

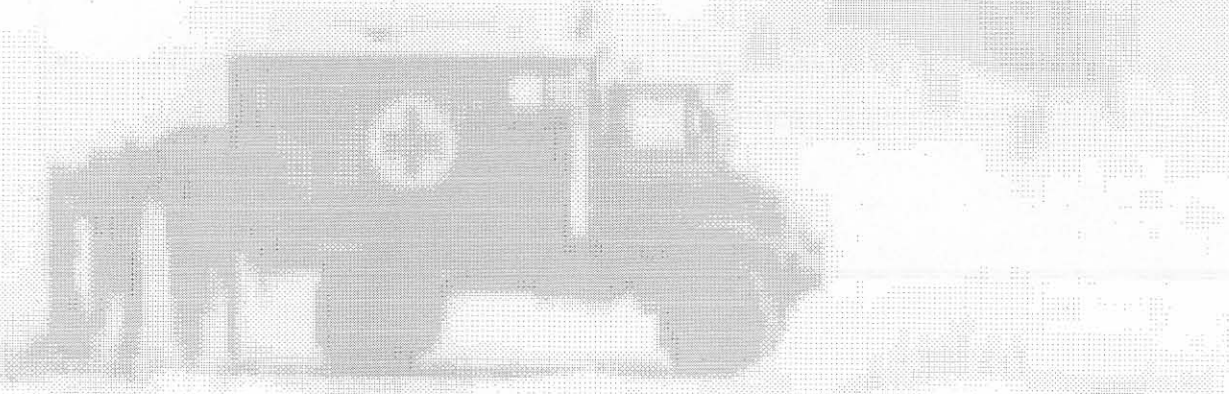
## CHAPTER 2

### LITERATURE REVIEW

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### *Literature review*

Presentations. How can you use multimedia to make presentations more effective? The use of multimedia in the workplace. The use of multimedia in the classroom. The use of multimedia in the home. The use of multimedia in the hospital. The use of multimedia in the military.



This section explores multimedia and multimedia applications, for a variety of purposes, such as education, training, and simulation.

#### 2.2.1 Multimedia

Multimedia is defined by Willis (1995) as 'any document which uses multiple forms of communication, such as text, audio and/or video'. When the end user is allowed to control what and when the elements are delivered, it is interactive.

## CHAPTER 2

### LITERATURE REVIEW

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#### 2.1 Introduction

This chapter gives an overview of the literature to address the following research sub-questions:

- **Presentation:** How can text, images, graphics and animation be combined to create an attention-getting, realistic environment to simulate the deployment of the field hospital and provide information to prepare military nurses for functioning during military operations?
- Which **delivery system** will be best suited, taking into consideration the constraints and restrictions of the South African National Defence Force (SANDF)?

#### 2.2 Presentation

This section explores multimedia, multimedia building blocks, how to create or gain attention and simulation.

##### 2.2.1 Multimedia

Multimedia is defined by Willis(1995) as :any document which uses multiple forms of communication, such as text, audio and/or video". When the end user is allowed to control what and when the elements are delivered, it is interactive

multimedia (Vaugh,1998:5). Schwier & Misanchuk (1993:6) argue that whether multimedia programs happen on one screen, two screens, a video wall or in virtual reality, matters very little. The resonance and interactivity of the program lend it its identity.

Fox, as quoted by Liu *et al.*, describes multimedia as a “software program or document containing media such as text, audio, video, animation, and graphics combined or hyper linked and presented in a non-linear and interactive mode for the purpose of exploring one or more ideas”. Vaughan (1998:4) describes multimedia as any combination of text, graphic art, sound, animation and video delivered to an end-user by computer or other electronic means. When the end-user is allowed to control which and when the elements are delivered, it is referred to as *interactive* multimedia. When a structure of linked elements is provided through which the user can navigate, interactive multimedia becomes *hypermedia*. A multimedia project needs not be interactive to be called multimedia. When a multimedia project starts at a beginning and runs through to an end with no interaction from the viewer, it is known as *linear*. However, when users are given navigational control and can move through the content at will, multimedia becomes *non-linear* and interactive. The four fundamental organising structures used (often in combination) in multimedia projects are (Vaughan 1998:464):

- **Linear.** The user navigates sequentially, from one frame or bite of information to another.
- **Hierarchical.** The user navigates along the branches of a tree structure that is shaped by the natural logic of the content.
- **Non-linear.** The user navigates freely through the content of the project, unbound by predetermined routes.
- **Composite.** The user may navigate freely in a non-linear way, but is occasionally constrained to linear presentations, movies or critical

information and/or data that are most logically organised in a hierarchy.

According to Vaughan (1998:9) the use of multimedia is appropriate whenever an interface connects a human user to electronic information of any kind. Multimedia furthermore enhances traditional text-only computer interfaces and yields measurable benefit by gaining and holding attention and interest, since multimedia improves information retention. Multimedia is presently enjoying widespread use in education and training programs and will provoke radical changes in the teaching process of the future since teachers may become more like guides and mentors instead of the primary providers of information and understanding.

From the above-mentioned definitions of multimedia it is evident that multimedia can constitute any number and combination of different media for the manufacture of multimedia products. In order to produce a multimedia product, it is necessary to make use of individual building blocks. The most appropriate building blocks to be used for the intended multimedia product, are discussed below.

## **2.2.2 Multimedia building blocks**

### **2.2.2.1 Text**

Text, and the ability to read and write it, are expected and necessary skills within most modern cultures and societies. Text is still the most widely used medium to deliver information that can have potent meaning, albeit distributed by means of electronic media. Computer screens provide a very small work space for developing and explaining complex ideas. At some stage, it will be necessary to deliver high-impact or concise text messages on the computer screen in as condensed a form as possible. The choice of font size and the number of headlines placed on a particular screen must be related to both the complexity of the message and its venue. When a message forms part of an interactive project where the user is seeking information, a large quantity of textual information can be placed on a screen before it becomes overwhelmingly busy. Too little text on a

screen, however, could require a large number of page turns and mouse clicks which can cause unnecessary waiting periods and delays. It is therefore necessary to attempt to put neither too much nor too little text on a single screen (Vaughan,1998:190).

With the recent explosion of the Internet and the World Wide Web (WWW), text has become more important than ever. During the last number of years, the meaning of the word “text” in its traditional sense, has however, gradually been eroded by its electronic counterparts on diskette, CD-ROM and the Internet, and “text” is becoming increasingly synonymous with “hypertext” (Kussler & van der Merwe, 1998:323). Hypertext refers to any computer application which allows non-linear exploration of information. According to Slatin (1991:153), hypertext in particular not only serves as a tool for presentation, but also as a device for the composition of thought.

#### 2.2.2.2 Text attributes

Text can have various attributes which have an effect on how the text is displayed. The various attributes of text and which can influence the way the text is seen and perceived by the user, is discussed below.

##### ■ Fonts and faces

The font, or typeface, is the name given to a collection of characters with a distinctive shape. In computer science, it generally includes not only the “normal” or plain appearance of the characters, but also the italics, boldface and combinations thereof. The names of fonts can thus be modified to include such descriptors. Fonts may furthermore assume different styles, e.g. outline, shadow, small caps, reverse and various combinations thereof. Venesky & Osin (1991:218) suggest being as near as possible to the excellence of the printed typography, since the resolution of the printed media is one order of magnitude above that of the standard screens.

## ■ Print size

The golden rule for choosing a font is that it should be large enough to be read comfortably. The size of print required is partly influenced by the screen definition - the higher the definition, the more likely it is that small print can be read more comfortably (Schwier & Misanchuk, 1993:240).

## ■ Type styles

Schwier & Misanchuk (1993:212) state that good writing style of instructional material dictates that the use of unusual type styles (e.g. italic, bold, reverse, shadowed etc.) be strictly limited. He suggests that plain text should be stuck to with the occasional use of bold or italics for specific purposes. The use of italics for mere emphasis, or for foreign words, is specifically discouraged and the use of italics is recommended only for

- introducing technical terms the first time they are used;
- titles of books, films, articles and periodicals;
- characters, words or phrases that are cited as linguistic examples;
- specialised applications (e.g. genera and species and statistical symbols); and
- distinguishing different types of material.

Schwier & Misanchuk (1993:242) quote the following suggestions regarding fonts and style as a synthesis of advice from various sources adding thereto some of their own:

- When reverse video is used to highlight text, one reverse video space should be left before and after the relevant text to provide a border around the characters.
- Since underlining text can make the following line of text difficult to read, and since most computers nowadays provide italic and boldface fonts, italic or boldface should be used instead of underlining.
- Blinking and flashing text should be used extremely rarely and cautiously and should never be used in more than one place on the same screen.

#### ■ Cases

Some authors suggest that fonts should have lower case letters as well as variable character widths (proportional spacing) which seems to be a standard feature on most computers nowadays. A combination of upper case and lower case letters seems to promote legibility as opposed to the use of upper case letters only.

#### ■ Serif versus Sans Serif

Serif and sans serif refers to the type's mechanical and historic properties. On printed pages, serif fonts are normally used for body text because it is believed that the serifs help guide the reader's eye along the line of text. Sans serif fonts are traditionally used for headlines and bold statements. Since the computer screen is not the same as printed text, Vaughan (1998:189) argues that sans serif fonts are far more legible and attractive when used in the small sizes of a text field on a screen. This author suggests to use what is right for the specific delivery system, which may not be the same as what is right when it is printed on paper.

- Justification of text

A large number of authors are of the opinion that the right-justification of text is detrimental to reading and when text is right-justified, it must be accompanied by proportional spacing. Right-justification of text typically creates “rivers of white”, unless some words in a paragraph are hyphenated which further inhibits comprehension. Hyphenation can cause a reader to skip from the beginning of a line to the end of the previous line. According to Schwier & Misanchuk (1993:244) the bottom line seems “Don’t right-justify text on the screen”.

- Menus for navigation

Multimedia and web sites normally consist of a body of text content through which a user can navigate. Text is useful to users to provide perpetual cues about their location within the content. When a user must click through many layers of menus in order to reach a goal, they may get lost.

The simplest menu consists of a text list of topics from which the user can exercise a choice of what is to be accessed. The more locations included in the menu list, the more options will be available for navigation. The four fundamental organising structures often used in combination in multimedia projects have already been discussed in paragraph 2.2.1 (Multimedia) and will not be repeated here. Navigation within a project depends on the specific organising structure used and forms part of the user interface.

Many navigation maps are essentially non-linear which affords the user the opportunity to freely jump to an index, a glossary or various menus. Vaughan (1998:467) argues that it is important to give viewers a sense that free choice is available which empowers them within the content of the subject matter. Consistent clues regarding importance, emphasis and direction should still be provided by varying the typeface size and look, colouring, indenting or using special icons. He states that it is important to give users a sense of free choice,



but that too much freedom can be disconcerting and may result in viewers getting lost.

To overcome this problem, Vaughan (1998:468) suggests that content be organised along a steady stream of the major subjects, allowing users to branch outward in order to explore details. He furthermore suggests the provision of an anchor, with buttons leading to expected places and to build a familiar landscape to which the user may return at any time.

#### ■ Buttons for interaction

In multimedia, buttons are the objects that make things happen. They were invented to result in certain properties such as highlighting, other visual or sound effects to indicate to the user that what was intended, had been achieved. Vaughan (1998:195) states that the default buttons and styles supplied with multimedia and HTML page authoring systems seem overused or trite. However, by using common button styles, shapes, borders and highlights, the probability that the user will know what to do with them is increased; especially when they are also labelled. He suggests that a font be picked which is legible and then to adjust the text size of the labels to provide adequate space between the rim of the button and the text or label. Vaughan (1998:195) also proposes the highlighting of a button when the mouse is over it or when it has been clicked.

Schwier & Misanchuk (1993:228) are adamant that care should be taken to ensure that learners understand how they are to respond with regards to interactivity. While it may not be necessary to place elaborate instructions on each screen, at least some guidance should be given the first few times a particular response method is employed.

#### ■ Fields for reading

According to Vaughan (1998:198) research has shown that reading text on a

screen is slower and more difficult than reading text on paper. Unless the purpose of the multimedia project is to display large blocks of text, it is suggested that the user be presented only with a few paragraphs of text per page. A font that is easy to read should be used, and it must be attempted to display whole paragraphs on the screen, and to avoid breaks where users must switch pages to read an entire paragraph.

Treuhaft (1995:2) is of the opinion that many designers put too much text on the screen and therefore suggests that the number of lines of text should be limited to six or eight. Text lines longer than 60 characters are difficult to read, because the eye has to shift too wide a distance to read from line to line without losing the place (Reeves, 1994).

#### ■ Symbols and icons

Symbols are concentrated text in the form of stand-alone graphic constructs which convey meaningful messages. The value of icons for representing certain activities has become common. Icons can depict choices succinctly, thereby reducing the learner's memory load. Schwier & Misanchuk (1993:247) state that, for icons to be effective they must be

- unambiguous;
- relatively small; and
- simple line drawings.

Symbols and icons have become very popular for indicating highly repetitive actions or activities such as traversal through a sequence via arrows. Vaughan (1998:201) recommends that symbols and icons be treated as text because they carry meaning. Some symbols must be learned before they can be used as message carriers, but Vaughan (1998:201) warns that the developer of a

multimedia project should not be seduced into developing an own language of symbols and icons.

#### ■ Animating text

Animating text is one of the ways that can be used to retain a viewer's attention when displaying text. Text can, for example, be animated to "fly" onto the screen; to "grow" one character at a time; keywords can be stacked and made to fly past the viewer; others can be made to rotate, spin or dissolve (Vaughan, 1998:203).

Animated text must, however, not be overdone since such animations will inevitably become boring for the reader thereof.

#### ■ Layout of text

Alessi & Trollip (1991:35) devote a large section on text layout and their suggestions in this regard are summarised below:

- Scrolling should always be avoided since most people find it hard to read text when it is scrolling. Because it is difficult to distinguish between the boundary between new information and old, important information is sometimes erased unintentionally. Lynch & Horton (1997) state that less than 10% of Web readers ever scroll beyond the top of web pages.
- Sentences and paragraphs should be well formatted and the use of indentations or blank lines to indicate new paragraphs should be used. Text should not be squeezed into half of the display leaving the rest almost empty.
- Spacing between lines influences the readability and line spacing should be adjusted in such a manner as to make text readable and

Table 2.1 Principles of screen design

- When a combination of text and graphics appears on a display, it is useful to enclose the primary text in a box (isolation).
- Since blinking text is annoying and makes text difficult to read, it should never be used. Boxes and arrows are more effective in this regard.

Organising information requires that methods be used to allow users the ability to access information in a controllable fashion. Program information must be organised into manageable segments so that users are not overwhelmed by the amount of information contained in the program (Reeves, 1994).

### 2.2.2.3 Screen design

According to Schwier & Misanchuk (1993:212) the purpose of interactive multimedia instruction is not to dazzle, impress, amaze or to delight, but rather to communicate. While gaining (and holding) attention are important concerns in any communication process, a tendency might be experienced to want to apply all facilities that multimedia offers. These authors suggest that the basic principles that should be followed in screen design are: simplicity, consistency, clarity, and aesthetic considerations such as balance, harmony and unity.

For the purpose of this study, the following table was constructed by the researcher in order to demonstrate the principles of screen design.

**Table 2.1 Principles of screen design**

Simplicity	Consistency	Clarity	Aesthetic considerations
<p>Keep it simple and straightforward.</p> <p>Present only the message.</p> <p>Use as few textual and audiovisual stimuli as possible.</p>	<p>Level of discourse and style of presentation.</p> <p>Placement of various items e.g.</p> <ul style="list-style-type: none"> <li>* orientation information</li> <li>* navigation devices</li> <li>* student input</li> <li>* feedback</li> <li>* operating instructions</li> </ul> <p>Use of colour.</p> <p>Access structure.</p> <p>Use of cues e.g.</p> <ul style="list-style-type: none"> <li>* font (including size and style)</li> <li>* bolding</li> <li>* italics</li> <li>* colour</li> </ul> <p>Style of graphics.</p> <p>Screen density and white space.</p> <p>Terminology e.g.</p> <ul style="list-style-type: none"> <li>* directions</li> <li>* prompts</li> <li>* menus</li> <li>* help screens</li> </ul> <p>Names of commands and manner of evoking them.</p> <p>Interaction behaviour required.</p>	<p>Keep the instruction at a language level compatible with the learners.</p> <p>Use "point form" (bullets) whenever possible.</p> <p>Use the active rather than the passive voice.</p> <p>Stay away from negative statements.</p> <p>Use informal language.</p> <p>Use personal pronouns.</p> <p>Use familiar examples.</p> <p>Use inclusive language.</p>	<p>Balance.</p> <ul style="list-style-type: none"> <li>* formal vs informal</li> <li>* symmetric vs asymmetric</li> </ul> <p>Harmony.</p> <ul style="list-style-type: none"> <li>* consistency (font &amp; graphic style)</li> <li>* repetition (font &amp; graphic style)</li> </ul> <p>Unity.</p> <p>Lots of white space.</p>

Szabo & Kanuka (1998:27) describe the principles of screen design as to include unity (also referred to as harmony), focal point (also referred to as dominance or emphasis), balance, and colour (which was not used in their study). They add that when the designer strives for a technically good design, the inclusion and use of these design principles produces a much better visual image.

- Unity

Szabo & Kanuka (1998:27) state that if objects in a design appear separate and/or unrelated, the pattern falls apart and appears unrelated.

- Focal point

The purpose of a focal point is to draw attention, thereby encouraging the viewer to continue looking. The two techniques commonly used to create a focal point are contrast and isolation (Szabo & Kanuka, 1998:30).

- Balance

Szabo & Kanuka (1998:31) point out that a lack of balance is disturbing, and once a designer selects images for a composition, a decision must be made as to how the images are to be balanced within the page.

Szabo & Kanuka (1998:31) state that using a lesson with good screen design principles (as set out above) appears not to affect achievement one way or the other. These authors state that it indicates that the screen design principles chosen in their study do not affect recall learning, but that the poor use of these design principles is related to increased instructional time and a reduced completion rate.

#### 2.2.2.4 Colour combinations

The use of colour is closely related to that of graphics. New hardware and software make the use of colour increasingly easy. While colour is effective for attracting attention, colour is easily misused so as to be ineffective or even detrimental. The use of more colour decreases the effectivity thereof. Schwier & Misanchuk (1993:245) recommend a cautious approach to the use of colour, also because colour monitors frequently vary widely in their representation of colours which makes it difficult for a designer to predict what individuals will actually see on their screens.

Schwier & Misanchuk (1993:245) recommend two approaches that can bolster attractiveness where colours have to be used:

- The reduction of saturation (intensity) of the colours used. Adjusting the saturation of colours helps produce less garish displays since pastels can be more pleasing to the eye than computer default colour palettes.
- The restriction of the number of colours (hues) employed. Attractive displays can be made by using different shades of the same basic colour.

Alessi & Trollip (1991:42) suggest that whenever colour is used, it must be attempted to convey the information in another way as well. An example of this is that when graphs are presented in colour, they should be labelled with text as well.

Colour is perhaps the most abused characteristic and text should preferably be done in black and white or equivalent monochrome. The use of colour is only likely to make a difference when it is truly salient and seems unlikely to have a powerful effect when applied to text (Schwier & Misanchuk, 1993:243). Colours facilitate recognition equally, and both realistic and non-realistic colour materials are superior to monochrome materials for cuing (Berry, 1991). Treuhaft (1995:1) states that the visibility of text depends on the contrast between the text colour

and the background and suggests blue and black text on a white background. He suggests the use of red to highlight a single key word.

Still images may be the most important element of a multimedia project. No matter

Alessi & Trollip (1991:42) point out that some colours, especially those near the centre of the visual spectrum such as yellow and green, are easier to perceive than others; while colours at the extremes of the visible colour spectrum (reds and blues) are the most difficult perceptual colours and should be avoided for text or detailed pictures. Some colour combinations are better than others, and combinations that should be avoided are red with green, blue with yellow, green with blue, and red with blue. The simultaneous use of more than four to seven colours should also be avoided. Alessi & Trollip (1991:43) are convinced that the use of colour should be consistent with common usages in society: using green to mean “stop” and red for “go” will result in errors. Colour should be used sparingly for important information and should be avoided in text.

Regarding to the use of colour in web-linking, Kussler & van der Merwe (1998:327) warn not to use non-standard link colours:

- Links to pages that have not been opened, are blue.
- Links to previously opened pages are purple or red.

According to Nielsen (1999) these colours are standard in most web browsers and should therefore be used consistently. Creative designers may sometimes intentionally violate screen design principles for effect or to otherwise focus the user’s attention (Reeves & Harmon, 1994).

Nielsen (1999:30) suggest three primary uses of graphics during the design phase:

#### 2.2.2.5 Images

Most authoring systems available provide the necessary tools with which the graphical objects of multimedia can be created directly on the screen. Where these tools are not available, the authoring system normally makes provision for a



facility whereby images can be imported from another source.

Still images may be the most important element of a multimedia project. No matter what form such images are, still images are generated by the computer in one of two ways: as bitmaps (or paint graphics) or as vector-drawn (plainly- drawn) graphics.

Bitmaps are used for photo-realistic images and for complex drawings that require fine details, while vector-drawn objects are used for lines, circles, boxes, and other graphic shapes that can be mathematically expressed in angles, coordinates and distances. The appearance of both type of images depends on the display characteristics and resolution of the computer's graphics hardware and monitor. Both types of images can be stored in various file formats and can be translated from one type of file format to another and between computer platforms. Image files are normally compressed in order to save memory and disc space and many image formats use compression within the file itself. Vector objects are easily scalable without losing image quality or resolution. Most drawing programs offer several file formats for saving work (Vaughan, 1998:300).

#### 2.2.2.6 Graphics and animation

A major consideration regarding the effectiveness of graphic information is the importance of the information being presented. Attention should be focussed on the important information rather than on the unimportant information. Pictures, especially animated ones, capture attention more than text and therefore graphic presentations should be based on what is important in the text. Alessi & Trollip (1991:38) suggest three primary uses of graphics during the presentation part of a tutorial:

- As the primary information.
- As an analogy or mnemonic.

- As a cue.

Graphic information should be consistent with and integrated into the rest of the message and care should be taken to avoid excessive detail or realism, since detail can overload memory and cause confusion. Realistic pictures usually contain more detail than simplified ones. Graphics containing a vast amount of information should be broken down into its components or simpler parts. A useful technique is to produce *part* of a graphic and then to *overlay* the next part or add details (Alessi & Trollip, 1991:40).

#### GIF format

The user should be allowed to control the length of time used for looking at graphics and pictures should not disappear after a predetermined time period. This should be controlled by the user. Pictures should be presented simultaneously with the related text so as to afford the user the opportunity to inspect the illustration and the explanation together. Willis (1995) states that pages which take too long to download frustrate the user, and if home pages require the extensive use of graphics, the user should be warned.

When confronted with the question as to which format (GIF or JPEG) is the better format to use for storing bitmap images, Wurtzel (1997) states that it depends on the type of image, how small the image file is to be, and the way in which the image is to load.

- JPEG format

According to Wurzel (1997) photographs and graphics which contain large numbers of graphics and particularly colours that blend and fade into one another, are best saved in JPEG format. The reason for choosing JPEG format for images with more complex colour patterns is that this format makes it possible to save images with millions of colours.

Another important issue is the file size. JPEG permits a greater degree of compression than the GIF alternative, enabling quicker downloading times for larger graphics. JPEG appears to retain almost complete image quality for most photographs.

The JPEG format does not work well for graphics that contain large fields of colour, since these colour fields can break up and fragment. Another disadvantage of JPEG format is that it cannot be animated.

#### ■ GIF format

If an image has flat colour fields, it will compress well into the GIF format. The GIF option, however, restricts one to the use of 256 colours only (Wurtzel, 1997). As a result of this, photographs saved in GIF format produce dots which is the result of the GIF format's characterising adjustment of pixels within a graphic to simulate the display of colours not in the GIF format's colour palette. The background of a GIF format can be made transparent which results therein that the background colour of the browser window will be seen (Wurtzel, 1997).

Tashian (1998:5) states that GIF animations seem the best to use and lists some of the features of GIF animations as being

- smaller;
- faster;
- much easier to use than server push animations, since no special server access and configuration is necessary; and
- even if the browser does not support animated GIF images, the first frame of any GIF animation can still be seen.

### 2.2.2.7 “Drag-able” screen objects

The recent emphasis on object-orientated programming environments has resulted in the fact that objects can be moved on the screen by clicking and dragging them. Schwier & Misanchuk (1993:250) see the dragging of screen objects as reasonable to use since it provides variety to keyboard response. Users must, however, be given the opportunity to develop the necessary eye-hand co-ordination required by a mouse. Alessi & Trollip (1991:68) sees the dragging of screen objects as a useful type of interaction and makes a distinction between the dragging of words to label a picture, construct a sentence, answer a matching exercise or alphabetise a list. Pictures may be dragged to construct an apparatus, create a map or diagram, or match pictures to words.

### 2.2.3 **How to create/keep attention**

Alessi & Trollip (1991:11) state that, for perception of proper lesson elements to occur, the attention of the student must not only be initially attracted, but maintained throughout the lesson. Since effective instruction depends on presentations designed for easy and accurate perception, perception may be facilitated by many presentation design factors: detail and realism, the use of sound versus visuals, colour, characteristics of text such as its size and font, animation, and position of screen elements.

Attention is furthermore affected by many additional considerations including the level of student involvement, personal interests and foreknowledge of the student, lesson difficulty, novelty and familiarity, pacing and variety.

Alessi & Trollip (1991:32) summarise the four factors of gaining and holding attention as challenge, curiosity, control and fantasy. According to Keller, as quoted by Alessi & Trollip (1991:33), attention, relevance, confidence and satisfaction are the four design considerations relevant to creating motivational instruction.

Alessi & Trollip (1991:38) are of the opinion that graphic presentations should be chosen based on what is important in the text, because pictures, especially animated ones, capture attention more than text.

Colour is effective for attracting attention, but care should be taken not to use too much colour. The more colour is used, the less it will attract attention. Alessi & Trollip (1991:42) clearly state that colour can and should be used, like graphics, to attract attention to important information, but also warn that there is a danger that information may be lost when a student is colour blind (about one in fifteen). Colour should therefore be used as a redundant cue, which means that information should be conveyed in another way as well.

With regards to the effect of text layout on motivation and attention, Alessi & Trollip (1991:38) are of the opinion that consistency is more important than varying layouts. They believe that motivation and attention can and should be maintained, but through vehicles other than variable text layout. Considerable advantages can be gained with conventions that clearly indicate when new topics are being introduced, where to look for directions, or how to answer questions.

Venezky & Osin (1991:218) state that the computer display has a clear advantage over the printed media in terms of gaining attention. The computer screen has the usual possibilities for highlighting as are present in books, but the dynamic features characteristic of the computer environment add a dimension not available in print. These dynamic features are particularly useful for remedial loops, where the student's attention may be focussed on a particular expression by highlighting it during the remedial explanation. After this, a list of attention-getting or highlighting devices follow.

#### **2.2.4 Simulation**

Simulations differ from interactive tutorials since, with a simulation, the student learns by actually performing the activities to be learned in a context that is similar

to the real situation. The purpose of simulation is to help the student build a useful mental model and to provide an opportunity to test it safely and efficiently (Alessi & Trollip, 1991:119).

The different types of simulations are summarised in the following table which was constructed by the researcher for the purpose of this study.

**Table 2.2 Categories and types of simulation**

Simulation category	Type of simulation
<i>"About"</i> simulations	Physical simulations Process simulations
<i>"How to"</i> simulations	Procedural simulations Situational simulations

Alessi & Trollip (1991:119) point out that the word simulation has different connotations to people of different disciplines and that most simulations do not distinctly fall into just one of these categories, but are rather a combination or synthesis of more than one type.

According to Alessi & Trollip (1991:130) simulation has several advantages as an instructional tool as compared to using real-life situations for learning purposes. For the purpose of this study, the following table was constructed by the researcher to illustrate this.

**Table 2.3 Advantages and the convenience of simulations with examples**

Advantages of simulations	Examples
Advantages of simulations as instructional tools	<ul style="list-style-type: none"> <li>* They enhance safety.</li> <li>* They provide experiences not readily available in reality.</li> <li>* They modify the time frame.</li> <li>* They control the complexity of the learning situation.</li> <li>* They save money.</li> </ul>
Convenience of simulations	<ul style="list-style-type: none"> <li>* They cost less than real-life situations.</li> <li>* They are available at any time.</li> <li>* They are repeatable.</li> <li>* They are more controllable than reality.</li> <li>* They are not only imitations of reality, but simplifications of it which are instructionally advantageous.</li> <li>* They facilitate initial learning by simplifying the phenomenon.</li> </ul>

Simulations generally have three major advantages over conventional tutorials, drills, and tests. They enhance motivation, they have better transfer of learning and they are more efficient. Alessi & Trollip (1991:119) classify simulations in two main groups, namely those that teach about something and those that teach how to do something.

■ Simulations that teach *about* something

Physical and process simulations differ from other simulations in that they are **not as interactive**.

- Physical simulations

In computer-based physical simulation, a physical object or phenomenon is

represented on the screen, giving the student the opportunity to learn about it (Alessi & Trollip, 1991:120).

- Process simulations

Process simulation is generally used to inform students about a process or concept which does not manifest itself visibly, e.g. how the economy works. Instead of participating as in situational simulations, or constantly manipulating as in procedural simulations, the student selects values of various parameters at the beginning of the simulation, and then watches the process occur without intervention. Learning, in this case, comes from observing the effect of changing values on the outcome (Alessi & Trollip, 1991:123).

- Simulations that teach *how to do something*

- Procedural simulations

The purpose of most procedural simulations is to teach a sequence of actions or events that constitute a procedure. They most often contain simulated physical objects because the student's performance must imitate the actual procedures of operating or manipulating some physical entity. Whereas the physical objects in physical simulations are themselves the focus of the instruction, in procedural simulations the simulation of the physical objects is necessary to meet the procedural requirements (Alessi & Trollip, 1991:126). The primary objective of a procedural simulation is to teach the student how to do something, while a physical simulation teaches how something works.

A primary characteristic of procedural simulations is that there is one or more correct or preferred sequences of steps which the student should learn to perform. There are many different ways to reach the same conclusion, however, not all of them are equally efficient. A procedural simulation thus provides the opportunity to explore these different paths and their associated effects.



- Situational simulations

Situational simulations deal with the behaviours and attitudes of people in different situations, rather than with skilled performance (Alessi & Trollip, 1991:127). Unlike procedural simulations, which teach sets of rules, situational simulations usually allow the student to explore the effects of different approaches to a situation, or to play different roles in it.

## 2.3 Delivery systems

This section explores multimedia delivery systems which include the use of computers, CD-ROM, Hypertext Markup Language (HTML), and CD-ROM/WWW hybrids. The future of training in the SA National Defence Force (SANDF) and the constraints thereof on the delivery of multimedia are also discussed.

Multimedia for learning takes many forms and requires large amounts of digital memory when stored in an end-user's library, or large amounts of bandwidth when distributed over a network. It is thus of cardinal importance to find a delivery system which will be best suited for the information transfer regarding the deployment of the field hospital. Schwier & Misanchuk (1993:151) state that the location of the audience is important. If learners are centrally located, many types of training approaches are possible. If the audience is, however, dispersed, located over a wide geographic area, then an individualised approach is necessary which has the potential for power, immediacy, durability, and the flexibility of interactive multimedia becomes more attractive. These authors state that multimedia can provide a cost-effective means of distributing instruction, especially considering the savings realised from travel and lodging expenditures often associated with events offered centrally.

Mudge (1999:12) distinguishes between the advantages and disadvantages of multimedia delivery. Some of these are appropriate to all forms of teaching, some are specific to using multimedia, while some are also specific to delivery through

the Internet. He does, however, recommend that the WWW should be used to supplement rather than replace existing teaching methods. The most important **advantages** of multimedia delivery, as quoted by Mudge (1999:12) are the following:

- Students are able to use computer-based learning when they want to, not just at specified times and can thus choose the best time for them.
- Distance learning may be best for older, mature students who have family considerations and access from home may provide the best solution for their particular needs.
- Material can be accessed as many times as students need, and certain more difficult concepts can be repeated as many times as necessary.
- A range of different media can be used in concert to reinforce the message.
- There is no limit to the number of students who can access the information stored in a computerised teaching module.

The most important **disadvantages** as quoted by Mudge (1999:13) for multimedia delivery are the following:

- The bandwidth could be problematical since text takes up only a small amount of space, while pictures take up more and video can be very demanding.
- Security problems, which include the potential problem of downloading files and/or programs from the Internet that may contain viruses.
- Before anything can be distributed by the WWW, the information needs to be authored into the correct language, usually HTML, which requires

considerable time and skill to create and present the information in the best manner to get a message across.

- Data and information presented needs to be updated as the field expands and progresses.
- Less contact with students.

### 2.3.1 Computers

Computers have been employed to perform a variety of tasks in education and training. They are often used in diagnosing student needs, delivering instruction, drilling students in need of practice, grading student responses, reporting student progress, and simulating expensive equipment or dangerous experiments. The computer, when equipped with well-written software, has several strengths that combine to make it appropriate for instructional use. On the other hand, the computer also has weaknesses which must be considered when attempting to convey a particular message (Hannafin & Peck, 1988:33).

Hannafin & Peck (1988:35) conclude that both teachers and computers have strengths that serve as logical solutions to educational problems. Neither can fully replace the other, nor can either be rejected categorically as ineffective or undesirable. Students are best served when teachers and computers are employed in combination, capitalising on strengths and minimising the effects of weaknesses. Landa (1984) views computers as a “cadre of teaching assistants” performing a variety of tasks, from presenting remedial instruction to introducing new topics to the capable, self-directed learners who are ready to proceed.

To take advantage of the computer’s particular capabilities and not waste them, the first rule for correctly using or developing Computer Based Instruction (CBI) material is to do so in a situation where the computer is *likely* to be beneficial. Those situations are where the **cost of instruction by other methods is very**

**high, safety is a concern**, it is very difficult to teach the material by other methods, extensive individual student practice is needed, student motivation is typically lacking, or **where there are logistic difficulties** in traditional instruction. While none of these situations guarantees that a computer will be beneficial, the probability is nevertheless increased. High quality and creative instructional design coupled with careful evaluation and revision are also necessary (Alessi & Trollip, 1991:6).

It is very clear that the cost of training nurses with regards to the deployment of the field hospital is very high as a result of the fact that they presently have to be trained on a centralised basis which incurs cost such as housing, daily allowance, rations and a loss of productivity when they are away from their normal places of duty. A number of logistic difficulties are also experienced e.g. the fact that expensive equipment has to be transported and deployed which place a heavy burden on operational, support and maintenance personnel. The movement of expensive equipment poses a further risk to such equipment which invariably incurs cost.

The reduced cost and widespread availability of computer technology means that, in principle, many people can afford to have their own personal computer that is capable of delivering interactive learning resources. The development of computer-based tuition can therefore offer an attractive substitute for 1:1 human tuition. Provided the software is well-designed, it should be able to adapt its behaviour to the specific needs of the individual user and provided that suitable telecommunication facilities or delivery systems are available, this type of tuition can be made totally independent of geographical location. Students can receive it wherever they are located (Barker 1994:6).

### 2.3.2 CD-ROM

CD-ROM (compact disc read-only memory) has emerged during the last few years as one of the most cost-effective distribution media for multimedia projects since it

can contain unique mixes of images, sound, text, video and animations controlled by an authoring system to provide unlimited user interaction. Most personal computers sold include a CD-ROM player, and the software that drive these computers is commonly available on CD-ROM discs.

### 2.3.2.1 Characteristics of CD-ROM

CD-ROM discs have specific sectors and fields that must contain certain kinds of data in order for them to work properly. According to Schwier & Misanchuk (1993:104-107) CD-ROM has the following attributes:

- Very large amounts of information, up to 660 MB per disc when only digital data are encoded, can be stored on them. Careful planning is, however, required with regards to the arrangement of and the relationships between the various files when large quantities of data are placed on a single disc. They are also able to hold a variety of kinds of information and because of the digital nature of the encoding, they are inherently multimedia.
- CD-ROM discs can be produced at a relatively low unit cost, are very economical for the distribution of software and can be produced relatively quickly.
- CD-ROM discs provide a robust and stable storage medium, inasmuch as they are constructed like videodiscs. They do not deteriorate significantly with age and do not require much care in handling as magnetic media. Their toughness makes them a viable alternative where more delicate media might suffer.
- These discs are a read-only medium, which means that, once pressed, they cannot be altered. Although this feature is an advantage in some cases, not all applications require only reading of files.

- CD-ROM discs offer random access to information stored on them, albeit at a modest seek time. Users will have a tendency to want to move files from the CD-ROM onto a hard disc to increase the speed of access. Many times, however, the files are too large to do this conveniently and for this reason it may be necessary to implement a system of installing and removing files from such a hard disc. CD-ROM is considered a better distribution medium than as a real-time access medium and audio and video will require good real-time compression techniques before CD-ROM is viable for their real-time access.
- They are portable, both in terms of size and weight, and are compatible with all brands of players.
- CD-ROM discs provide a standardised file format which works with a variety of computer operating systems, irrespective of who manufactured the computer or the CD-ROM disc.

From the above, it must be concluded that CD-ROM offers a high-capacity integrated storage medium for the storage and dissemination of learning resources for use in many learning situations. This technology is particularly useful for the support of distance learning, open learning, and use in the office or home.

Since a large number of nurses within the SA Military Health Service have access to a computer, but are located throughout the country, the use of CD-ROM for the delivery of a multimedia project, seems a logical option.

### **2.3.3 Hypertext Markup Language (HTML)**

The files which make up web sites on the Internet are structured similar to *Windows*® Help-files. Since the HTML with which web sites are created provides for referencing within and between files (and not for “expanding” text), the problem of bad readability and disorientation is often aggravated (Kussler & van der

Merwe, 1998:324). According to these authors, there are two basic hypertext functions: Internal expansion when activated and external referencing of other files. They furthermore point out that expanding text adds to the length of the files which complicates reading; while referencing, which is activated from long lists, causes users to lose their place within the hypertext. This seems to be the basic problem confronting hypertext developers and hypertext readers.

According to Plewe (1995:634) HTML was envisioned to be a format that would allow scientists using very different computers to share information seamlessly over the network, and several features were necessary for this:

- **Platform independence**, in which a document can be displayed similarly on computers with different capabilities (i.e. fonts, graphics, and colour) was vital to the varied audience.
- **Hypertext**, which allows for any word or phrase in one document to reference another document; would allow for easy navigation between and within the many large documents on the system.
- Rigorously **structured documents** would allow for advanced applications such as converting documents to and from other formats and searching text databases.

Kussler & Van der Merwe (1998:330) conclude that a concise answer to the question as to when good hypertext is found, is when an application

- does have a clear hierarchical structure;
- utilises the unique properties of the visual display screen;
- which, in turn, is enhanced by a sensible and consistent system of external controls and internal links;

- 2.3.5 so that it provides users with free and effortless access to every unit of information contained therein.

This section explores the main points to be considered in constructing a web site.

### 2.3.4 CD-ROM/WWW hybrids

#### 2.3.4.1 Layout of a web site

One of the problems regarding the delivery of educational content via the WWW, has been the unreliability and inconsistency of information transfer via Internet connections which is largely caused by bottlenecks at the server level, or because of congestion at any point in the line of transmission. Larger multimedia files require lengthy download times which result in the fact that students have to wait long to view or hear these files. Diaz (1998:90) proposes the use of a CD/Web hybrid, which is essentially a web site on a CD-ROM disc, as a workable solution to these problems.

Pressing a multimedia web site onto a CD-ROM, may prove to be one of the most efficient and effective ways of delivering educational content via the WWW. The creation of a web site that could be played off a CD-ROM drive would enable an instructor to include rich audio and video content since the delivery would not be restricted to the slow transfer speeds of the modem. Hyperlinks on the CD-ROM would take a student from a CD-ROM out to the Internet, and back, seamlessly. The ability to integrate more multimedia resources onto the web site could increase student activity, curiosity, and interest, thereby increasing student motivation (Diaz, 1998:93).

There are a number of guidelines to be followed when designing a web site for the WWW.

The fact that information that is likely to change in the short term, cannot be included on a CD-ROM/WWW hybrid as well as the fact that updates to a CD-ROM are not as convenient or as immediate as updates to a web site, are disadvantages of this particular delivery system.

organisation. The goal is to be consistent and predictable (Lynch & Horton, 1997).



### 2.3.5 Constructing a web site

This section explores the main points to be considered in constructing a web site.

#### 2.3.5.1 Layout of a web site

The first step in designing a web site is to ensure that a defined set of goals exists. Without a clear statement of purpose and objectives, the project will either begin to wander off course, or may go on beyond the point of diminishing return. Before beginning to build a web site, the following should be done (Lynch & Horton, 1997):

- Identify the target audience.
- Have a statement of purpose.
- Know the main objectives.
- Have a concise outline of the information the proposed site will contain.

All of the content information and graphic resources to be collected or created in order to achieve the goals of the web site, should also be identified.

Some important guidelines for the layout and style of web sites are the following:

- Consistency in layout. For maximum functionality and legibility the page and site design should be built on a consistent pattern of modular units, all sharing the basic layout grids, graphic themes, and hierarchies of organisation. The goal is to be consistent and predictable (Lynch & Norton, 1997).

- Utilise a consistent format for each page. Jones & Okey (1995) suggests using a metaphor or theme for the program, which should reflect the content of the program. Lynch & Norton (1997) state that the best information designs are the ones most users never notice.
- The main page should be kept short, and the main index should jump to a number of shorter pages. The subject must be presented in manageable segments even though comprehensive in coverage (Willis, 1995).
- Links to internal information should be maximised, while links to external information should be minimised (Willis, 1995).
- Do not use unnecessarily large graphics. Pages which take too long to download frustrate users and may force them to retreat hastily. If the home page requires extensive use of graphics to demonstrate points, the user should be warned. Research has shown that the threshold of frustration is around ten seconds (Lynch & Norton, 1997).
- Do not let the home page become out of date. The home page should be an ongoing part of development, and information should be added or changed as necessary (Willis, 1995).
- Feedback and dialogue. Lynch & Norton (1997) state that well-designed web sites should always provide direct links to the site's editor or the "web master" responsible for the running of the site, which seems vital to the long term success of a program. Web sites should always have a revision date.
- Design stability. If the users are to be convinced that what you have to offer is accurate and reliable, the web site is to be designed with high editorial and design standards. A web site that looks sloppily built, with poor visual design and low editorial standards, will not inspire confidence in the users of such a site. Interactive elements of the site must work reliably (Lynch &

Norton, 1997).

### 2.3.6 Constraints and the future of training in the SA National Defence Force (SANDF)

Whilst exploring the delivery system which will be best suited, certain **constraints** have to be taken into account for the development of this specific multimedia product, for example:

- As a result of certain security restrictions placed on information and documentation of the SANDF, the Internet cannot be utilised. Use of the SANDF's Intranet might, however, be considered.
- The fact that the nurses are located throughout the country and have access to different types of computers with different configurations and capabilities must also be kept in mind.

The downsizing of defence forces, which includes a reduction in personnel and military hardware, is a momentum-gaining trend in many nations today. Modern defence forces are required to fulfil the same roles as before, and in some instances, additional secondary roles have been allocated to them which have to be executed with reduced numbers of personnel, hardware and budgets. The acquisition of new technologies and a decreasing budget have had a great impact on the training systems used by defence forces. This fact necessitated the introduction of alternative delivery approaches into the military training environments which are less manpower intensive and are state of the art in design and function (Weller, 1997:58). This, however, required a paradigm shift from the conventional training methods to an investment in information technology in order to facilitate technology-based training. The budget of the SANDF had been reduced from 4% of the Gross Domestic Product (GDP) to 1,6% of the GDP in recent years, thus forcing it to have a closer look at its training requirements, the availability of funds and possible alternative methods of delivering training.

The SANDF is presently a force operating in a peacetime environment. According to Van der Walt (1997:115) this means, *inter alia*, having a new vision, mission and goals and strategies for operating; having masses of probably outdated course content and material; and maintaining a defensive posture which is stronger than the offensive posture of an external threat, **whilst maintaining an offensive capability**. Van der Walt (1997:115) states that the challenges facing SANDF trainers can be met, amongst others, by:

- Undergoing a paradigm shift in terms of thinking about the learner, viz more individualised and achieving potential. Thinking about training as part of human resource development which culminates in a negotiated strategy between individual needs for development and an organisational need for effective, performing employees. Thinking about training strategies which imply conventional versus alternative strategies, training for impact, training for a specific job, training for portability as well as lifelong learning opportunities.
- Proper instructional design.
- Proper instructional development, including selecting method/s of instruction and selecting media.
- Designing, planning and implementation of a training system, *inter alia*, including provision of technological infrastructure for instruction and learning (hardware and software) and provision of managing technological structure (hardware and software), enablement of instructors, e.g. different roles played in different instructional situations and handling of new instructional technology.
- Employing various and alternative training strategies and **media of instruction**, for example individualised institution centred training; interactive distance training, interactive video, interactive television,

computer-assisted instruction, computer-assisted learning, on-line training and virtual reality. Training incorporating the Internet, Intranet and Extranet. Incorporating facilities such as tele-conferencing, video-conferencing, fax machines and e-mail.

Van der Walt (1997:119) also states that a cost-effective, efficient training system suited to meet the needs of the individual as well as those of the organisation, can be developed by integrating all these principles and technologies.

Recent advances in virtual environment and virtual reality technology make the battlefield available to the individual combatant or teams for special training. This type of technology not only supports the training of a wide range of combat operations, but also non-combatant activities such as evacuations, humanitarian relief operations and search and rescue operations (Weller, 1997:60).

Computers and simulators are presently being used by a large number of defence forces for training purposes (including the SANDF). It has become necessary to take a fresh look at the utilisation of these technological resources in order to make their use more appropriate and generalised. Against the background of the above-mentioned, the SANDF will have to do the trade-off between what training it needs versus what training it can supply in ensuring it does what needs to be done. The SANDF will have to research into new technologies which will reduce the overall cost of training in the long term, without negatively affecting the high standard of training, but improving on it instead.