rather confusing, most test users were able to perform the task according to the instructions in the manual. The confusion stems from the software which is, for some reason, designed to be somewhat complicated. At least as far as this procedure is concerned, the user interface is not very intuitive or user-friendly, the buttons are not where you expect them to be and the software seems to have a logic of its own. However, as confusing as the procedure itself may be, the instructions seem to follow it fairly well. Nevertheless, about 58% of the test users had some minor problems with the procedure as the software was not logical and they did not pay close enough

attention to the instructions. Also most test users (little over 86%) had some sort of trouble with file paths. This was due to the fact that the manual just was not clear enough on this part.

In a nutshell, the test users had no real problems in finding the information, also the structure of the text, the language, and the terminology seemed appropriate. And as has already been established, the procedure was also fairly authentically described, although the procedure itself was inherently complicated causing some confusion in the text. Table 9 below provides a summary of how different test users were estimated to cope with the different features of the manual extract. The different features were assessed on a scale of one to five. The table presents the results of the accessibility analysis, as well as the highest, lowest, and average scores of the test users. The information finding and task completion times of the test users were presented in Table 10 below.

Table 9 Observed Aspects in Task 1 (on a Scale of 1 to 5)[9]

Property	Accessibility Analysis	Highest Test User Score	Lowest Test User Score	Average Test User Score
FINDING	5	5	3	4.6
STRUCTURE	4	5	4	4.9
SIMPL. ENGL.	5	5	5	5
TERMINOLOGY	5	5	5	5
AUTHENTICITY	5	5	4	4.3

Table 10 Information Finding and Task Completion Times for Task 1

Property	Longest Time	Shortest Time	Average Time
FINDING	6 min 22 s	31 s	2 min 4 s
COMPLETION	10 min 12 s	3 min 12 s	6 min 35 s

[9] On this scale, 5 is the highest possible value, whereas 1 is the lowest possible.

6.2.3. Task 2

Also the second task seemed to be fairly simple for all of the test users. They found the correct manual straight away (the information finding times are presented in Table 12 below) and most of them got very near to the correct instructions. As it happens 71% of the test users started to perform the wrong one of the two very similar procedures. Luckily, 60% of these test users realized their mistake early on before completing the procedure, and only 40% had to go back and start the entire procedure all over again.

The text extract is fairly short, which alone almost guarantees appropriate structure, language, and terminology. The procedure is also very authentic, and the short step-by-step instructions are clear and thoroughly described. Due to these factors, the test users managed to perform the procedure very quickly (the task completion times are also presented in Table 12 below) and with little effort once they knew which procedure they were expected to perform. A summary of how the test users managed with this task is provided in Table 11 below.

Table 11 Observed Aspects in Task 2 (on a Scale of 1 to 5)[10]

Property	Accessibility Analysis	Highest Test User Score	Lowest Test User Score	Average Test User Score
FINDING	5	5	2	3.6
STRUCTURE	5	5	5	5
SIMPL. ENGL.	5	5	5	5
TERMINOLOGY	5	5	5	5
AUTHENTICITY	5	5	5	5

Table 12 Information Finding and Task Completion Times for Task 2

Property	Longest Time	Shortest Time	Average Time
FINDING	3 min 2 s	1 min 5 s	2 min 5 s
COMPLETION	4 min 10 s	1 min 12 s	2 min 2 s

[10] On this scale, 5 is the highest possible value, whereas 1 is the lowest possible.

6.2.4. Task 3

The third task was one of the advanced tasks and it clearly proved to be more challenging than the two previous tasks. The task description for this task was more vague and did not clearly name the procedure to be performed. This made it more difficult to search for the relevant information. For this reason all the test users were more or less at a loss as to which manual to pick out from the pile. As many as 42% of the test users tried four of the other manuals before finding the correct one. Altogether 29% of test users found the correct manual as their third choice and another 29% as their second choice. What is significant is that all the test users initially suspected that the information would be found in the User's Guide.

When the test users finally found the correct manual, it did not take long for them to find the correct place in the manual (or one of the three sections related to this procedure). After finding the correct instructions, all the test users were able to perform the task, although there was a certain amount of hesitation involved as they browsed between the three relevant sections guessing where to find each necessary piece of information. The information finding times along with the task completion times for this test task are presented in Table 14 on page 92.

The instructions for this procedure were not as straightforward (or as authentic) as the instructions for the two previous tasks, and this is clearly reflected on the behavior of the users. One test user was very clever and following the pictures avoided having to read the complicated instructions. This approach might also have benefited others, since many test users tried to follow the instructions too thoroughly. Consequently, as many as 29% of the test users almost performed one sub-procedure twice as they mistook the description of two alternative ways to perform the sub-procedure as a step list. It was

obvious that the test users had more problems with this test task than with any of the previous ones. Although all the necessary information was in the manual, it was somewhat illogically presented.

A summary of how the test users managed with the observed features in this task is provided in Table 13 below.

Table 13 Observed Aspects in Task 3 (on a Scale of 1 to 5)[11]

Property	Accessibility Analysis	Highest Test User Score	Lowest Test User Score	Average Test User Score
FINDING	3	4	2	3.1
STRUCTURE	2	4	3	3.6
SIMPL. ENGL.	5	5	5	5
TERMINOLOGY	5	5	5	5
AUTHENTICITY	4	4	4	4

Table 14 Information Finding and Task Completion Times for Task 3

Property	Longest Time	Shortest Time	Average Time
FINDING	17 min 2 s	3 min 36 s	9 min 9 s
COMPLETION	8 min 43 s	5 min 3 s	6 min 28 s

6.2.5. Task 4

The final test task was also an advanced task. This task proved even more difficult than the previous one, partly for the same reasons. In contrast with the previous task, the task description for this task states a clear procedure to be performed. Nevertheless, this did not help most of the test users to find the correct information. Only 28% of the test users found the information easily. For 58% the correct manual was the third one they tried, for one test user it was the fifth. The information finding times for this test task are presented in Table 16 on page 95.

[11] On this scale, 5 is the highest possible value, whereas 1 is the lowest possible.

Most of the test users encountered problems as soon as they started following the instructions. One test user misunderstood the first step and almost neglected to follow it. As many as 42% of the test users did not know how to perform the sub-procedure in the first step as the instructions were not detailed enough.

A total of 71% of the test users also had problems with the second step. These problems concerned certain file path names, which turned out to be incorrectly described in the manual. This was an interesting discovery as it was completely missed in the accessibility analysis. Similarly it was also somewhat surprising to notice that all test users did not even realize that there was an error in the manual. According to the manual, the backup file should be copied from *<DigiCORA III setup folder>\backup\ folder*. This even looks very confusing, not to mention that the correct path (in the correct Vaisala format) is actually *DigiCORA III – bin – backup*. Further, the user is instructed to copy the backup file to *<DigiCORA III setup folder>\bin\ folder*, which is technically correct, but could be expressed in a more simple way, for example, *DigiCORA III – bin*. In addition to one of the file paths being incorrect, the file path in question is also reported in the preceding section, instead of the section where the information is actually needed.

Although most of the test users seemed to follow the instructions very closely, they all had similar problems. 29% of the test users neglected to open a necessary branch, another 29% tried to open it some but not enough, whereas yet another 29% of the test users tried to open it 'too far'. Only one test user succeeded correctly with this sub-procedure.

Similarly all but one tried to make the crucial mistake of restoring the wrong file. Furthermore, as many as 71% of the test users could not at first even find the restore option, as the manual did not mention that it was on the menu bar. This, along with the

other problems, testifies that the procedure is not very authentically described in the manual, and also that the structure of the instructions (divided into two separate sections) is not the best possible. Once again most of the necessary information was actually in the manual extract, but it was either unevenly distributed between the two sections (in the wrong place, that is), or then it was not detailed enough, forcing the users to read between the lines (which most of them in this case were unable to do). The task completion times are presented in Table 16 on page 95.

During this task it also became apparent that one entire step was missing from the procedure. In the first step users are instructed to turn off the DigiCORA III services, which after completing the task should be turned back on. This important detail is, however, left out from the instructions. Some users (about 58% in this test, for example) may remember to perform this operation even if it is not mentioned, but it should still be mentioned in the instruction for those who do not. As was already mentioned in context with the usability theory, truly usable instructions should also include the easy steps (Sinkkonen et al, 2002: 75).

This manual extract also contains some minor terminology and language issues. The procedure involves working with two very different backup files, which are not clearly distinguished from each other in the instructions, neither is their purpose explained thoroughly enough. The users also stumbled on different path and branch names that were expressed in a confusing manner. A summary of how the test users managed with this task is provided in Table 15 on page 95.

Table 15 Observed Aspects in Task 4 (on a Scale of 1 to 5)[12]

Property	Accessibility Analysis	Highest Test User Score	Lowest Test User Score	Average Test User Score
FINDING	4	5	3	3.9
STRUCTURE	3	4	3	3.6
SIMPL. ENGL.	5	5	5	5
TERMINOLOGY	5	4	4	4
AUTHENTICITY	2	3	2	2.4

Table 16 Information Finding and Task Completion Times for Task 4

Property	Longest Time	Shortest Time	Average Time
FINDING	6 min 31 s	54 s	3 min 38 s
COMPLETION	22 min 7 s	12 min 33 s	17 min 54 s

6.2.6. Summary of the Usability Test Results

Table 17 below provides a summary of all the results of the usability test. This table includes the estimated averages counted from each test user's individual test results. The *Average* column provides an average estimation of the accessibility (or usability) of each of the observed aspects. The *Average* row, on the other hand, provides an average estimation of the usability (or accessibility) of the texts for each test task. The results in Table 17 (below) can be assessed with the same *satisfactory* and *excellent* limits as the results of the accessibility analysis.

Table 17 Results from the Usability Tests on a Scale of 1 to 5[14]

Property	Task 1	Task 2	Task 3	Task 4	Average
FINDING	4.6	3.6	3.1	3.9	**3.8**
STRUCTURE	4.9	5	3.6	3.6	**4.3**
SIMPL. ENGL.	5	5	5	5	**5**
TERMINOLOGY	5	5	5	4	**4.8**
AUTHENTICITY	4.3	5	4	2.4	**3.9**
Average	**4.8**	**4.7**	**4.1**	**3.8**	

A look at the *Average* column reveals that the most difficult aspect for the users seemed to be the finding of information. The other weak point in the manual set seemed to be the authenticity of procedures. The *Average* row, on the other hand, reveals that

[12] On this scale, 5 is the highest possible value, whereas 1 is the lowest possible.

the two more advanced tasks (Task 3 and Task 4) were clearly deemed more difficult than the other two, more basic tasks. As all the observed aspects as well as the test tasks, however, seem to exceed the satisfactory limit, it can be said that the extracts are fairly usable.

During the test sessions it became evident that the test users' previous experience with the DigiCORA III system had no effect on their test results. Even if this was not the expected result, it is at the same time understandable, as having used the system before does not guarantee that one has used the manuals before or that one even knows how to use them. On the contrary, it became evident that the users who had taken the time to familiarize themselves with the manuals at some point, seemed to receive the best test results. Although the difference between those who had browsed the manuals before and those who had not, was not very significant. This result may lead one to think that maybe the manuals are not as user-friendly as they should be if one has to familiarize oneself with them before being able to use them. This is of course not necessarily the whole truth, as users' attitudes towards manuals also have an effect on how quickly and efficiently they learn to use them.

During the test sessions it was also discovered that the more advanced test tasks were the most difficult ones to complete, not only because they were the most advanced and thus less frequently needed, but also because they were the ones that had the most structure and authenticity problems. This of course should not be the case. The more difficult procedures should naturally be even more thoroughly described than the more basic, everyday procedures, especially if these more complicated procedures are performed more rarely than the more basic ones.

6.3. User Comments from the Usability Tests

During the debriefing stage of the usability test, the test users underwent a short, semi-structured interview that included questions about the test, the DigiCORA III system, and their use and opinions of the DigiCORA III manual set. This interview consisted of fourteen questions which were handed to the test users in the form of a questionnaire. The users were not, however, asked to fill out the questionnaire, it was completed as an interview. All test users were only asked the questions that were directly relevant to them. Some user comments were also collected during the test stages of the usability tests. Most of these issues were reintroduced during the interview.

The results of the interviews as well as the questions that were asked are presented in the following sections. For the sake of clarity, it is important to note that the following sections do not list all the included alternatives, only the ones that were actually selected by the users. The entire questionnaire is attached as an appendix.

6.3.1. Test Related Questions

The interview included three questions that dealt with the test itself. The first question inquired the test users their opinion of the test tasks. 29% of the test users reported that the test tasks were difficult, whereas 71% described them as being somewhere between easy and difficult. The most common reason for both answers was that the test users had not used the system much recently (or at all), and that they were not used to using manuals.

The second question was concerned with how the users managed to complete the tasks with the manuals. Again 29% reported that this was difficult and 71% reported that it was somewhere between easy and difficult. The users explained their answers by saying that the manuals were not properly organized and lacked details, also the information was said to be difficult to find.

The third question on the test tasks inquired the test users whether or not they could have managed to complete the tasks without the manuals. As many as 42% answered *no*, whereas 29% answered *yes*. Another 29% answered both *yes* and *no*, saying that they could have managed the few first tasks without the manuals. Some test users pointed out that they could hardly even manage the tasks with the manuals. The results discussed above are also reported in Table 18 below.

Table 18 Results of the Test Related Interview Questions[13]

1. What did you think of the test tasks?	
Between easy and difficult	71%
Difficult	29%
2. How did you manage performing the tasks with the manuals?	
Between easy and difficult	71%
Difficult	29%
3. Could have managed without the manuals?	
No	42%
Yes	29%
Yes & No	29%

6.3.2. DigiCORA III Related Questions

The interview also included three questions that dealt with the DigiCORA III System. The first of these inquired the test users in what capacity they normally use the system. Of all the test users, 29% use the system as sounding operators, 13% as sounding administrators, and 29% as both operators and administrators. 29% reported that they use the system in some other capacity. These included the pilot test users who are more concerned with testing the system or writing manuals for it than actual usage.

To the question of how often they approximately use the system, 71% of the test users answered *monthly*. Also as many as 43% gave the answer *rarely*. The last question dealing with the system asked what the users tended to do in case of problems. As many as 86% reported that they turn to the manual, 43% would ask a colleague, 29% would

[13] For the sake of clarity, only the alternatives that were selected by the users are included in this table. The entire questionnaire is attached as an Appendix.

try once more on their own, and also 29% would call the HelpDesk. The percentages for these answers add up to over 100%, because the users were allowed to choose more than one option. The results discussed above are also reported in Table 19 below.

Table 19 Results of the System Related Interview Questions[14]

1. In what capacity do you use the MW21 DigiCORA III system?	
Operator	29%
Administrator	13%
Both	29%
Other	29%
2. How often do you use the MW21 DigiCORA III system?	
Monthly	71%
Rarely	43%
3. What do you do in problem situations?	
Read the manual	86%
Ask a colleague	43%
Call HelpDesk	29%
Try on your own	29%

6.3.3. Manual Set Related Questions

The section of the questionnaire that dealt with the DigiCORA III manual set included altogether eight questions. Seven of these were multiple choice questions, whereas the last one was presented in free form and did not include options.

The first question in this section inquired how often the users use the manuals. Of all the test users 57% reported that they use the manuals rarely. As many as 43% reported that in the beginning they used the manuals every time they used the system. 29% reported that they use the manual set every time they have a problem with the system.

The next question, how often the users find the information they need in the manuals, was only relevant for four test users who had more experience with the manual

[14] For the sake of clarity, only the alternatives that were selected by the users are included in this table. The entire questionnaire is attached as an Appendix. Also the percentages for these answers add up to over 100%, because the users were allowed to choose more than one option.

set. 50% of them answered that they find the information often. 25% reported that they find the information always, and another 25% reported that they find the information sometimes.

The third manual related question inquired what methods the users use to search for information. All the test users reported that they use the table of contents, 71% also browse the headings, and 14% browse the figures. 14% also reported that they like to read and memorize the manuals before using the system. All the test users mentioned that they would like the manuals to have indexes in them.

Again only four test users answered the question of why they think they cannot sometimes find the correct information. All of these test users said that the information which they seek is sometimes simply not in the manuals. Half the test users suspected the logic of the manual structure, whereas 25% suspected that they were using the wrong manual, and another 25% claimed that the manuals were missing vital search elements.

When asked to describe the structure of the manuals, 50% of the test users commented that it was understandable. Another 33% reported that in their opinion it was logical, 17% thought that the structure was badly organized, and 17% saw it as confusing.

When asked about the information content of the manuals, 67% reported the manuals to contain enough information. Another 50% of the test users, however, were of the opinion that the manuals did not contain enough information. All the test users agreed that the terminology and the language in general in the manuals was appropriate.

The results discussed above are also reported in Table 20 on page 101.

Table 20 Results of the Manual Set Related Interview Questions[15]

1. How often do you use the MW21 DigiCORA III manual set?	
Rarely	57%
Every time you use	43%
Every time you have problems	29%
2. How often do you find the information you need in the manuals?	
Often	50%
Always	25%
Sometimes	25%
3. What methods do you use to find the information?	
Table of contents	100%
Browsing headings	71%
Browsing figures	14%
Reading and memorizing	14%
4. Why do you think you cannot find the correct information?	
It is not in the manual.	100%
Manual structure is not logical.	50%
You are using a wrong manual.	25%
Search elements are missing.	25%
5. How would you describe the structure of the manuals?	
Understandable	50%
Logical	33%
Confusing	17%
Badly organized	17%
6. How would you describe the information content of the manuals?	
There is enough information.	67%
There is too little information.	50%
7. How would you describe the terminology in the manuals?	
Appropriate	100%

During the interview the test users were also given a chance to give their own comments and suggestions about the manual set. These were plentiful. Most users had some comments on the structure of the individual manuals and the entire manual set. Some felt that the structure of the individual manuals is logical and that the manuals names are clear enough to indicate what information can be found in which manual. Others, however, were not at all satisfied with the structure and claimed that it definitely needs reorganization.

[15] For the sake of clarity, only the alternatives that were selected by the users are included in this table. The entire questionnaire is attached as an Appendix. Also the percentages for these answers add up to over 100%, because the users were allowed to choose more than one option.

The test users had plenty of suggestions on how to improve the structure. Some suggested that some of the manuals, for example, the User's Guide, the Technical Reference, and the Maintenance Manual, could be combined into one slightly thicker manual. Some only wanted the manuals to have the basic information relevant to them, and thus suggested that there could be, for example, two user's guides, one with the basic operating information and another one with more details for reference purposes. Others were less drastic and suggested that some information could simply be shifted from one manual to another, so that it would be easier to locate. Some suggested that the finding of information could also be eased by adding to the manuals (or possibly to only one of them) a general table of contents that would list what information is in which manual.

The information content of the manuals was also criticized. Nearly all test users complained that some of the procedures lacked important details, which made the procedures difficult or even impossible to understand or complete. Some procedures were also deemed illogically described. Some test users had detailed suggestions on how the descriptions of these procedures could be improved. (A more detailed report of these suggestions is published as an internal report for the company.)

The test users also had other miscellaneous suggestions. Some wanted the manuals to include more pictures, some wanted more exploded views. Others felt they needed more spare parts lists, and others wanted the manuals to include more customer-specific configurations. Some also wanted the manuals to be translated to their native language.

6.3.4. Summary of User Comments

The interview turned out to be very useful as it provided some necessary background information about the test users. It was interesting to learn in what capacity and how often the users used the DigiCORA III system and also how often and in what way they used the DigiCORA III manual set.

As customers rarely offer feedback directly to the customer documentation team, it was interesting to hear their comments on the manuals. It was also useful to know what they thought was wrong with the manuals and how they thought the manuals could be improved. The same issues that had emerged in the accessibility analysis and been confirmed in the usability test were also introduced in the interview. The issues that the users had most comments on included authenticity and structure. According to the users, the most difficult procedures in the manuals were often illogically described and lacked details, and the information was fairly difficult to find.

In retrospect, the questionnaire could have been altered in some way to ensure that all the test users would have been able to answer all the questions. Alternatively, all the test user groups could have been interviewed with slightly different sets of questions, designed particularly for them. Despite the problems with the questionnaire, the interview proved to be an important part of the usability study, as it shed some light on the users' general attitude towards the manuals and provided ideas for possible future improvements.

6.4. Final Results

The final results of the accessibility analysis and the usability test are presented in Table 21 and Table 22 below. These tables are organized as similarly as possible to allow for easy comparison. The results of the two tables are fairly easy to compare as they actually are very similar.

Table 21 Results from Accessibility Analysis on a Scale of 1 to 5[16]

Property	**Task 1**	**Task 2**	**Task 3**	**Task 4**	**Average**
FINDING	5	5	3	4	**4.3**
STRUCTURE	4	5	2	3	**3.5**
SIMPL. ENGL.	5	5	5	5	**5**
TERMINOLOGY	5	5	5	5	**5**
AUTHENTICITY	5	5	4	2	**4**
Average	**4.8**	**5**	**3.8**	**3.8**	

Table 22 Results from the Usability Tests on a Scale of 1 to 5[18]

Property	**Task 1**	**Task 2**	**Task 3**	**Task 4**	**Average**
FINDING	4.6	3.6	3.1	3.9	**3.8**
STRUCTURE	4.9	5	3.6	3.6	**4.3**
SIMPL. ENGL.	5	5	5	5	**5**
TERMINOLOGY	5	5	5	4	**4.8**
AUTHENTICITY	4.3	5	4	2.4	**3.9**
Average	**4.8**	**4.7**	**4.1**	**3.8**	

After the accessibility analysis, it was suspected that the two more advanced tasks might be the most difficult ones to complete. As Table 21 and Table 22 above indicate, this result was also confirmed by the usability test. In the accessibility analysis the two most difficult features were estimated to be the structure and the authenticity of procedures, finding the information was deemed the third possible factor to cause problems. The usability test did indeed confirm that these were the three most difficult features, only their order was slightly different. During the usability test the finding of

[16] On this scale, 5 is the highest possible value, whereas 1 is the lowest possible.

information seemed to be the number one problem, followed by authenticity and then by structure. Of course once again one has to keep in mind that the structure and finding the information are actually two sides of the same feature.

Based on the results in Table 21 and Table 22 on page 104, one can say that the usability (as well as the accessibility) throughout this manual set is at least satisfactory, as all the values are higher than *three*. For the easier tasks, however, the usability is almost excellent, as the values are close to *five*. It is also important to notice that the aspects of Simplified English and terminology are close to excellent as well.

7. Conclusions

When conducting a usability study such as this, one should keep in mind that the results may not as such be applicable to all Vaisala's manuals. They do, however, give some idea of the general usability of the manuals and can be applied when determining what general aspects of customer documentation might need improving.

The similarity of the results of the accessibility analysis and the usability test proves the initial hypothesis, which assumed that if a text is accessible it is also likely to be usable. The two approaches were not, however, too similar, they rather complemented each other, with the accessibility analysis concentrating on the theoretical side of the subject, and the usability test on the practical side.

Based on both the accessibility analysis and the usability test, the usability throughout the manual set can be estimated to be at least satisfactory. This estimation gives two kinds of answers to the research question of whether the usability of Vaisala's customer documentation satisfies the needs of its users. If the users' need is simply to perform tasks, then they will eventually accomplish this purpose with the help of the manuals. If, however, the users wish to complete tasks quickly and efficiently, there is room for improvement in the usability of the manuals.

As the test confirmed, the following three features, the structure, the finding of information, and the authenticity of procedures need to be looked into to improve the usability of this manual set. There are several ways to deal with these issues. The authenticity of the manuals' procedures, for example, can be improved by arranging more tests for the manuals before they are published. This could be conducted as, for example, random testing of different manual procedures by the documentation team, or by integrating manual testing more thoroughly as a part of the release tests for products. The documentation team could also spend some time testing previous versions of

manuals to get new information for the next version. It is important to remember that it is not always necessary to test the entire manuals. Testing only a few procedures here and there is, after all, better than testing nothing at all. Occasionally it might also be a good idea to involve actual users in these test situations, but even this is not necessary every time a test is conducted.

Another way to improve the authenticity of manuals' procedures would be to get the designers of the products as well as the product managers more deeply committed to the manual creation process. Having these people, and others with close connections to the customers, take their share of the process more seriously would most likely increase the general accuracy of the manuals.

Improving the structure of the manuals may turn out to be a bit more complicated. Of course testing the manuals can also help with this aspect, provided that the manuals are tested by someone other than the person who wrote the manuals. More thorough proofreading of the manuals may also help with the structure issue. Also simply going through the different manuals of the set simultaneously (the manuals are usually proofread one at a time) can help determine which instructions and procedures belong to which manual. Also having thorough indexes in the manuals would help users make better sense of the current structure of the manuals.

This usability study was intended as a pilot project for similar studies in the future. As the study succeeded as well as it did, bringing interesting results on the usability of the tested manual set, the same test structure can also be recommended to be applied to the documentation of other products. Some minor improvements to the test structure are of course possible. In this study the seven test sessions proved enough to determine the usability of the manual set. Also the manual extracts, which were selected fairly

randomly based on their length and the level of expertise required, proved to be rather well selected as the users clearly had problems with similar issues (and in similar places) when using the instructions.

To make the results of future studies more reliable, the number of samples (of both test users and manual extracts) can, for example, be increased. Also the selection of manual extracts could be made on more scientific basis, for example, according to a user analysis that determines both the actual needs of the users and the most common tasks that they ordinarily perform.

Some of the results of this study, however, can also be implemented as such to other manuals within the company. Updating the documentation procedure to include further testing for authenticity and structure, for example, will surely benefit all customer documentation within Vaisala.

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MW21 DigiCORA III Technical Reference

MW21 DigiCORA III User's Guide

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Appendix

TEST QUESTIONNAIRE

ABOUT THE TEST

1. What did you think of the test tasks? Were they:
    a) Difficult
    b) Easy
    c) Something in between

    WHY? _____

2. How did you manage performing the tasks with the manuals? Was is:
    a) Difficult
    b) Easy
    d) Something in between

    WHY? _____

3. Do you think you could have managed without the manuals? (YES/NO)
    WHY/HOW? _____

ABOUT THE SYSTEM

1. In what capacity do you use the MW21 DigiCORA III system?
    a) Operator
    b) Administrator
    c) Both
    d) Other, what:_____

2. Approximately how often do you use the MW21 DigiCORA III system?
    a) Never
    b) Rarely
    c) Monthly
    d) Weekly
    e) Daily

3. Should you encounter problems with the MW21 DigiCORA III system, where do you normally/most often seek help?
    a) You try once more on your own
    b) You ask a colleague
    c) You call the HelpDesk
    d) You read the manual
    e) Other, what:_____

ABOUT THE MANUALS

1. How often do you use the MW21 DigiCORA III manual set?
    a) Never
    b) Rarely
    c) Monthly
    d) Weekly
    e) Daily
    f) Every time you have a problem with the system
    g) Every time you use the system

2. How often do you find the information you need in the manuals?
    a) Never
    b) Rarely
    c) Sometimes
    d) Often
    e) Always

4. What methods do you use to find the information you need in the manuals?
    a) Index
    b) Table of contents
    c) Browsing the headings
    d) Browsing the figures
    e) Reading and memorizing the manual
    f) Other, what:_____

5. When you don't find the correct information in the manual, why do you think this is?
    a) You are using a wrong manual by mistake.
    b) The structure of the manual is not logical.
    c) The manual is missing vital search elements.
    d) The information is not in the manual.
    e) Other, what:_____

6. How would you describe the structure of the manuals? Is it:
    a) Badly organized
    b) Confusing
    c) Understandable
    d) Logical
    e) Other, what:_____

7. How would you describe the information content of the manuals? The manuals contain:
    a) Too much information
    b) Too little information
    c) Enough information
    d) The wrong kind of information
    e) Other, what:_____

8. How would you describe the terminology in the manuals? Is it:
    a) Too technical
    b) Confusing
    c) Appropriate
    d) Not technical enough
    e) Other, what:_____

9. Do you have any other comments, suggestions, or questions about the manuals?

Tampereen yliopisto
Kieli- ja käännöstieteen laitos
Englantilainen filologia
TIINA NIKANDER: Usability of Vaisala's Customer Documentation, 113 sivua, 3 liitesivua.
Pro Gradu -tutkielma
Toukokuu 2003

Tutkimuksen tavoitteena oli perehtyä säähavaintolaitteistoa valmistavan Vaisalan asiakasdokumentaatioon ja tutkia sen käytettävyyttä. Toisin sanoen, tavoitteena oli selvittää pystyvätkö Vaisalan asiakkaat käyttämään Vaisalan tuotteita ja suorittamaan tarvittavat tehtävät tuotteiden mukana saamiensa käyttöohjeiden avulla. Koska Vaisalan koko asiakasdokumentaatiota oli mahdotonta tutkia, kohteeksi valittiin DigiCORA III Sounding System -niminen tuote ja sen seitsemän manuaalia sisältävä asiakasdokumentaatio. Näistä seitsemästä manuaalista valittiin vielä neljä katkelmaa tarkempaa tutkimusta varten.

Tutkimuksessa hyödynnettiin kahta teoriaa, käytettävyyttä (usability) ja helppoymmärteisyyttä (accessibility). Tutkimus muodostui kahdesta vaiheesta. Ensimmäisessä vaiheessa valitut manuaalikatkelmat analysoitiin helppoymmärteisyysteorian (accessibility) valossa. Tämän jälkeen samoja manuaalikatkelmia käytettiin käytettävyystestissä (usability test), jossa asiakkaita pyydettiin suorittamaan tiettyjä tehtäviä manuaaleja apunaan käyttäen.

Helppoymmärteisyysanalyysissä keskityttiin manuaalien terminologiaan, sekä kielen että manuaalikatkelmien rakenteeseen. Terminologian osalta tavoitteena oli erityisesti selvittää miten teknistä manuaaleissa käytettävä terminologia on ja miten konsistentisti sitä on käytetty. Kielen osalta analysoitiin missä määrin manuaalit noudattavat tekniseen viestintään soveltuvan yksinkertaistetun englannin (Simplified English) säännöstöä. Rakenteen osalta yhtenä tavoitteena oli tutkia manuaalien rakennetta yleisesti lähinnä tietojen löytymisen kannalta. Yksittäisten manuaalikatkelmien rakenneanalyysissä erityispaino oli katkelmissa kuvattujen proseduurien autenttisuuden tarkastelussa.

Käytettävyystestissä keskityttiin tutkimaan erityisesti tiedon löytymistä manuaaleista ja sitä miten helppoa manuaaleja oli muuten käyttää. Lisäksi tarkkailtiin esiintyikö testihenkilöillä ongelmia helppoymmärteisyysanalyysissä tutkittujen teemojen eli terminologian, manuaalien kielen, ja manuaalien rakenteen kanssa.

Helppoymmärteisyysanalyysin tulosten perusteella Vaisalan manuaalien helppoymmärteisyysasteen voisi määritellä tyydyttäväksi. Perusproseduureja kuvaavien manuaalikatkelmien helppoymmärteisyysaste oli lähellä erinomaista, kun taas vaikeampien proseduurien kohdalla manuaalikatkelmien rakenteessa ja proseduurien autenttisuudessa esiintyi puutteita. Sama tulos vahvistui edelleen käytettävyystestissä, jossa kuitenkin tiedon löytyminen nousi varsinaista manuaalikatkelmien rakennetta suuremmaksi ongelmaksi.

Tuloksista voidaan päätellä että Vaisalan asiakasdokumentaation käytettävyys on vähintään tyydyttävää. Parannukset ovat mahdollisia mm. proseduurien autenttisuuden ja manuaalien rakenteen suhteen. Näitä voisi parantaa mm. lisäämällä manuaalien testausta, oikolukua, ja rakenteen pohdintaa. Tutkimuksen onnistuminen antaa myös aiheen miettiä vastaavanlaisten käytettävyystutkimusten suorittamista Vaisalan muille manuaaleille.