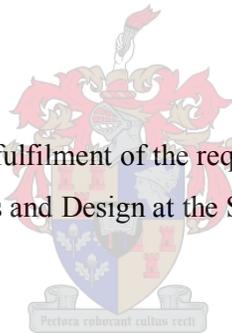


# **SHARED MENTAL MODELS AS A CULTURAL PHENOMENON – FACT OR FICTION?**

Using the card-sorting method to investigate the shared mental models of web users

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Assignment presented in partial fulfilment of the requirements for the degree of MPhil  
in Document Analysis and Design at the Stellenbosch University



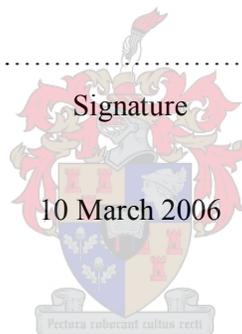
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April 2006

## **Declaration:**

I, the undersigned, hereby declare that the work contained in this assignment is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.



## Summary

In this study, the mental models of the target audience of the FACT web site (official Stellenbosch University HIV/Aids web site) were investigated and compared with the structure of the web site (representing the mental model of the expert). The target audience were divided into six groups representing three different race groups (white, coloured and black) and the two sexes (male and female).

The mental models of these groups were the main focus of the study. The question was whether the different groups have different mental models of the subject (HIV/Aids) and to what extent are mental models shared within groups. The mental models of users were determined using the card sorting method and the resulting dendograms (through a cluster analysis) were compared. It was found that there were smaller differences between the white and coloured groups' dendograms compared to that of the black group. This indicates that the white and coloured groups are quite similar in their shared experience and knowledge of the subject. A comparison of the dendograms of all participants (whole population) and that of the structure of the web site indicated that there were differences, but that it was not significant enough to warrant different information structures for the different groups. The differences can be addressed by providing links to the same information from different places in the structure.

The card sorting method was also evaluated in terms of its effectiveness as a research method in the South African context. It was found that the method is usable and that it delivered representative results. The problems that were found related to the participants' language proficiency rather than an incapability to perform the card sorting exercise.

## Opsomming

In hierdie studie is die mentale modelle van die doelgroep van die FACT webwerf (offisiële HIV/Vigs webwerf van die Universiteit Stellenbosch) ondersoek en met die struktuur van die webwerf (wat die mentale model van die ekspert verteenwoordig) vergelyk. Die doelgroep is in ses subgroepe verdeel wat drie verskillende rassegroepe (wit, kleurling, en swart) en die twee geslagte (manlik en vroulik) verteenwoordig.

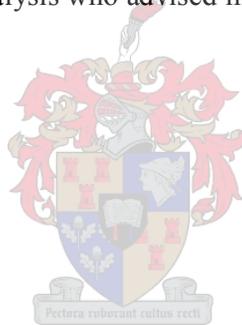
Die mentale modelle van hierdie groepe was die hooffokus van hierdie studie. Die vraag was of hierdie verskillende groepe verskillende mentale modelle van die onderwerp (HIV/Vigs) het en tot watter mate hierdie mentale modelle in groepe gedeel word. Die mentale modelle van die doelgroep is bepaal deur gebruik te maak van die kaartsorteringmetode en die dendogramme wat deur 'n groepeeringsanalise (cluster analysis) bepaal is, is met mekaar vergelyk. Die bevinding was dat daar kleiner verskille tussen die wit- en kleurlinggroepe se dendogramme is as wat daar tussen hierdie twee groepe en die swart groep is. Dit is 'n aanduiding dat die wit- en kleurlinggroepe baie ooreenstem wat hulle gedeelde ondervinding en kennis van die onderwerp betref. 'n Vergelyking van die dendogramme van al die deelnemers (hele populasie) en die dendogram van die webwerf het aangedui dat daar wel verskille is, maar dat hulle nie beduidend genoeg is om verskillende informasiestrukture te regverdig nie. Hierdie verskille kan eerder aangespreek word deur skakels na dieselfde informasie vanuit meer as een plek in die webwerf te maak.

Die kaartsorteringmetode is ook geëvalueer met betrekking tot sy effektiwiteit as 'n navorsingsmetode in die Suid-Afrikaanse konteks. Die bevinding was dat die metode uitvoerbaar is en dat dit verteenwoordigende resultate opgelewer het. Die probleme wat ondervind is, het te make gehad met die deelnemers se taalkennis, eerder as 'n onbevoegdheid om die kaartsorteringmetode uit te voer.

## Acknowledgments

I would like to thank the following persons for their input in my studies:

- First and foremost, my God for helping me through my studies. Without the comfort of our relationship, I would not have been able to finish this.
- My study leader, prof Leon de Stadler, who always asks the difficult questions and never gives the easy answers.
- Dr Thea van der Geest who introduced me to the topic and the methodology I used in this study.
- My parents who brought me to where I am.
- My cell group members who prayed for me.
- Centre for Statistical Analysis who advised me on the interpretation of the cluster analysis results.

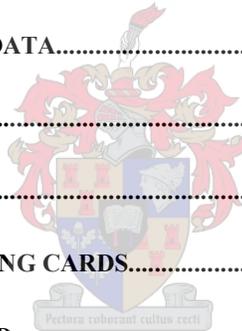


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## Chapter 1 - Introduction

The organisation of information in any web site is one of the most important activities to consider when designing a web site. Users of web sites usually have a very specific purpose when using the internet. They usually look for specific information and are more often than not browsers of a text rather than close readers.

Electronic texts, specifically web texts, also differ from paper texts concerning a number of significant aspects:

- Readers of electronic texts are not able to judge the full scope of the site by looking at the homepage, where readers of paper texts can make this judgement through a mere observation of the size of the book/text. Readers of electronic texts therefore have no visual cues providing them with context.
- Readers may get “lost” in the site because they can freely determine their own path by following any of the links. A paper text, to a certain extent, demands that the reader follow a set path with the content of chapters often building on each other.

The characteristics of the reader (as a browser) and the text require that close attention be paid to the information architecture or structure of a web site in order to make it easy for the user to:

- find information quickly
- get an overview of the content, therefore assisting the browsing behaviour of the user
- judge how much significant or relevant information the web site contains
- know where they are in the structure because they understand the hierarchy/organisation of the information

Electronic texts are also, in many ways, similar to instructive texts. According to Jansen and Steehouder (1997: 28), instructive texts (requesting that the reader/user perform an action) require that the reader process the information in such a way so as to be able to perform the action. Web sites, as a genre may not be an instructive text form in the strictest sense of the word. It does, however, require that the reader does

something/performs an action like following links. This shared characteristic should therefore require the same amount of ‘processing’ before the action is performed. It is therefore important to look at this information processing when considering the reader of the text.

The mental model of the reader represents the outcome of the processing that a reader has to do before being able to perform an action (in this case, interact with the information). A reader needs to form a mental model of the organisation of the structure in order to understand what to do next or where to go. Each person's mental model looks different from the next person's because of individual experiences. Shared experiences, however, allow users to form shared mental models and this is what designers of information architecture rely on.

More often than not, web sites’ information architecture is based on the mental model of the designer/writer of the text. The relationships they think are the most logical are most often the way that the end product is organised. The most prominent question is whether this model reflects the user’s mental model and whether this is important for a web site to be effective. Mental models may be shared by users; however, the question is whether these shared mental models are shared by the cultural groups and at the same time significantly different from other cultural groups.

The structure of the information (information architecture) is made visible through the navigation system of the web site interface. This navigation system includes elements such as menu items, links and orientating information.

A card sorting experiment done by Stacey Trooster (2004), determined that there is a difference in the mental models (information architecture) of two different groups based on their level of expertise (medically trained and layman users). This study replicates the methodology of Trooster's card sorting study in a South African context. The question is whether shared mental models exist because of shared experiences of users or are mental models shared because of a cultural affiliation? This study aims to determine whether the mental models that users have of the structure of a web site are shared culturally.

## 1.1 Research problem and objectives

In the bigger context of the EPIDASA project (which aims to improve the quality of HIV/Aids information in South Africa) the information architecture of the official HIV/Aids web site of the Stellenbosch University (FACT) was investigated.

The logic of the information structure/architecture of this web site is potentially problematic in itself. Readers of the web site may not be able to find the information that they are looking for because the structure is not logical in some cases. The headings for the main menu items may also be problematic because it does not give the reader a clear enough idea of its content. For instance, the menu item “website” contains the conventional “About us” section. Not using the conventional wording may be confusing to the user. The menu item is in the first position which is where users may expect this kind of information but it does not follow the mental model that users may have of menus.

The target audience of this web site include subjects from at least three ethnic groups, namely white, black and coloured. Because of the diversity of this group, there might be differences in the way that they structure information. Whether these differences are shared by the different ethnic groups is the main focus of this study. If there are differences and these differences are big enough, it may suggest that different structures should be implemented for the different ethnic groups.

Classifying culture, however, is a difficult issue. The reason for this is that recent studies done in the EPIDASA (Improving the Effectiveness of Public Information Documents on HIV/AIDS in South Africa) project concluded that using a popular method like the INDCOL value scale (Jansen et al 2006) delivered unexpected results. For instance, groups that were expected to score high on the collectivistic scale scored higher on the individualistic scale and vice versa. This is problematic since it leaves questions about the effectiveness and reliability of the measuring instruments that are currently available to measure cultural differences. For this reason, it was decided not to base cultural classification on an instrument but rather, to make the assumption that there are differences between the cultures based on the existing knowledge we have of the cultural differences in South Africa. The classification was, therefore, made on

the basis of ethnic affiliation indicated by the participants in the profiling questionnaire. This leaves one with a problem, of course, since differences in mental models cannot be explained properly. It is clear that much more research will have to be done to solve this problem, research that does not lie within the scope of this study.

## 1.2 Problem statement

Three problems were identified. They are:

- a. The FACT web site's structure is based on the mental model of an expert (HIV/Aids co-ordinator at Stellenbosch University - Monica du Toit) but no research was done to find out what the users' mental model looks like. Is the mental model (portrayed by the menu structure, for instance) representative of the target audience's mental model? The reason that this is important is that if the mental model of the web site differs fundamentally from that of the target audience, they may find it difficult to find the information that they are looking for, undermining the informative function of the web site.
- b. Do different ethnic groups have different mental models and to what extent are these models shared (how high are their levels of agreement)? Will they, therefore have an effect on how effectively the users find the information that they are looking for?
- c. How effective is the card-sorting method in a South African context? In other words, is it possible to derive definite and different structures between the different groups using this method? What do the results tell us about the effectiveness of the method and what can it be used for?

## Chapter 2 – Theoretical framework

### 2.1 Introduction

It is important to define and contextualise the most important concepts that underlie this study in order to understand its significance. The relevant concepts include mental models which are important when designing the information architecture of a web site; information architecture which is the information structure of a web site; and the information seeking behaviour of web users which tells us how we should structure the web site's information to be most effective.

Mental models, the first important concept, are in essence a shorthand version of something in the real world. In this study, mental models are the object of study, so it is important to know what they are and how they work. A basic understanding of the concept will allow us to understand and interpret the results of the card sorting method, which is the evidence of the participants' mental models.

In this case, the specific mental models that are of interest are that of the basic structure of a web site (in general) and the mental model users have of the topic of HIV/Aids. This is especially important since it is a socially relevant topic that may have an impact on future communication on the topic. It is, therefore important to this study to know what the user's mental model is of the structure of the content that can be found on the FACT web site.

The structure of a web site is, therefore, one of the most important elements of a web site because if users are looking for information, the information architecture guides them to find it. If the structure is logical to the user, they will be able to find information more easily, if not, they will not be able to fully utilise the potential of the web site. In this case, we are dealing with an informative web site which seems to have a problem regarding this issue.

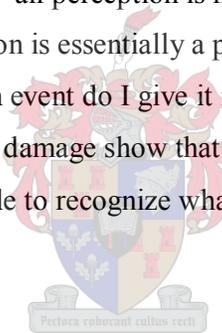
A good structure is based on good research about how users use web sites and how they see the elements fit together. Building the information architecture based on the

information seeking behaviour of the reader can strengthen a web site because users will be able to successfully navigate and find the information they are looking for. Knowing what the information-seeking behaviour of the reader is will help the researcher to judge whether the current structure of the FACT web site is successful or not.

## 2.2 Mental models

Mental modelling is a form of stereotyping strategy in that it is an automatic categorization process. In this process, perception is an important link. Perception is not necessarily the truth; what we perceive to be the truth is influenced by our mental models of a situation. Mental models, in turn, are formed through individual and shared experiences making them quite subjective in nature.

According to Hinton (2003: 31), “all perception is necessarily the end product of a categorization process. Perception is essentially a process of classification and only when I categorize an object or an event do I give it meaning” (Hinton 2000: 31) Studies using patients with brain damage show that when a person loses the ability to categorize objects, it is impossible to recognize what it is and what the object is used for. (Hinton 2000: 31)



The process of categorization happens automatically and acts as a mechanism to prevent cognitive overload, in effect ‘freeing’ the mental resources to process more complex information that doesn’t necessarily fit into a category. Categorization allows us to go beyond the information we have, allowing us to make inferences based on our knowledge of the category. This is important because we have the need to be able to predict how people and things will react under certain conditions. This allows us a certain amount of perceived power and control over the world and our lives. “We wish to understand the world in order to predict and control it.” (Hinton 2000: 84) “Experience guides the way we construe people and events. And how we construe people and events guides the way we experience them. We are in a constant cycle of experience and construction” (Hinton 2000: 42).

Because we are all individuals, we experience the world around us differently. In our

classification, we may not necessarily agree about the constructs of our categorization. However, we do share “many similar experiences with other people and these common experiences lead to common ways of viewing people and events” (Hinton 2000: 43) We are also social beings that rely on the judgement and input of our peers when we are categorizing people or objects. “We may change our perception of events to conform to those of other people.” (Hinton 2000: 43)

The categories in our heads that we have of people and objects in our world are known as “schemas” or “mental models”. When we encounter new people or situations, our schemas serve to fill in the gaps and prepare us for what to expect. We immediately know the context, the features that make up the situation as well as “the relationship of the features to each other.” (Hinton 2000: 46) “A schema can influence the way we interpret new information, remember information or make inferences about people and events.” (Hinton 2000: 46)

Mental models, therefore, form a fundamental part of how we perceive and ultimately react to the world around us. We constantly draw on our mental models of concepts, objects, people and situations to understand our environment.

In defining mental models, one can say that in the first place, it is a shorthand representation of something in the real world and as such, the user is able to predict and explain the system it represents. (Greca & Moreira 2000: 3). For example, a student will have a mental model of how to answer a long question in an exam situation and will have a different mental model of how to answer a multiple choice question. These are two separate mental models that operate within another mental model - the exam situation. By employing the appropriate mental model, the student will be able to predict what to expect in each situation. Being able to predict what to expect enables the student to correctly prepare for the situation.

A mental model may also serve as a way to “predict the result of one’s own actions”. (Greca & Moreira 2000: 3) It also predicts how we should act in certain situations. In the previous example, the student will be able to predict that if he studies for recognition for the multiple choice exam, he will be able to answer the questions. However, if he uses his mental model of multiple choice exam questions to study for

the long question exam, he will not be able to answer the question successfully because long questions require that you reproduce memorized facts, not merely recognition of the facts.

Mental models also help us to evaluate the consistency of our own actions. (Legrenzi et al 2003: 131) In other words, a user will be able to determine whether his actions are appropriate for a given situation by evaluating them through the application of his mental model of this situation.

The main characteristics of all mental models are that they:

- include what a person thinks is true, not necessarily what is actually true
- are similar in structure to the thing or concept they represent
- allow a person to predict the result of his actions
- are simpler than the thing or concept they represent. They include only enough information to allow accurate prediction. (McDaniel 2003)

According to Greca & Moreira (2000: 3), there are two main schools regarding mental models. They were developed by Gentner & Stevens and Johnson-Laird. Gentner & Stevens' theory states that mental models are "internal, personal, idiosyncratic, incomplete, unstable and essentially functional. The main role of a mental model is to allow its builder to explain and make predictions about the physical system represented by it." (Greca & Moreira 2000: 3)

De Kleer and Brown (in Greca & Moreira 2000: 3) state that the "running" of a mental model involves two steps:

- a. The envisioning of the system, and
- b. The running or execution of the causal model based on basic operational rules and on general scientific principles.

Johnson-Laird's theory, on the other hand, claims that "mental models are analogical representations of reality" (Greca & Moreira 2000: 3). "Mental models are working models of situations and events in/of the world, and that through their mental manipulation we are capable of understanding and explaining phenomena and are able

to act accordingly to the resulting predictions.” (Greca & Moreira 2000: 4)

As individuals, we do not live in isolation and are constantly influenced by elements in our world. This has the result that we are constantly changing our opinions (and necessarily also our mental models) about the world. It follows therefore that “a mental model is never complete, but it continues to be enlarged and improved as new information is incorporated into it.” (Greca & Moreira 2000: 5)

In the context of web sites, the mental model users may have of a web site represents their expectation of the structure of it. This is based on their personal experience and knowledge of web sites. The web site structure is made visible through the navigation system like the menu and links. The successful transfer of knowledge depends on successful navigation by users. According to Whitaker (1998: 65), successful navigation requires “situational awareness”. “Situational awareness can be defined as the continuous extraction of environmental information, integration of this information with previous knowledge to form a coherent mental picture, and the use of that picture in directing further perception and anticipating future events”.

It is important, therefore, that the structure of the web site reflects the mental models of most of its users for the successful transfer of knowledge to take place. The structure of the web site must be so ‘transparent’ that the users can find what they are looking for quickly and easily. This implies that users do actually share a mental model of some topic. This, in turn, is important since the existence and exploitation of such a shared mental model can have a marked influence on the design of a website (or any other text, for that matter).

There are two major approaches regarding shared mental models:

- complete shared mental model
- partial shared mental model

“The shared mental models approach proposes that the overlap of individuals’ mental models lead to greater shared expectations” (Banks & Millward 2000: 513) by users.

“The hypothesized process by which shared mental models operate is that individuals run their mental models independently of each other to form expectations and explanations of the task. Where these are the same, performance is optimum.” (Banks & Millward 2000: 514) “Therefore, complete overlap across individual mental models is the optimum arrangement” (Banks & Millward 2000: 514) to ensure that users have similar expectations of a web site’s structure.

The partially shared mental model approach is more appropriate in a context where users need to work together in a team. This approach proposes “that the cognitive process of running a mental model can be divided or distributed amongst the team. One benefit of a team is to distribute and not to duplicate labour. A fully shared mental model entirely duplicates labour so that each team member does all the work rather than dividing it between the team.” (Banks & Millward 2000: 514)

In this study, the complete shared mental model approach is supported since we are not dealing with a task that needs to be shared by group members. In this case, it is important to know how much sharing of the mental model exists within a group - in other words, what the level of agreement about the elements of the mental model is. This is important in the interpretation of the results of the tree structures which are the result of the cluster analysis of card sorting data.

### **2.3 Information Architecture**

Information architecture refers to the way that information is structured on a web site. This structure is made visible through the navigation system of a web site. The navigation system is a user’s only way to access the information making it a very important element in the design of a web site.

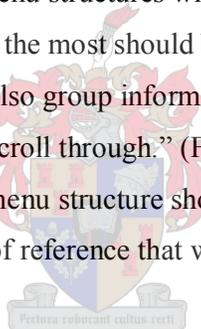
According to Lynch and Horton (2002) a web site is characterised by the fact that it isn’t a linear document - users can navigate through a web site using many different routes, making it difficult to keep track of the context of information.

When users experience problems with web site structure, the most common problem is that they become lost within the structure. They lose their way because, unlike

printed texts, there are very few contextual clues indicating to them where they are in the structure. The nature of users' reading strategies of web texts is non-linear and random. Unless the mental model of a user is highly developed, he can very easily become lost in the web of information. The way this happens is:

- Users become disoriented because they are unfamiliar with the structure of the site. The biggest decision to make involves “understanding one’s current location within the site and then selecting the proper route. Users often may not even know where their current location is within a site.” (Bernard 2000)
- Embedded digression takes place.
- Short-term memory does not allow users to remember in detail where they have just been or what they just read because of the “sheer vastness of options and information.” (Bernard 2000)

The most effective and intuitive menu structures will structure information so that “the information which users need the most should be within two to three levels away from their starting point.” It will also group information in order to “avoid long lists of information that the user must scroll through.” (Frick et al 1999) In order to minimise user disorientation, the menu structure should also be visible on every page. This way, users will have a point of reference that will allow them to go back to the start.



According to Bernard (2000), “an essential ingredient in constructing the content of a web site is knowing the typical users' mental model or ‘schema’ for the characteristic location of web objects on a web site.” Applying this knowledge to the information structure of a web site may markedly increase the usability of the site. The reason for this is that the user will ‘intuitively’ know where to look for information, making the act of transferring information so much easier and effective.

There are many different types of web sites with different functions and different target audiences. It follows, therefore, that there is no one formulaic structure that will fit all web sites. “Different types of web sites seem to demand different approaches to organization.” (Dobroth et al 2000: 23) According to Dobroth, three major types of organisation schemes are important:

- a. Task organisation scheme
- b. Topic content organisation scheme
- c. Type of user organisation scheme

### **2.3.1 Task organisation scheme**

With a task organisation scheme, information is organised in a way that visitors have to first select an action before information is provided. “Organizing by task may be most beneficial when visitors need to accomplish tasks quickly, without considering options along the way.” (Dobroth et al 2000: 24) An example where the task organisation scheme can be employed is a web site where users must log in, perform a search or fill in a form.

### **2.3.2 Topic content organisation scheme**

“When a site is organized by topic content, visitors choose a topic first and then determine what to do with it. Organizing by topic content may work best when designers want to encourage users to spend time browsing in a relatively undirected way.” (Dobroth et al 2000: 24) An educational web site is an example of this type of organisation scheme where the other options on the web site (like search facilities) are linked to different topics that the user must first select.

### **2.3.3 Type of user organisation scheme**

In a web site that is organised by the type of user, a form of identification is required to enter the site. “Organizing in this way seems to work best when boundaries between the user groups are exceptionally clear.” (Dobroth et al 2000: 24) An example of a website that employs this organisation scheme would be an online journal where access is granted only to members that are registered subscribers. Most of the content of the web site will be hidden from users who are not subscribers.

The complexity of the web site structure and the ‘maturity’ of the users’ mental model of the web site’s structure are interlinked:

- It may be more difficult for users to develop a mental model of sites with complex structures.
- Having an accurate mental model may matter less when visitors come to the site

infrequently and when visitors need to do tasks quickly in a directed way (like registering to have access to hidden information).

- Cross-referencing links may distract visitors when they are integrated into the content, as opposed to appearing underneath or alongside the content.

(Dobroth et al 2000: 24)

The menu structure of a web site is the visible ‘evidence’ of the underlying information structure. This is often the only tangible link the user has to the structure to form and develop their mental model of a web site. An effective menu structure is, therefore an important consideration in design. Different menu types are more effective in different situations and for different reasons. For instance:

- “Information is found more quickly in index menus than in cascading menus.
- The use of the ‘breadcrumb’ menus may help reduce user disorientation within the structure of a site.
- Categorical menus are superior in both search performance and satisfaction to alphabetized sitemaps.
- Categorical menus arranged in columns are searched faster than menus arranged in rows.”

(Bernard 2002)

There are several types of menu structures and several advantages and disadvantages of each. However, the most successful menu structure is the hierarchical structure. The reason for this is that the information is layered by organising it into bigger groups. It is therefore easier for readers to find what they are looking for because they do not have to read through a long list of options - they can first choose a broader category and they make their way to the information they are looking for. An example of an item in a hierarchical menu is the typical “about us” link. The reader knows that they will find information like the vision and mission of the company, the contact details and the staff detail under this broader category. It is a very popular menu type since information is clustered together in a logical way.

There are several factors that need to be considered when designing a hierarchical menu structure. These include:

- depth (the number of levels)

- breadth (the number of items per page)
- menu dimension
- task complexity, and
- the knowledge structure of the www user ” (Frick et al 1999)

With informative web sites, the most important aspect is that users are able to find the information that they are looking for. The information structure may be the most important tool for users to find what they are looking for. It follows, therefore, that the way it is organised is important. “In organizing the content, it has repeatedly been found that people find information faster and make fewer mistakes if the hierarchical structure of the site is broader rather than deeper. That is, if users have to follow more than two or three hyperlinks paths to get the information they want, then the chance that they will find this information will be reduced considerably.” (Bernard 2000) This structure “results in the most efficient navigation and information retrieval.” (Frick et al 1999)

The information architecture influences the user’s mental model. If the information architecture doesn’t make the structure clear, the mental model of the user may be influenced. The user will either be forced to adapt their mental model to fit the web site’s structure; or more likely - the user may not be able to find information and exit the site because they experience a certain level of frustration. The mental model is important because it determines the way that the reader will process the information.

“Any schema that is developed will depend to a large degree on the web experience of the user. As they become more experienced with different types of web sites they may develop a more precise schema for the placement of these objects. If there is a difference between novice and experienced users, this difference could impact web site accessibility, depending upon the match between the users’ schema and the placement of the web objects.” (Bernard 2001)

## **2.4 Information seeking behaviour of users on web sites**

Users usually enter a web site either as a result of a search they did on a topic, or because they clicked on a link that took them to a new web site. In either case, the

reader is searching for specific information and followed links that promised results. It is very rare that readers use the internet without a specific goal in mind.

The literature suggests two major role players in theory development concerning the information seeking behaviour of users. They are McCreadie and Chang's framework, which focuses on the task that needs to be performed and Gabrielli's framework, focusing more on the abilities of the user.

According to McCreadie and Chang (as cited by Trooster 2004: 20), "the information seeking process starts with a problem or question (situation) and an attempt to find answers in the form of information (strategy) with the assumption that the strategy is intentional and rational". Of course, this strategy is not limited to online texts, "readers have bounced from one content point to another in reference documents since the dawn of writing." (Lynch 2000) Users most often use reference material in "non-linear patterns of search-and-retrieval or browsing" (Lynch 2000). This reading strategy does not relieve authors of the need to structure documents in carefully organized narratives - it makes the necessity of well-structured documents even more important since it aids the information-seeking process.

A common strategy that readers employ is that they do "not spend too much time on a particular page. Instead they scan the page looking only for information that is of direct interest to them." (Bernard 2000) A study conducted by Nielsen showed that 79% of "users always scanned new pages they came across and only 16 percent read word by word." (Nielsen 1997)

This has major design implications for online texts, specifically web pages. The design should reflect the needs of the readers and "employ scannable text, using:

- highlighted keywords
- meaningful sub-headings
- bulleted lists
- one idea per paragraph
- the inverted pyramid style
- half the word count than conventional writing" (Nielsen 1997)

McCreadie and Chang furthermore include the following aspects in their definition of information seeking behaviour that needs to be considered when designing for the web:

- “Context (larger picture in which both the user and information system can be placed)
- Situation (awareness or need for information under a set of circumstances)
- Strategies (attempt to address the situation)
- Outcomes (the actual retrieval and use of found information)”

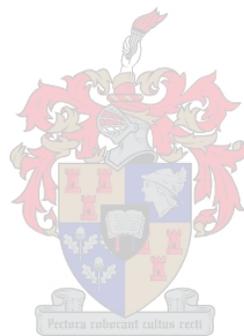
(Trooster 2004: 20)

Gabrielli’s framework for the information seeking behaviour of readers, on the other hand, determines that browsing is influenced by the *repertoire of tasks* (strategies a user has to satisfy information retrieval needs); *decision making* (cognitive effort required in making efficient decisions in the information system); *mental strategies*; and *perception-action capabilities* (the effect of external strategies on the interaction and perception of the information) (Trooster 2004: 22).

The structure of a web site is one of the most important elements that support the information seeking behaviour of users. However, users do not necessarily “care about the underlying structure” of a web site - they might just “opportunistically look for promising links and click” (Steehouder et. al: 2000: 60), hoping that it will lead to information that is relevant to their search. Users may not have a complete grasp of the structure of a web site, and the “information structure clarifies categories and relationships” (Steehouder et. al: 2000: 60). This is important if the user needs to find certain information and their conceptual (mental) model of the content of the web site is not clear. Even though a good structure of a web site is relatively invisible to the user, a bad structure immediately becomes clear and hinders information retrieval.

“Information architecture, in effect, supports information seeking behaviour. The user is looking for something and the information architecture allows the user to find it” (Trooster 2004: 20). In order to ensure successful information retrieval, it is of the utmost importance to help the user “to build a conceptual map of the nodes and links”

of a web site since it allows the reader to understand “the relationship among the ideas that appear on the various pages of the web site” (Steehouder et. al: 2000: 60) and where to find the information that they are looking for.

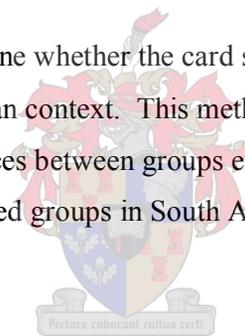


## Chapter 3 Methodology

### 3.1 Research design

The research study consisted of three parts. Firstly, an analysis of the FACT web site was done to systematically identify problem areas regarding the structure of the web site. Secondly, the card sorting method was used as a tool to collect data regarding the mental models of the target audience of the FACT web site. The third stage in the research was a systematic analysis of the tree structures resulting from a cluster analysis of the card sorting exercise. These results were then compared to the original structure of the FACT web site to determine firstly whether the mental models of the target audience correlate with that of the FACT web site and whether there are problem areas that need to be addressed in the structure of the FACT web site.

The study also aimed to determine whether the card sorting method is an effective research tool in the South African context. This method has been applied successfully in cases where definite differences between groups exist. Whether this method can be applied to culturally differentiated groups in South Africa will receive attention in this study.



A three by two research design was used with the variables being race and sex. The race variable was divided into three groups, namely white, black and coloured while the sex variable was divided into two groups, namely male and female. This resulted in six groups:

- White men
- White women
- Black men
- Black women
- Coloured men
- Coloured women

## 3.2 Analysis of the FACT web site (<http://www.sun.ac.za/fact>)

In 2003, four students (including the writer) created the FACT web site as part of a course in multi-media design at the Department of Information Science, University of Stellenbosch. It was created for the university's HIV/Aids initiative with content and structural input from the co-ordinator of the programme, Monica du Toit. Every step in the planning, design, implementation and publishing of the web site was carefully recorded in a report which can be found in Appendix E.

Even though an expert (Monica du Toit) was used to plan the structure of the content, there were strong indications that some elements in the structure were not logical, that is, not reflecting the mental models of users, in which case these users may have difficulty finding the information that they are looking for. An analysis of the structure was therefore done to determine whether these problems exist and where they exist. The analysis was done concentrating on four aspects of navigation design:

- a. *Navigation system*
- b. *Placing navigation*
- c. *Consistency of navigation*
- d. *Web site tree structure*



The results of this analysis can be found in Chapter 4.

## 3.3 Card Sorting

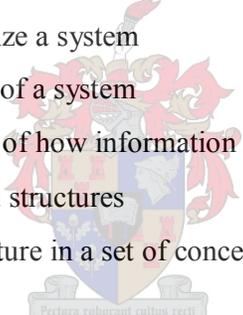
### 3.3.1 Background

“Card sorting is considered one of the best usability methods for investigating users’ mental model of a system and for making their mental models explicit.” (Trooster 2004: 24) It has been used in many different fields including marketing and social science research. This method has not only been applied to research - it has proven to be very useful when an amount of data has to be sorted into meaningful categories. An important aspect that should be remembered, however, is that the method always implies the presence of a user group with the goal to determine what is in the ‘mind’ of the user.

It is in the context of web design and specifically the information architecture of a web site that card sorting is specifically useful. It is assumed that if users group cards together, the concepts represented by the cards should probably be reflected in the information architecture of the web site because “the result suggests how users would organize a given set of concepts, which can be very valuable information when organizing a system or web site.” (Faiks & Hyland 2000: 350) In using the card sorting results to develop the structure of a web site, one can “maximize the probability of users being able to find items.” (Gaffney 2000)

The benefits of card sorting in the context of web site structure are numerous. “It can help the researcher to:

- capture information about how users represent the functional organisation of a user interface
- understand users’ perceptions of relationships between items
- understand how people organize a system
- discover users’ mental model of a system
- understand the users’ concept of how information should be sorted
- testing organisation and menu structures
- uncover the hierarchical structure in a set of concepts”



(Trooster 2004: 25)

It is important to note that a card sorting exercise does not produce a finished structure. In other words, it cannot be used as a final structure of a web site. The function of the tree structure is rather to give the researcher an indication of how strong the mental model of users is (looking at the level of agreement) and an indication of what the mental model looks like. The results of a cluster analysis on card sorting data are a dendogram (tree structure) that represents the combined structures of the group. A researcher will be able to ‘read’ the trends of the grouping and use it as a guide to the user’s mental model, but “there are many other inputs into the information design process” (Robertson 2001: 1) that needs to be considered.

According to Robertson (Robertson 2001: 1), these include:

- business requirements
- strategic directions

- technical goals and limitations
- usability guidelines

There are many benefits to using the card sorting method in any research. They include:

- that it is simple and well understood
- that it is cheap to use
- that it is quick to apply, which allows more users to be involved
- that it draws out the natural grouping of information in a way that avoids directly asking users (which may produce more objective results)
- that it involves the users in the design process, and helps to demonstrate that the system will be created with the users' need in mind

(Robertson 2001: 2)

Other benefits are that:

- it enables you to understand how people are likely to group items
- it identifies items that are likely to be difficult to categorize and find
- it identifies terminology that is likely to be misunderstood

(Gaffney 2000)

Card sorting also have marked weaknesses that may influence researchers to not use the method. These include:

1. The time commitment of conducting the exercises. The time estimated for a card sorting exercise using 50 cards is approximately 30 minutes. Using 60 participants will therefore involve at least 30 hours conducting the exercise.
2. It takes some time to learn how to use the software and to understand and interpret the result of the analysis.
3. The wording on the cards may influence the way the subjects group cards so great care must be taken to avoid grouping of cards because of the words rather than the concepts.
4. The singular nature of physical cards: a user is not able to put one card into two places if a concept falls into more than one category. However, the static nature of the cards forces the user to select what he or she considers the strongest relationship. (Faiks & Hyland 2000: 350)

It takes as much preparation to conduct a card sorting exercise as it would any other research method. The biggest preparation involves selecting items to place on the cards and selecting participants. For each of these activities, certain considerations must be made to ensure the best results. According to Gaffney (2000) there are three issues that are important:

- ensure that each term is as clear and unambiguous as possible;
- ensure that you have included all the items you need to categorize;
- ensure that the wording on the cards does not influence the grouping negatively

(Gaffney 2000)

Robertson expands on the list by including the following:

- The length of the list needs to be manageable. Too few items, and there is little scope for the users to come up with a structure. Too many items and the task become daunting and confusing.
- Existing structures should not be reflected in the description and selection of the topics. It is important not to “pre-judge” the structure by leaving clues that will lead the users back to the current way of arranging the content.
- The hardest challenge is to find the right level of detail. That is, how much information is encompassed by each item on the list?
- The terms used in the list must be meaningful to the participants in the session. This should be checked by people knowledgeable about the working environment and subject matter.

(Robertson 2001: 3)

When conducting a card sorting session, the following must be done to ensure success:

- shuffle or randomise cards prior to each participant session
- script a set of instructions so that all participants have the same understanding of the process
- leave participants alone while they are sorting the cards to avoid placing them under unnecessary time pressure, but make sure they can contact you easily to ask questions or when they have finished
- provide additional blank cards for people to write group names

(Gaffney 2000)

It is important that the participants of the card sorting session are the actual end-users of the web site. It does not make sense to learn the structure of users that are not the target audience. In order to build an effective structure, one needs to understand what the mental model of the target audience looks like.

### **3.3.2 Cluster analysis**

Cluster analysis is used to create the tree structures by analysing the data of a card sorting exercise. Cluster analysis was first used in 1983 by Tryon and “encompasses a number of different algorithms and methods for grouping objects of similar kind into respective categories.” (Statsoft 2004) This method of analysis proved to be of great use to researchers who wanted “organize observed data into meaningful structures, that is, to develop taxonomies.” (StatSoft 2004)

Cluster analysis is a method that is most effective as an exploratory data analysis tool where the data represents different objects that is sorted into groups “in a way that the degree of association between two objects is maximal if they belong to the same group and minimal otherwise.” (StatSoft 2004)

The result of a cluster analysis is a dendrogram that shows the strength of the relationships between objects in a card sorting exercise. It is therefore possible for researchers to “discover structures in data without providing an explanation or interpretation of the results.” (StatSoft 2004)

Although cluster analysis is recognised as a statistical method, it is not a typical statistical test. It is rather the output of a collection of algorithms that “puts objects into clusters according to well defined similarity rules.” (StatSoft 2004) Cluster analysis finds the “most significant solution possible. Therefore, statistical significance testing is really not appropriate here.” (StatSoft 2004)

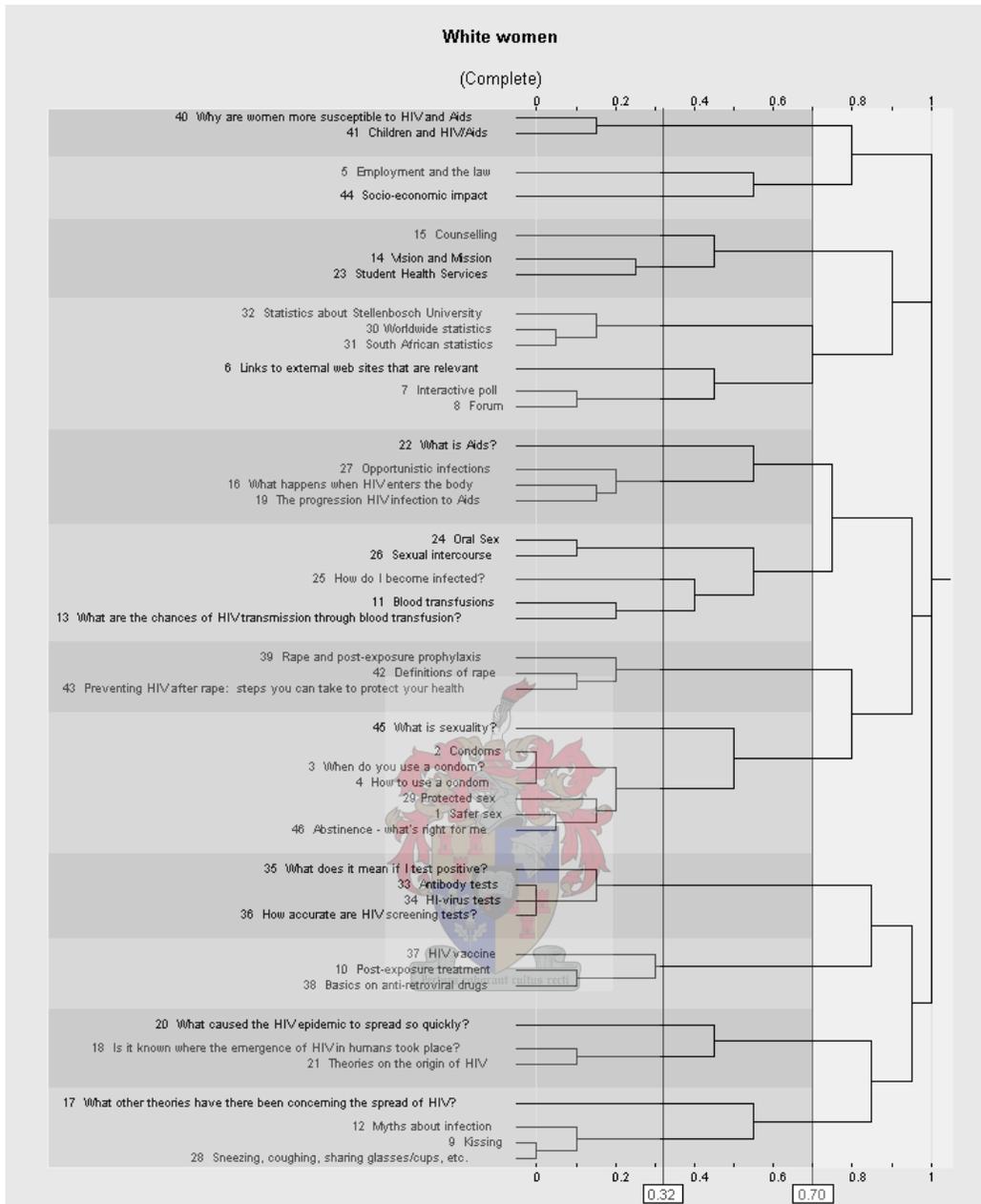
The main algorithm used in cluster analysis is Joining or Tree Clustering. “The purpose of this algorithm is to join together objects into successively larger clusters, using some measure of similarity or distance.” (StatSoft 2004)

**a. Interpreting the result (hierarchical tree)**

The interpretation of the hierarchical tree is not a statistical process. It is done by the researcher "eyeballing" the tree structure and inferring what the data means. In other words, it is somewhat subjective and therefore cannot be used when an exact answer is required. The function of the tree structures is only to give a broad impression of the structures in the users' heads.

“The diagrams indicate the strength of the perceived relationships between pairs of pages by the relative distance from the origin (0) of the nearest vertical line that connects the pages’ horizontal lines.” (Martin 1999) On the left hand side of the tree structure, each object is listed and is in a class by itself. As you move to the right of the structure, you “lower (the) threshold regarding the decision when to declare two or more objects to be members of the same cluster.” (StatSoft 2004) In other words, as you move right, you relax your criteria of what makes two objects belong together. In a card sorting exercise, the criteria refer to how many participants sorted the two cards together. If a vertical line joining two clusters lies at 0, it means that all participants sorted the two cards together. If a vertical line joining two clusters lies further to the right, it means that fewer participants sorted the two cards together (see fig.1).





**Figure 1 - Example of a tree structure**

On the vertical axis, we can see the clusters that are formed as more and more objects are linked together. As the clusters become bigger (move to the right), there are “larger and larger clusters of increasingly dissimilar elements.” (StatSoft 2004) The horizontal axis therefore shows the linkage distances of the different clusters. “Thus, for each node in the graph (where a new cluster is formed) we can read off the criterion distance at which the respective elements were linked together into a new single cluster.” (StatSoft 2004)

## **b. Distance measures**

“The joining or tree clustering method uses the dissimilarities (similarities) or distances between objects when forming the clusters.” (StatSoft 2004) Therefore, the more ‘similar’ two objects, the closer the distance measurement. The reasons why objects are sorted together depends on the mental models of the participants of the study and can only be speculated.

The way that the cluster is formed is through amalgamation or linkage rules. “We need a linkage or amalgamation rule to determine when two clusters are sufficiently similar to be linked together.” (StatSoft 2004) There are various ways in which this can be determined:

- “nearest neighbours” or single linkage - “This rule produces “stringy” types of clusters, that is, clusters “chained together” by only single objects that happen to be close together.” (StatSoft 2004)
- “furthest neighbours” or complete linkage - “the distances between clusters are determined by the greatest distance between any two objects in the different clusters” (StatSoft 2004). This is the best method when objects form naturally distinct groups.

## **c. Manipulating tree structures**

The left and right threshold lines and their attached data flags provide visual aids for the analysis of information structure displayed in the hierarchy. The attached data flags indicate the distance score thresholds corresponding to the location of the threshold lines. The alternated shaded colours show the high-level groupings. The different shades of branches in a tree diagram show the low-level groupings. Differences in vertical distances among card name items provide additional visual cue for both low-level and high-level groupings. “The two threshold lines can be dragged horizontally and dropped at the desired place to better visualize the groupings.” (IBM Ease of use)

It should be noted, however, that 'dragging' the threshold lines do not alter the integrity of the data, it only serves to better visualise the data so that interpretation of the results is made easier. It is also important to note that the purpose of these lines is

to better visualise the groupings on an individual level. As soon as comparisons between tree structures are made, it is important to have the thresholds at the same level otherwise comparisons will not be sensible.

### 3.4 Card sorting methodology

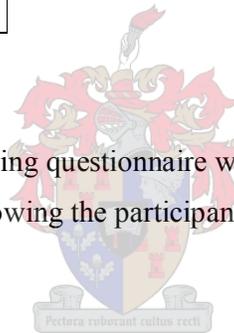
#### 3.4.1 Participants

A convenience sample of 60 participants was used in the card sorting study. The schema of the sample is as follows:

	Male	Female
White	10	10
Black	10	10
Coloured	10	10

Figure 2 - Schema of sample

The participants filled in a profiling questionnaire where they indicated to which race group they belong, therefore allowing the participants to classify themselves into broader cultural groups.



Participants met the criteria for participation if they:

- were part of one of the three race groups - white, black and coloured
- had internet experience which is defined as having used the internet before, but preferably using it at least once a week
- had a reasonable knowledge of HIV/Aids

To determine whether participants met these criteria, a profiling questionnaire was used (see Appendix A) where participants were asked to indicate how often they use certain software and the internet. It also has general questions about HIV/Aids ranging from very basic to more in-depth questions. As was mentioned earlier, a mental model is a "representation of something in the real world" (Greca & Moreira 2000: 3) which is acquired through knowledge and experience of a subject. The existence of a mental model is therefore determined by the knowledge that the reader

has of a subject. It was, therefore, necessary to test the participants' knowledge which would indicate the existence of a mental model of the topic.

The FACT website has students as their main target audience because it is the official website of the Stellenbosch University. Employees of the university are the most important secondary audience of the website. For this reason, only students were used because they realistically represent the main target audience of the website.

### **3.4.2 Materials**

#### **a. Profiling questionnaire**

The profiling questionnaire is divided in three sections, the first deals with the personal information of participants, the second section deals with the computer experience/knowledge of the user and the third section deals with the participants' knowledge of HIV/Aids.

The section on personal information of the participants contain two questions pertaining to the independent variables race and sex, the other questions in this section was used to generate interesting statistics about the population. These questions included the age of the participants, the language of the groups, and the academic year of the participants.

The questions in the second section of the questionnaire ask the person to mark how often they use Microsoft Word, Excel, e-mail software and the internet. Their choices included:

- No more than once a week
- More than once a week
- At least three times a week
- More than three times a week

The reasoning behind these questions is to determine the participants' level of experience/knowledge with the computer in general and the internet in particular. If the participants have a knowledge or experience of computers, it can be assumed that

they have a developed mental model of the computer. The most important question in this section is the participants' use of the internet which will determine whether they have a mental model of how the internet works.

A mental model of the internet is important because participants were told that the information on the cards used in the card sorting method was taken from a web site and that they must sort it into a logical structure, thinking of the navigation of a website. All participants should, therefore, know how web navigation works in order to participate in the study.

The correlation between the participants' computer knowledge of the internet and whether they found the exercise easy or hard may therefore be significant. It can be assumed that if the participant found the exercise difficult, it may be because their mental model of web navigation is not well-developed.

The next section tests the participants' knowledge of HIV/Aids. As is the case with the computer/internet knowledge, the participants' knowledge of HIV/Aids will indicate their mental model of the subject because having knowledge implies the existence of a mental mode. Having a strong mental model of the subject will probably make the exercise easier for participants. The more knowledgeable they are about the topic, the more developed their mental model would presumably be.

In the questions on HIV/Aids, the participants were asked to indicate whether a statement is true (by answering "yes"), false (by answering "no") or "don't know" if they were unsure. The answers to the statements are not opinion questions; the answers are either true or false. The questions therefore tests the participants' knowledge, not their opinions on the subject (Appendix A contains the correct answers to the questions).

#### **b. The cards**

In this study, 48 cards were chosen to represent the main content of the FACT website. (See appendix B for a list of these cards) The cards consist of a heading and information describing the content of the section. In most cases, the heading is all the participant needs to sort the cards into a logical structure because it is self-descriptive;

the description is added in the cases where the participant may not understand what the heading means. For example where technical terms are used, the description will help the participant to understand the content. Some of the descriptive content on the cards are sentences that come from the website and which is informative enough so that the participants will be able to know what the content is about. For example:

- What does it mean if I test positive?
- A positive test result means that you have HIV antibodies, and are infected with HIV.

I also included descriptions of the content not taken from the website. For example:

- Myths about infection
- This section deals with the many myths concerning the HIV/Aids phenomenon.

Some of the cards represent main links in the menu, while other cards represent content on individual pages. For instance, the following titles of cards represent different links in the menu:

- What is Aids?
- Vision and Mission
- Student Health Services
- Links to external web sites that are relevant
- Forum
- Interactive poll



The following titles represent information on one page:

- Theories on the origin of HIV/Aids
- What other theories have there been concerning the spread of HIV?
- The progression of HIV infection to Aids
- Is it known where the emergence of HIV in humans took place?
- What caused the HIV epidemic to spread so quickly?

The reason for choosing the cards in this way is so that high-level and low-level topics in the structure are represented. In the case of the web site structure, the high-level topics represent the topics that form part of the main menu items. For example

“What is Aids?”, “Vision and Mission” and “Forum”. In the context of the hierarchical tree structure, the high-level groups refer to the clusters that consist of more than one sub-cluster.

Some of the cards are semantically linked through a repetition of key words, for instance “statistics” which appears on three different cards. The semantic relationships should allow participants to group these cards together easily. In other cases the semantic relationship is not evident, requiring a deeper knowledge of the subject.

### **c. Post-sorting structured interview**

A post-sorting structured interview was used where all participants were asked the same questions to determine how the participants experienced the exercise. The answers were recorded on a form (see appendix C). The data generated by these questions were used in statistical analyses with the data generated by the profiling questionnaire.

The post-sorting interview aimed to generate data concerning the participants’ experience of the exercise. Some of the questions were used as a cross-check for the profiling questionnaire. For instance, if they found the exercise difficult, an assumption would be that their level of knowledge of the topic would also be low. However, if this is not the case (determined by comparing the data), one must find a different explanation for the perceived difficulty of the exercise. It might, for instance, be that the type of exercise asked for more cognitive energy than what they were expecting to exert and they judged the difficulty based on the level of cognitive energy expended. Unfortunately, it was not determined in the post-sorting exercise what the reasons were why participants found the exercise difficult.

Question 1 in this interview asks the participant to rate how difficult it was to perform this task on a scale of 1 to 9 where 1 is easy and 9 is difficult. The data of this question will be compared to the knowledge/experience of the user regarding the internet and HIV/Aids.

Question 2 asks the participant what they used for headings. The options they have to choose from are their “own words”, words from the “text” or “both”. This is very important because it gives an understanding of why participants sorted the cards in the structure that they did. Headings are used as representative of the content of their groupings which may give interesting insights into the mental models of the participants.

Question 3 asks the participants to describe how they sorted the cards. What method did they use to get the structure they ended up with? The main reason for asking this question was to determine up to what level they invoked their mental models in the card sorting process. In other words, if the participants said that they had categories ‘in their heads’ and they just sorted the cards into these categories, it means that they have and are aware of their mental model. However, if they say that they developed categories as they read the information on the cards, it may mean that they are not aware of their mental model or that it was reformed as the information became available to them.

Question 4 asks whether the participants have any special/specific training regarding HIV/Aids or web design. If, for instance, they have training in web design they could be regarded as experts and a strong mental model would be expected. Their level of expertise could then also be compared to their experience of the difficulty level of the exercise. It would be expected that experts would not find the exercise difficult because they have good knowledge of the subject.

The last question asks whether it was easy for the participant to see a structure. This is a control question, because it correlates with the first question on their perception of the difficulty level. One would assume if they found the exercise easy, it would be because they could easily see a logical structure. However, this correlation must be statistically tested before the conclusion can be drawn.

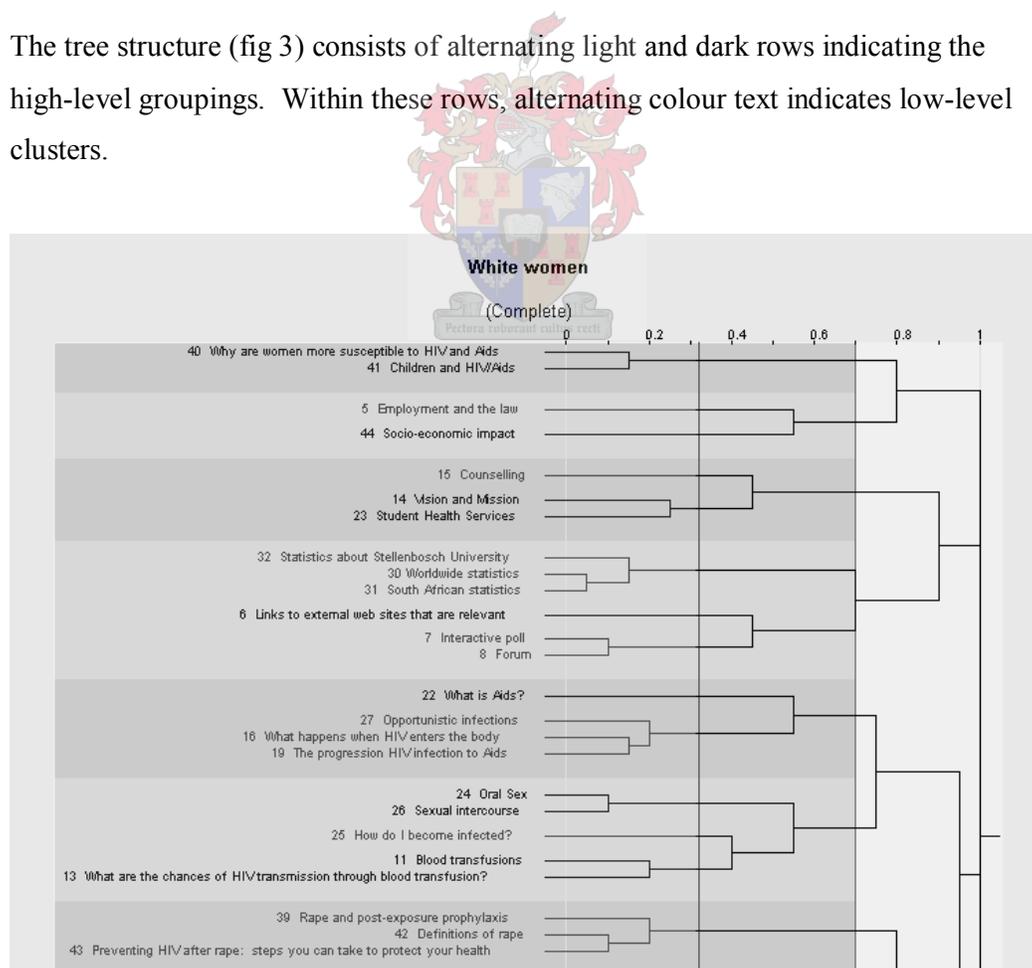
#### **d. Software**

IBM’s EZSort application was used as the software to analyse the data recorded with the card sorting exercise. The application consists of USort and EZCalc. USort allows the researcher to enter the data indicating the structure that the participant

created, and show high-level and low-level groups and name the high-level groups. EZCalc performs a cluster analysis of the groups as selected by the researcher. For instance, a cluster analysis can be done using the variables race and gender to produce separate tree structures for white males, white females, black males, etc. The researcher can also do an analysis using one of the variables producing separate structures for males and females or white, black and coloured participants.

The result of the cluster analysis is a tree structure which represents the clusters that the group have formed. The software makes use of different algorithms to derive its structures. In this study it was decided to use complete linkage rules because it is the most appropriate test as “the distances between clusters are determined by the greatest distance between any two objects in the different clusters” (StatSoft 2004). The fewer people sorted items together, the further they will be apart in the tree structure.

The tree structure (fig 3) consists of alternating light and dark rows indicating the high-level groupings. Within these rows, alternating colour text indicates low-level clusters.



**Figure 3 - Extract from a tree structure**

### **3.4.3 Pre-test**

The method and procedure was pre-tested to determine:

- how long it takes to complete the task;
- whether there are too many cards, therefore making it difficult for the participants to complete the task;
- whether there were any difficulties in understanding the content of the cards;
- whether the instructions and procedure of performing the task is usable;
- whether the method of data collection is usable;
- whether the interview questions facilitate a natural conversation producing usable data.

It was determined that the task takes between 20-40 minutes and that it is not too taxing for participants. The pre-test participants did not have any problems understanding the contents of the cards. It was, therefore, deemed unnecessary to modify the cards' content. The experiment could continue using the current content of the cards.

### **3.4.4 Procedure**

The researcher introduced herself and thanked the participants for taking part in the study. They were given general information about the study and what was expected from them, explaining exactly how the study would be conducted (Benson et al 2000). They were told that the information on the cards comes from the official website of Stellenbosch University regarding HIV/Aids.

Each participant received a stack of shuffled cards, a set of instructions, a pen and blank cards. They were asked to sort the cards into groups that make sense to them. They were told that there is no right or wrong way to do this and no limit to the amount of groups or cards in a group. If these groups formed any bigger groups, they were asked to place them together. They were then asked to provide a heading for each high-level group, writing it on the blank pieces of paper provided. No instructions were given regarding what they were allowed to use as titles.

The researcher was present during the exercise and was available in case the participants had questions but was in an observational position only. When the participant completed the task, the participant was asked to help the researcher record the structure by reading the heading that they provided and then reading the numbers on the back of the cards. This would allow the participant to actively participate in the recording process, allowing them to indicate why they made certain choices if there are any unclear combinations.

### **3.4.5 Analysis**

The data generated by the hand-sorting was entered into IBM's USort application and analysed with IBM's EZCalc software. The data is represented in a dendrogram, or tree-structure. An analysis of the structures was made by carefully comparing the clusters that were formed with each other. An analysis of the strength of these clusters were also made and compared with the other tree structures' clusters. Differences were recorded and will be reported in Chapter 4.

The data generated by the two questionnaires were entered into and analysed with the SPSS software. The two statistical tests that were performed were frequency tests and cross-tabulations between the variables with chi-square tests revealing the significance of the cross-tabulation results.

## Chapter 4 Results

### 4.1 Web site structure analysis results

The web site that was chosen is the official HIV/Aids web site of Stellenbosch University called FACT. It was designed in 2003 by four Information Science students with the input of the HIV/Aids co-ordinator of the university regarding the content and structure of the site. The web site can be found at <http://www.sun.ac.za/fact>. (See fig. 4)



Figure 4 - Screen shot of the FACT web site

#### 4.1.1 Navigation system

A user survey was conducted with the target audience during the design stages of the site. Based on information obtained from the user survey, it is evident that potential users only want to view relevant information. In other words, users have a need to quickly find the information that they are looking for, they do not want to read through irrelevant information, and they need a structure that will allow them to do this.

All the topics in the web site are accessible through the menu system which is visible on all pages in the web site, allowing users to access all information from any page in the web site. The main- and their subsequent sub-menu items are:

- **Web site**

- Home
- Contact Info
- Events
- Links
- Site map
- FAQ
- Forum

- **University of Stellenbosch and Aids**

- Vision and Mission
- Curriculum Development
- US Student Policy
- US Employee Policy



- **Services**

- Student Health Service
- Centre for Student Counselling and Development
- Training & Workshops
- Community Outreach/@Heart

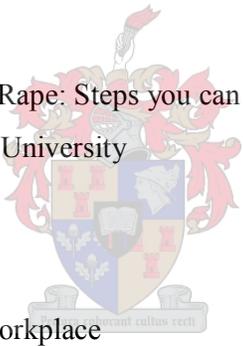
- **Fact or fiction?**

- What is HIV and Aids?
- History of Aids
- Myths about infection
- Statistics

- **How can I become infected**

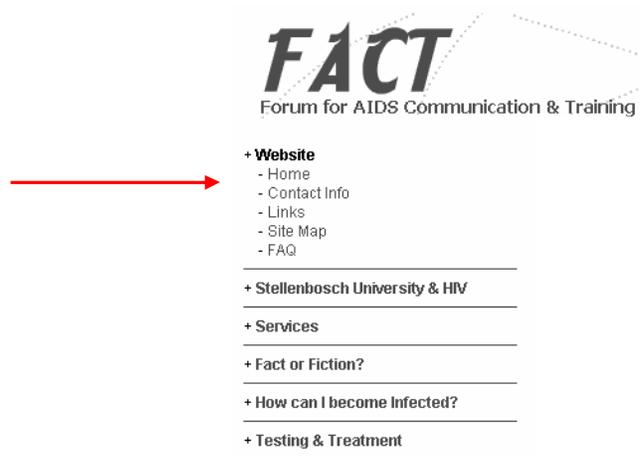
- Introduction
- Sexual intercourse
- Blood to blood
- Mother to child

- **Testing and treatment**
  - When is testing not allowed
  - HIV tests
  - Accuracy of tests
  - I tested positive, now what?
  - Medicine/treatment
  - Free services
  
- **How Aids affect**
  - Gender, culture and Aids
  - Children and Aids
  - Socio-economic impact
  
- **Rape**
  - What is rape?
  - Rape statistics
  - Preventing AIDS after Rape: Steps you can take to protect your health
  - Rape and Stellenbosch University
  
- **Your rights**
  - HIV/Aids and the law
  - Employment and the workplace
  - Healthcare
  - Your sexual rights
  
- **Prevention**
  - Sexuality
  - Sexual choices
  - Condoms
  - Safe sex



The sub-menu items only open when the user clicks on the main menu items. This is problematic since the main menu items are not descriptive enough in some cases to allow users to predict the content. For instance, the menu item “Website” (See fig. 5) contains information that would usually be called “About us”. Not using the conventional wording may be confusing to the user. The menu item is in the first

position which is where users may expect this kind of information but it does not follow the mental model that users have about menus.



**Figure 5 - Menu structure of FACT web site**

The menu item “Fact or fiction?” is also problematic as a high-level heading. The user may not be able to predict what information they will find behind the link. This is especially problematic if a reader is looking for the “Statistics” about HIV/Aids. It is not clear from the title of the menu item that ‘statistics’ will be found here. It is important to note that no web site contains all the information about a topic, so, unless it is clear to the reader that they will find the information they are searching for; they may not even know to look for it. What the reader is left with is to click on every link to see whether the information exists under the heading/link. “Statistics” could easily also have been found under the “Web site” link or the “University of Stellenbosch and AIDS” link.



**Figure 6 - Menu item "Fact or Fiction"**

Another problematic main menu item is “Prevention”. It contains information about sex and sexuality. The problem is that this information is hidden. If a user is looking for information about sexual choices, they may not necessarily choose to look under “prevention”. This information is also only accessible from one place. In other words, there is only one way to get to information pertaining to sexuality. A better solution is to group all information regarding sexuality, including pages like “Sexual intercourse” (found under “How can I become infected”) and “Your sexual rights” (found under “Your rights”) in a section that is entitled “Sexuality”. This will make the information more visible. It is also advisable to construct the structure in such a way that the user is able to access the information from more than one place. This will allow users with slightly different mental models to also find the information. The main menu item must, however, be clearer about its contents.

#### **4.1.2 *Placing navigation***

The placement of the navigation is very important. It should be logical and conform to the norms of web design. These norms are based on the trends established in the marketplace and the information seeking behaviour of the reader.

The trend is to place the menu system in the top third of the page because this is the most prominent position. Web design in recent years have ‘conditioned’ users to expect the navigation system to be located either at the top (third) or on the left of the page, therefore enforcing their mental models of navigation.

Readers also tend to regard information on the top of the page to be most important. Placing the menu-system in this position enables the reader to find information where they expect it. They do not have to waste mental energy trying to find out where to locate the information. It is also important to place the menu system above the scroll line because users may choose not to scroll down, therefore missing the menu system and consequently missing important information.

The main menu of the FACT web site is located on the left hand side of the screen. It is a hierarchical menu with only the main menu items visible until the reader clicks on it. That section’s sub-menu items then become visible and all other submenus are

closed. This is a very common and predictable menu structure which will make it easy for users to understand.

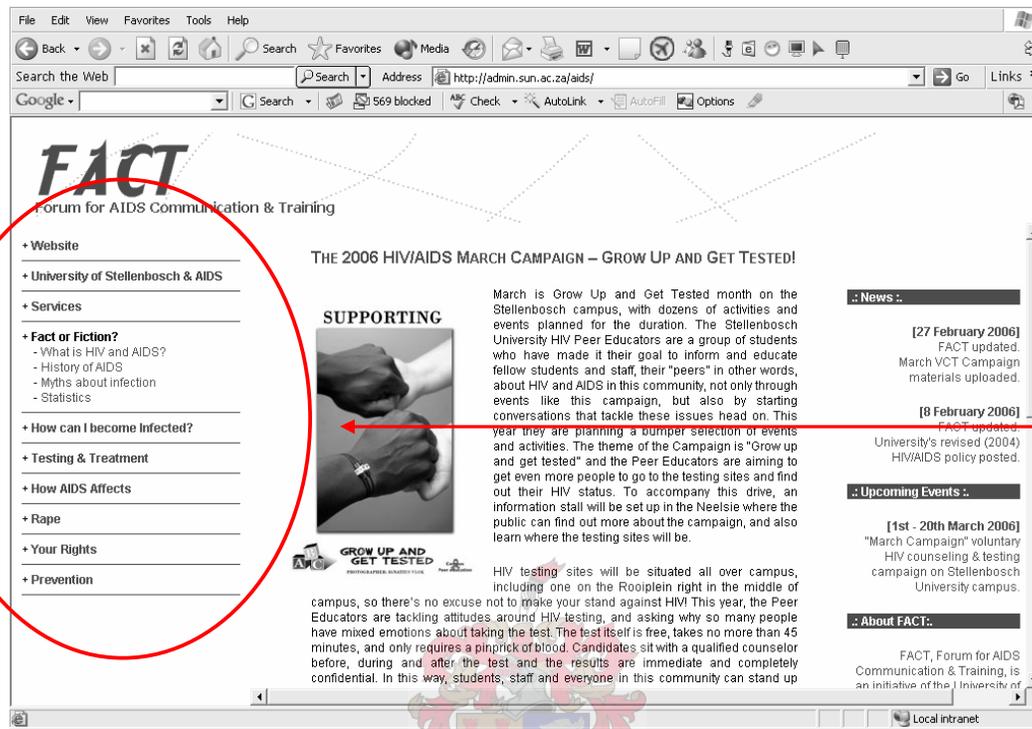


Figure 7 - Placement of navigation

#### 4.1.3 Consistency of navigation

It is important to keep the navigation system consistent because a user orientates him/herself through the menu system. The menu/navigation system looks the same on every page; therefore, the user can keep track of where they are in the web site and where to find the information they need.

#### 4.1.4 Web site tree structure

The web site tree structure was created using the IBM EZSort software. This was done in order to be able to compare the data with the other tree structures. The comparison between tree structures will be discussed later in this chapter, however, the analysis of the web site's tree structure will be reported on in this section.

The first interesting aspect is that “Employment and the law” and “Socio-economic impact of HIV/Aids” are not close to each other in the information structure.

“Employment and the law” falls under the main menu item “Your rights” while “Socio-economic impact of HIV/Aids” falls under the main menu item “How Aids affects” and also includes the other two items “Why are women more susceptible to HIV and Aids” and “Children and Aids”. In most cases, the different groups sorted “Employment and the law” and “Socio-economic impact of HIV/Aids” together. This might be because the participants did not have access to the original structure and main menu items; therefore they formed connections based on different criteria (in this case, the economy).

“Vision and Mission” falls under “University of Stellenbosch and Aids”, yet most groups sorted “Vision and Mission” with “Student Health Services” which falls under “Services”. The reason these items were sorted together might be because the other contextualising information placing them in different categories were not included in the cards. These two cards, therefore, makes the most logical sense given the information the participants had.

It must be made clear, however, that the goal of the exercise was not to produce a structure for the web site based on the participants’ mental models; the goal was to see whether the resulting structures (based on shared mental models) are different for different cultural/race groups.



## **4.2 Questionnaire results**

### **4.2.1 Personal information**

#### **a. Age**

Of the sixty participants, the majority (37.9%) are between 21 and 22. The next biggest age group are over 25. Only 13.8% are under the age of 21. This is good because it ensures that there is a mixture of different age groups participating in the study that represents the actual target audience of the FACT web site.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19-20	8	13.8	13.8	13.8
	21-22	22	37.9	37.9	51.7
	23-24	11	19.0	19.0	70.7
	25+	17	29.3	29.3	100.0
	Total	58	100.0	100.0	

**Table 1 - Frequency table "Age"**

**b. Language**

58.6% of participants indicated that their first language is Afrikaans. 24.1% of participants are Xhosa speaking and only 13.8 % of participants are English speaking. It follows therefore that less than the expected 20 black participants (14) indicated that Xhosa was their first language and only 2 black participants indicated that they speak another black language. Also, of the white and coloured groups, only 8 participants indicated that they speak English as a first language and 34 participants speak Afrikaans. This means that race does not imply choice of language.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Afrikaans	34	58.6	58.6	58.6
	English	8	13.8	13.8	72.4
	Xhosa	14	24.1	24.1	96.6
	4	2	3.4	3.4	100.0
	Total	58	100.0	100.0	

**Table 2 - Frequency table "Language"**

**c. Academic year**

58.6% of participants are either in their 4th year or post graduate meaning that the majority of participants are advanced students. This correlates with the age frequency analysis where most participants were over the age of 21. The participants that indicated that they were undergraduates are spread quite evenly with a 6.9% variation between the lowest frequency (second year students) to the highest frequency (third year students).

The target audience of the FACT web site are students at the University and include both undergraduate and postgraduate students. In order to ensure that the experimental group is representative of the target audience, it was important to include users from the both groups of students.

		Academic Year			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	First year	8	13.8	13.8	13.8
	Second year	6	10.3	10.3	24.1
	Third year	10	17.2	17.2	41.4
	Fourth year	3	5.2	5.2	46.6
	Post graduate	31	53.4	53.4	100.0
	Total	58	100.0	100.0	

Table 3 - Frequency table "Academic year"

#### 4.2.2 Computer experience

##### a. Use of Microsoft Word

The majority (53.4%) of participants use Microsoft Word more than four times a week. This means most of the participants are regular computer users. Only one participant indicated that they use Microsoft Word less than once a week. This does not, however mean that they have never used the software, it means that they are not frequent users. This means that 98.3% of users use the software at least once a week.

		Use of Microsoft Word			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	1.7	1.7	1.7
	No more than once a week	6	10.3	10.3	12.1
	More than once a week	6	10.3	10.3	22.4
	At least 3 times per week	14	24.1	24.1	46.6
	More than 4 times per week	31	53.4	53.4	100.0
	Total	58	100.0	100.0	

Table 4 - Frequency table "Use of Microsoft Word"

**b. Use of Microsoft Excel**

Fourteen (24%) of the participants indicated that they did not use Microsoft Excel while 21 (36.2%) indicated that they do use it, but not more than once a week. Microsoft Excel is, of course, not as common an application as Microsoft Word, so it is to be expected that less participants makes regular use of it. 39.6% of the participants use it more than once a week. The use of this application may indicate users that are more advanced computer users.

**Use of Microsoft Excel**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Missing	14	24.1	24.1	24.1
	No more than once a week	21	36.2	36.2	60.3
	More than once a week	8	13.8	13.8	74.1
	At least 3 times per week	6	10.3	10.3	84.5
	More than 4 times per week	9	15.5	15.5	100.0
	Total	58	100.0	100.0	

**Table 5 - Frequency table "Use of Microsoft Excel"**

**c. Use of E-mail**

An overwhelming majority of participants (70.7%) indicated that they use e-mail more than 4 times per week. This is expected since Stellenbosch University has an excellent network of computers with a ratio of one computer for every 10 students. This is one of the highest ratios in South Africa. Students, therefore have very good access to computers and most students use e-mail every day.

**Use of E-mail**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Missing	7	12.1	12.1	12.1
	No more than once a week	3	5.2	5.2	17.2
	More than once a week	2	3.4	3.4	20.7
	At least 3 times per week	5	8.6	8.6	29.3
	More than 4 times per week	41	70.7	70.7	100.0
	Total	58	100.0	100.0	

**Table 6 - Frequency table "Use of e-mail"**

**d. Use of internet**

Thirty five (60.3%) of the participants indicated that they use the internet more than 4 times per week. This is the majority of users. Because students make use of the internet to do research, it is expected that the majority would use the internet very frequently. Only seven (12.1%) of participants do not use the internet (missing values). This is exactly the same amount of participants that indicated that they do not use e-mail.

**Use of internet**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Missing	7	12.1	12.1	12.1
	No more than once a week	2	3.4	3.4	15.5
	More than once a week	4	6.9	6.9	22.4
	At least 3 times per week	10	17.2	17.2	39.7
	More than 4 times per week	35	60.3	60.3	100.0
	Total	58	100.0	100.0	

**Table 7 - Frequency table "Use of internet"**

**4.2.3 HIV/Aids knowledge**

The results of the section determining the HIV/Aids knowledge of participants is presented in two tables. The first table shows the results of the statements that are true and the second table shows the results of the statements that are false.

The average percentage of people who judged these answers as true are 73%. This is an overwhelming majority of participants. An interesting result is with the statement “You need to use a new condom every time you have sexual intercourse” where 100% of participants agreed that the statement is true. This might be because the HIV/Aids campaigns stress this fact repeatedly.

The statement “If a latex condom is used during sexual intercourse, there is no risk of HIV transmission” produced the most interesting result. Only 15.5% of participants answered this correctly. This may be that the statement was not well formulated and misunderstood. In the interviews, the participants indicated that using a condom during sexual intercourse is not 100% safe because it may break. However, the question implies that the condom is intact. The question should have been formulated to eliminate any ambiguities.

		Frequency	Percent	Cumulative Percent
HIV may be transmitted through insects	Yes	4	6.9	6.9
	No	51	87.5	94.8
	Don't know	3	5.2	100
	Total	58	100	
HIV is another name for IDS	Yes	3	5.2	5.2
	No	51	87.9	93.1
	Don't know	4	6.9	100
	Total	58	100	
Fellow employees have the right to know if someone in their workplace is HIV positive	Yes	14	24.1	24.1
	No	37	63.8	87.9
	Don't know	7	12.1	100
	Total	58	100	
Sometimes HI virus particles are small enough to go through a condom	Yes	20	34.5	34.5
	No	22	37.9	72.4
	Don't know	16	27.6	100
	Total	58	100	
HIV may be transmitted through sneezing	Yes	3	5.2	5.2
	No	50	86.2	91.4
	Don't know	5	8.6	100
	Total	58	100	
A mutated version of HIV can be transmitted through the air	No	42	72.4	72.4
	Don't know	16	27.6	100
	Total	58	100	

**Table 8 - Frequency table "HIV/Aids knowledge" (Correct answer is "Yes")**

79.14% of participants judged the section's statements correctly. It can therefore safely be assumed that the participants have a reasonable knowledge of the topic of HIV/Aids.

		Frequency	Percent	Cumulative Percent
The window period implies that HIV tests cannot verify your HIV status immediately after a risk incident	Yes	44	75.9	75.9
	No	4	6.9	82.8
	Don't know	10	17.2	100
	Total	58	100	
HIV is unable to reproduce outside its living host, except under very extreme laboratory conditions	Yes	33	56.9	56.9
	No	10	17.2	74.1
	Don't know	15	25.9	100
	Total	58	100	
Deep, open-mouthed kissing is a very low risk activity in terms of HIV transmission	Yes	40	69	69
	No	11	19	87.9
	Don't know	7	12.1	100
	Total	58	100	
Persons with HIV are infected for life	Yes	51	87.9	87.9
	No	5	8.6	96.6
	Don't know	2	3.4	100
	Total	58	100	
A positive test result means that you have HIV antibodies and are infected with HIV	Yes	43	74.1	74.1
	No	11	19	93.1
	Don't know	4	6.9	100
	Total	58	100	
Sexual intercourse is the main mode of transmission of HIV	Yes	54	93.1	93.1
	No	3	5.2	98.3
	Don't know	1	1.7	100
	Total	58	100	
If a latex condom is used during sexual intercourse, there is no risk of HIV transmission	Yes	9	15.5	15.5
	No	39	67.2	82.8
	Don't know	10	17.2	100
	Total	58	100	
You need to use a new condom every time you have sexual intercourse	Yes	58	100	100
HIV transmission depends on a transmission of virus-containing fluid from an infected person to a susceptible person	Yes	49	84.5	84.5
	No	2	3.4	3.4
	Don't know	7	12.1	100
	Total	58	100	

**Table 9 - Frequency table "HIV/Aids knowledge" (Correct answer is "No")**

85.3% of participants agree that the following statements are not true which indicates that there is a 12.53% difference between the two tables. The most interesting statistic is that no participants agreed that a mutated version of HIV can be transmitted

through the air. This statement, with “sometimes HI virus particles are small enough to go through a condom”, had the highest number of participants who did not know whether it was true or not (27.6%).

When all the answers in this section are considered, the overwhelming majority of participants judged the statements correctly, indicating that their level of knowledge of the subject is quite high. This also means that they will have quite strong mental models of the subject (considering knowledge of a subject supposes the existence of a mental model).

### 4.3 Structured interview results

The data of the structured interview was analysed using SPSS, a statistical analysis application. The result of this analysis is shown here.

The first question is “How difficult was it to perform this task”. The answers were plotted on a scale of 1 to 9 (1 is extremely easy, 9 is extremely difficult). The scores were relatively equally spread out with the fewest participants answered 8 or 9 while the most participants answered 4.

**How difficult was it to perform this task?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely easy	7	12.1	12.1	12.1
	Very easy	7	12.1	12.1	24.1
	Easy	5	8.6	8.6	32.8
	Not so easy	11	19.0	19.0	51.7
	Neutral	10	17.2	17.2	69.0
	Not so difficult	6	10.3	10.3	79.3
	Difficult	6	10.3	10.3	89.7
	Very difficult	3	5.2	5.2	94.8
	Extremely difficult	3	5.2	5.2	100.0
	Total	58	100.0	100.0	

**Table 10 - Frequency table "Level of difficulty"**

This could mean that most participants did not find the exercise too easy or too difficult. However, based on research done in the field of Document Design, some participants may have difficulty marking extreme values and prefer more neutral responses. However, no test was done to determine whether this was the case, so it is

could not be determined. The more probable explanation would be that participants are relatively knowledgeable about the subject (based on the questions testing their knowledge) and because of this, their mental models are relatively strong and therefore, they did not have particular difficulty performing the task.

This question can be compared with question 4: “Was it easy to see a structure?” 77.6% of participants found it easy to see a structure while only 22.4% of participants found it difficult. This is very similar to the number of people who judged the statements correctly which was 79.14%. This means, therefore that the assumption is true. Most participants were reasonably to very knowledgeable on the subject, they found it easy to see a structure and the task was not too difficult to perform. The strength of the relationship between these three questions can only be determined with a cross tabulation.

**Was it easy to see a structure**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	45	77.6	77.6	77.6
	No	13	22.4	22.4	100.0
	Total	58	100.0	100.0	

**Table 11 - Frequency table "Was it easy to see a structure"**

The other two questions that relate to the knowledge of the participants are “Do you have any special training in HIV/Aids” and “Do you have any special training in web design?” There was only a 17.2% difference between the participants who had special training in HIV/Aids where 41.4% have training and 58.6% do not have special training. Participants indicated that they received special training ranging from church to peer group education. This means that a relatively high number of participants range from knowledgeable to expert participants. It follows then that they will find the exercise less difficult than non-expert participants.

**Do you have any special training in HIV/Aids?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	24	41.4	41.4	41.4
	No	34	58.6	58.6	100.0
	Total	58	100.0	100.0	

**Table 12 - Frequency table "Special training in HIV/Aids"**

Predictably, the difference between participants who had web design training and those who don't is much bigger. It is much less common to find html programmers amongst the general public; it would therefore be predictable that fewer participants are expert web designers than would be the case with participants' HIV/Aids knowledge. Participants who had training were 34.5% while those with no special training were 65.5%. Participants with special training can, therefore, be regarded as experts and will therefore have a higher level of knowledge and a better developed mental model of web sites.

**Do you have any special training in web design?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	20	34.5	34.5	34.5
	No	38	65.5	65.5	100.0
	Total	58	100.0	100.0	

**Table 13 - Frequency table "Special training in web design"**

The last question "What did you use for headings?" was designed to determine how much the text influenced the choice of headings. This may also indicate whether the text influenced the grouping of cards. Only 17.2% of participants indicated that they used only their own words while 75.9% of participants made use of both their own words and word from the text. Since no direction was given to the participants as to what they may use for headings, it is clear that the text may have influenced their use of headings. This may also indicate that they only sorted the information into groups that were visible on the cards, and they did not think further to find more logical categories, they may have just tried to make sense of the cards using the categories that were most obvious (titles of the cards).

**What did you use for headings?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Own words	10	17.2	17.2	17.2
	Words from the text	4	6.9	6.9	24.1
	Both	44	75.9	75.9	100.0
	Total	58	100.0	100.0	

**Table 14 - Frequency table "Use of headings"**

**4.4 Cross-tabulation results**

Several cross-tabulations were performed to determine whether there were any correlations between the variables in the profiling questionnaire and the structured interview. In other words, are there any significant relationships between the variables?

**4.3.1 Race**

The independent variable “Race” was cross-tabulated with some of the dependent variables to see whether there are any important trends.

**a. Difficulty of the task**

The black group had the most participants (6) that found the task extremely easy to perform where the white group has no participants that felt the same. The white group didn’t have any participants who found the task extremely difficult while the black group again had the highest number of participants finding it extremely difficult (3). Most of the white group and coloured group’s answers ranged between “very easy” and “difficult” with the white group’s highest number of participants finding the exercise not so easy (a score of 4).

This could be an indication that white and coloured groups experienced the exercise as moderately difficult while some black participants experienced it as extremely difficult, which could be an indication that they find the type of cognitive exercise particularly difficult to perform. The results for the black participants are very mixed, however. These results could indicate that the card sorting method is not as user friendly in the South African context as one would have hoped.

		How difficult was it to perform this task?									
		Extremely easy	Very easy	Easy	Not so easy	Neutral	Not so difficult	Difficult	Very difficult	Extremely difficult	Total
Race	Black	6	0	2	2	4	2	1	1	3	21
	Coloured	1	4	2	4	3	1	2	1	0	18
	White	0	3	1	5	3	3	3	1	0	19
	Total	7	7	5	11	10	6	6	3	3	58

#### Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.490 <sup>a</sup>	16	.160
Likelihood Ratio	25.908	16	.055
Linear-by-Linear Association	.171	1	.680
N of Valid Cases	58		

a. 27 cells (100.0%) have expected count less than 5. The minimum expected count is .93.

**Table 15 - Cross-tabulation table "Level of difficulty" vs. "Race"**

#### b. How easy was it to see a structure?

The white, black and coloured groups were more or less equal in their experience in how easy it was to see a structure. The black group, however, had the highest number of participants finding it difficult to see a structure. This is an indication that the card sorting method should be applied carefully in the South African context since some groups find structuring information more difficult. The reason is that the card sorting method is based on the premise that participants are able to see a structure from information. However, this does not take individual differences and the attitude of the participant on the specific day into consideration. It might be that participants were less motivated to perform the sorting exercise and therefore found it more difficult.

This exercise may not, for instance, work across all groups of South African citizens because there is a great difference between education levels. Because the exercise requires a certain amount of cognitive skill, the application of a card sorting exercise must always be done with the knowledge that the participants will be able to perform the exercise.

**Crosstab**

Count		Was it easy to see a structure		Total
		Yes	No	
Culture	Black	14	7	21
	Coloured	16	2	18
	White	15	4	19
Total		45	13	58

**Table 16 - Cross-tabulation table "Race" vs. "Was it easy to see a structure?"**

**c. Use of E-mail**

There were no big differences between the three race groups' use of e-mail, they scored more or less the same. This means that all three groups are equally literate on this particular application.

**Crosstab**

Count		Use of E-mail				Total	
		Missing	No more than once a week	More than once a week	At least 3 times per week		More than 4 times per week
Culture	Black	4	1	1	0	15	21
	Coloured	2	2	1	0	13	18
	White	1	0	0	5	13	19
Total		7	3	2	5	41	58

**Table 17 - Cross-tabulation table "Race" vs. "Use of e-mail"**

**d. Use of Internet**

Five of the black participants indicated that they do not use the internet while only one participant each from the coloured and white groups does not use the internet. The highest number of participants that uses the internet more than four times per week are participants from the coloured group. The black and white groups both have 10 participants in this category which is not a lot less than the coloured group, indicating that the three groups are more or less equal.

**Crosstab**

Count		Use of internet					Total
		Missing	No more than once a week	More than once a week	At least 3 times per week	More than 4 times per week	
Culture	Black	5	1	2	3	10	21
	Coloured	1	0	1	1	15	18
	White	1	1	1	6	10	19
Total		7	2	4	10	35	58

**Table 18 - Cross-tabulation table "Race" vs. "Use of internet"**

**e. Knowledge of HIV/Aids**

Participants' knowledge of HIV/Aids is very important since it gives an indication of the possible existence of a mental model regarding the topic. It is interesting to compare the different race groups with each other in this case. Some of the questions determining HIV/Aids knowledge will be discussed.

*HIV is unable to reproduce outside its living host, except under very extreme laboratory conditions:*

This statement produced interesting results in the cross-tabulation with the variable "race". The white group had almost double the correct answers in this section with 17 participants indicating that this statement is correct while the black and coloured groups both had eight participants agreeing with the statement. The black group had six participants who answered incorrectly and seven participants who did not know. This fact is not something that one finds in the general HIV/Aids information brochures. It could therefore be an indication of where the different groups got their knowledge from.

**Crosstab**

Count		HIV is unable to reproduce outside its living host, except under very extreme laboratory conditions			Total
		Yes	No	Don't know	
Culture	Black	8	6	7	21
	Coloured	8	3	7	18
	White	17	1	1	19
Total		33	10	15	58

**Table 19 - Cross-tabulation table "Race" vs. "HIV/Aids knowledge"**

*Fellow employees have the right to know if someone in their workplace is HIV positive*

The black group had the highest number of participants (17) who answered the question correctly with the white and coloured groups having 10 participants each answering correctly. The black group also had no participants who didn't know whether the statement is correct or not. The consequential involvement of the black group with this topic may be higher and therefore explain why their score is higher on this particular issue.

**Crosstab**

Count		Fellow employees have the right to know if someone in their workplace is HIV positive			Total
		Yes	No	Don't know	
Culture	Black	4	17	0	21
	Coloured	4	10	4	18
	White	6	10	3	19
Total		14	37	7	58

**Table 20 - Cross-tabulation table "Race" vs. "HIV/Aids knowledge"**

g. *Sometimes HI virus particles are small enough to go through a condom*

The white group had the highest number of participants who responded to this statement incorrectly (10 participants) while the black group had the highest number of correct responses (13 participants). This means the black population is better educated on this issue.

**Crosstab**

Count		Sometimes HI virus particles is small enough to go through a condom			Total
		Yes	No	Don't know	
Culture	Black	3	13	5	21
	Coloured	7	4	7	18
	White	10	5	4	19
Total		20	22	16	58

**Table 21 - Cross-tabulation table "Race" vs. "HIV/Aids knowledge"**

*h. Sexual intercourse is the main mode of transmission of HIV*

The white group had all participants answering correctly while the black group had only one participant who did not know the answer. What is interesting, however, is that three of the black participants indicated that they did not think that sexual intercourse is the main mode of transmission of HIV. This could be because of cultural influence, but it could also be that these participants are in denial about the facts. There are a few myths regarding the spread of HIV/Aids in South Africa, and it could be that these myths have confused these participants, or that they believe that something other than sexual intercourse is more responsible for transmission.

**Crosstab**

Count		Sexual intercourse is the main mode of transmission of HIV			Total
		Yes	No	Don't know	
Culture	Black	20	0	1	21
	Coloured	15	3	0	18
	White	19	0	0	19
Total		54	3	1	58

Table 22 - Cross-tabulation table "Race" vs. "HIV/Aids knowledge"

**4.3.2 Gender**

Cross-tabulations with Gender were made to see if any interesting results ensued. The following is a report of these statistics.

**a. Use of E-mail**

There were no significant differences between the sexes concerning how often they use e-mail. Twenty-two male participants and nineteen female participants indicated that they use e-mail more than four times per week. This means that the use of e-mail is not influenced by Gender.

Crosstab

Count		Use of E-mail					Total
		Missing	No more than once a week	More than once a week	At least 3 times per week	More than 4 times per week	
Gender	Male	4	2	0	2	22	30
	Female	3	1	2	3	19	28
Total		7	3	2	5	41	58

Table 23 - Cross-tabulation table "Gender" vs. "Use of e-mail"

**b. Use of internet**

There are no significant gender-based differences concerning the use of the internet. Male participants marginally use the internet more often than female participants. Nineteen male participants use the internet more than four times per week while 16 female participants use it more than four times per week.

Crosstab

Count		Use of internet					Total
		Missing	No more than once a week	More than once a week	At least 3 times per week	More than 4 times per week	
Gender	Male	4	2	2	3	19	30
	Female	3	0	2	7	16	28
Total		7	2	4	10	35	58

Table 24 - Cross-tabulation table "Gender" vs. "Use of internet"

**4.4 Information structure results**

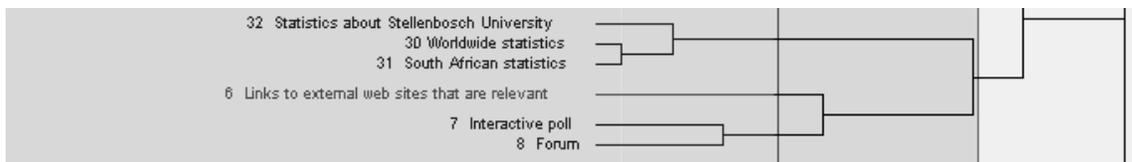
A cluster analysis was performed using IBM’s EZSort software. The results of the cluster analysis are shown as a tree structure. The results indicate how participants grouped information together and how many of them agreed that certain cards belong together. In other words, the tree structure shows the clusters made and the strength of these clusters. The tree structures of the different groups were analysed and compared with each other.

**4.4.1 White men vs. coloured men vs. black men**

In the comparison between the three groups, the threshold values of the tree structure were set at 0.31 and 0.71. In the white men's tree structure, the threshold values produced 11 high-level clusters when the furthest points were compared and 25 low-

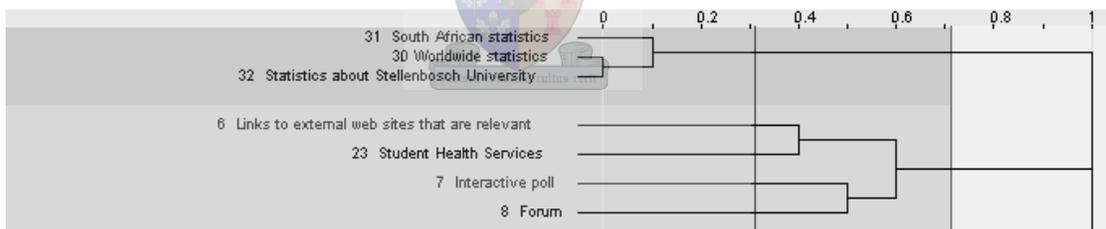
level clusters when the closest relationships were made. In the coloured men's tree structure, 13 high-level clusters and 33 low-level clusters were made. In the black men's tree structure, 15 high-level clusters and 34 low-level clusters.

There is not such a big difference in the number of high-level clusters that were formed between the three groups. The white men, however, made the fewest high-level groups which means that they saw smaller groups combined under a bigger theme more often than the black men. For example, the white men sorted the cards dealing with statistics, links, interactive poll and forum in such a way that they form three low-level clusters in one high-level cluster.



**Figure 8 - Extract from tree diagram (white men)**

The black men, on the other hand, sorted these same cards into five low-level clusters and two high-level clusters with a 0% level of agreement between the two high-level clusters.



**Figure 9 - Extract from tree diagram (black men)**

This could mean that the mental models of the white men are more refined because they saw deeper structures.

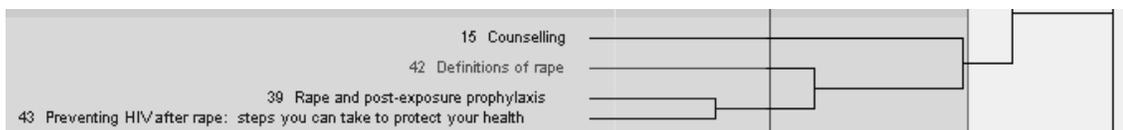
Every cluster that the black men made in the exercise was named and served as high-level clusters. They did not combine any groups to form higher level clusters. This could be because the black group had the highest number of participants that do not use the internet which indicates that their mental models for web sites may not be as highly structured.

The white men’s tree structure shows quite strong clusters making six groups lying at a threshold value of 0. This means that 100% of participants sorted these cards together. The biggest number of clusters formed between a 50% and 100% level of agreement. The tree structure of coloured men shows a much lower level of agreement. There is only one cluster that shows 100% agreement with most clusters lying between 40% - 90% level of agreement. The black men’s tree structure has a lot more elongated clusters than the coloured group, which means that their level of agreement is much lower with the biggest percentage of agreement lying between 40% and 80%. This means that there was not strong consensus between participants regarding the grouping of cards.

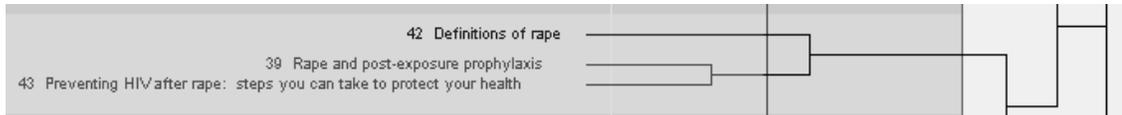
The tree structure of the coloured men is very similar to that of white men in terms of the content of the clusters. In other words, for the most part, the cards that the white men sorted together were also grouped by the coloured men. There are, however differences, such as weaker clusters (lower level of agreement) and some cards that are sorted differently.

For instance, links and statistics were grouped together by white men, but are two completely unlinked groups in the coloured men’s tree structure. The tree structure of the black men shows a lot of elongated clusters meaning that the level of agreement is not as high as the other two groups. The strongest cluster contains the cards dealing with statistics with a 100% level of agreement. The black group however saw the structure quite differently, making completely different groupings.

Some of the strong clusters (high level of agreement) can be ascribed to the card’s marked semantic relationship. For instance, the word “rape” occurs on three cards and all three groups sorted them in such a way that they form a distinct cluster.



**Figure 10 - Extract from tree diagram (white men)**



**Figure 11 - Extract from tree diagram (coloured men)**



**Figure 12 - Extract from tree diagram (black men)**

The level of agreement does, however, differ between the groups. The white and coloured men showed a level of agreement between 60% and 80% while the black group only showed a level of agreement between 40% and 70%. The clustering of semantically related cards is an expected result because the words serve as a trigger for grouping. The clusters that were similar across the three groups are those that have a strong semantic relationship.

There are, however, groups that belong together on a conceptual level, but that doesn't have semantic indicators to show their relationship. One such group is the group dealing with myths. The titles of the three cards are:

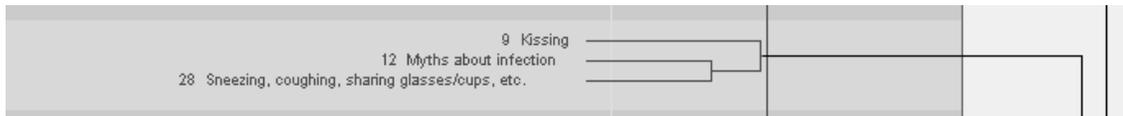
- myths about infection
- kissing
- sneezing, coughing, sharing glasses/cups etc.

The relationship is not apparent and is, therefore, dependent on the participant's knowledge of the subject. This is, therefore, a true test of the mental model of the participant. The white and coloured men sorted these three cards together with a level of agreement between 60% and 90% for white men and 70% and 80% for coloured men. The black group did not sort the three cards together. They sorted "kissing" and "myths about infection" together and "sneezing, coughing, sharing glasses/cups, etc." with "What happens when HIV enters the body" and "opportunistic infections". It is clear that the level of knowledge on HIV/Aids is lower in the black group because they believed the myths regarding transmission facts. Because these cards do not

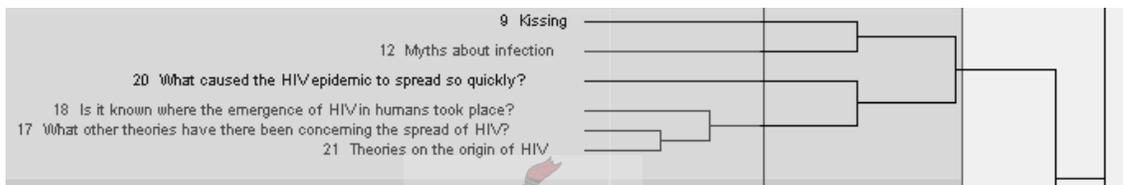
have a marked semantic relationship, it is more difficult to make a decision about its grouping.



**Figure 13 - Extract from tree diagram (white men)**

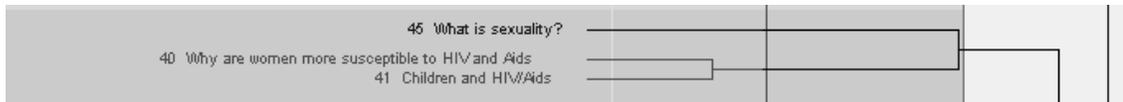


**Figure 14 - Extract from tree diagram (coloured men)**



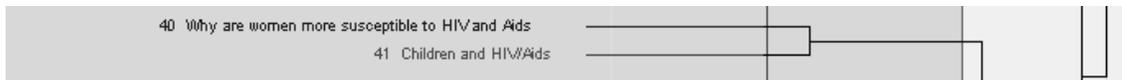
**Figure 15 - Extract from tree diagram (black men)**

An interesting result of the tree structure of white men is that they sorted “what is sexuality” with “why are women more susceptible to HIV and Aids” and “Children and HIV/Aids” and not with the cluster they made dealing with sex. Their level of agreement is 30% which is not very high.



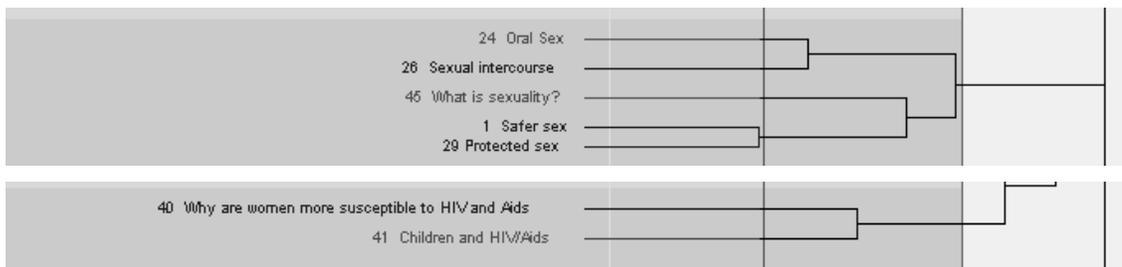
**Figure 16 - Extract from tree diagram (white men)**

The coloured men sorted “what is sexuality” with other cards that deal with the “how” of HIV/Aids. The other two cards were sorted together with a 60% level of agreement.



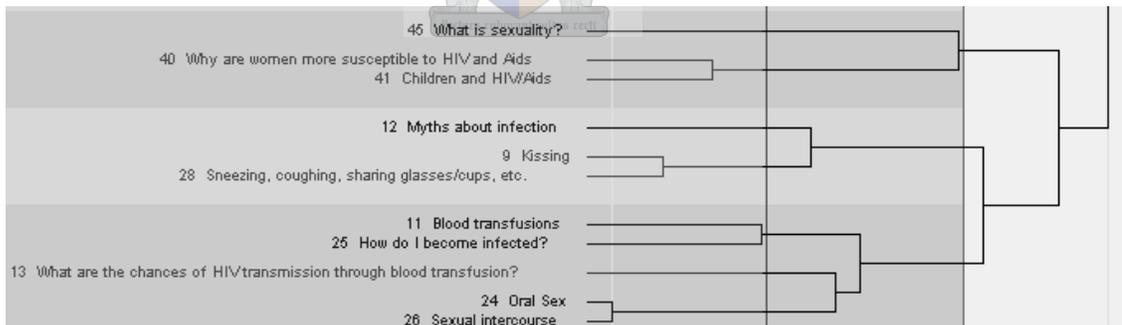
**Figure 17 - Extract from tree diagram (coloured men)**

The black men sorted “what is sexuality” with the cards dealing with sexuality (a semantic match) and the other two cards with “The progression of HIV infection to Aids” and “What is Aids”. The coloured and black groups therefore had a much more logical thought pattern than the white group in this particular case.



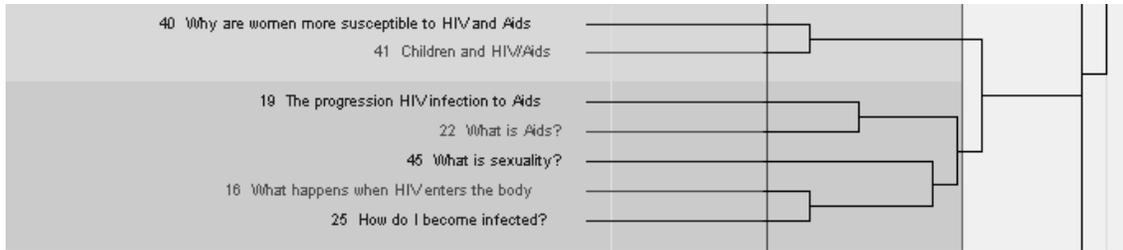
**Figure 18 - Extract from tree diagram (black men)**

The white men made a connection with other clusters dealing with transmission, so one can argue that the reason they sorted these cards together is that they are, in some way connected to transmission. However, the level of agreement is very low (10%) meaning that only one person in this group made the connection between the clusters.



**Figure 19 - Extract from tree diagram (white men)**

Coloured men, on the other hand saw a closer connection between this cluster and a cluster dealing with basic definitions. The level of agreement is not very high either (25%) which means that this is not a shared opinion.



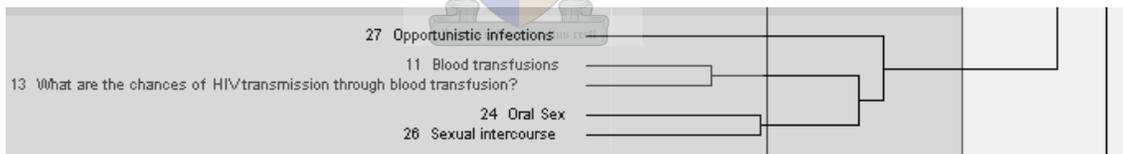
**Figure 20 - Extract from tree diagram (coloured men)**

This grouping shows that there are similarities but also differences between the three groups and the reason they group items together may differ between the groups.

In the white and coloured men’s tree structures, “Sexual intercourse” and “oral sex” is clustered with “blood transfusions” and “How do I become infected” with a range of 50% to 100% level of agreement. This grouping makes sense as all the cards are ways of infection.

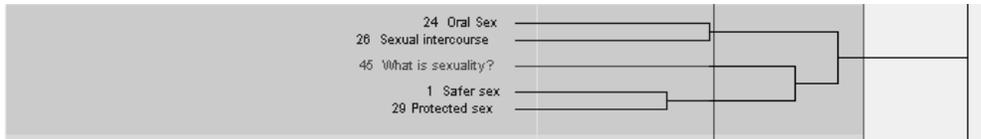


**Figure 21 - Extract from tree diagram (white men)**



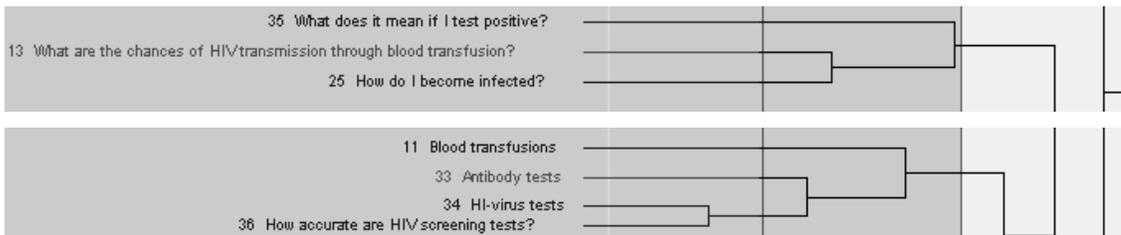
**Figure 22 - Extract from tree diagram (coloured men)**

The other cluster on sex has to do with protection, with a level of agreement also ranging between 50% and 100%. This grouping’s strong thematic relationship makes it a relatively strong cluster. A semantic link (like “sex”), therefore, does not automatically ensure that clustering will take place. The black men formed a stronger semantic cluster sorting “sexual intercourse” and “oral sex” with “what is sexuality?”, “safer sex” and “protected sex” with a 50% to 70% level of agreement. It seems, therefore, that black men are influenced much more by marked semantic relationships than the white and coloured group.



**Figure 23 - Extract from tree diagram (black men)**

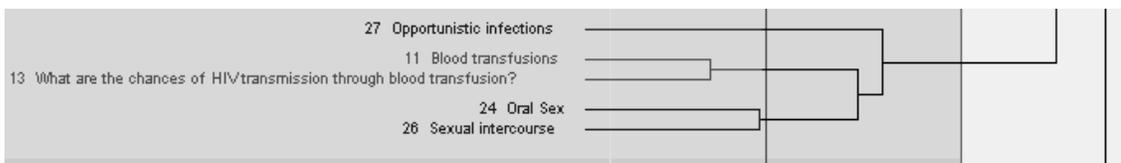
The black men broke up the strong semantically related group dealing with blood transfusions grouping “blood transfusions” with cards dealing with testing and “what are the chances of HIV transmission through blood transfusion?” with “what does it mean if I test positive?” and “How do I become infected?”.



**Figure 24 - Extract from tree diagram (black men)**

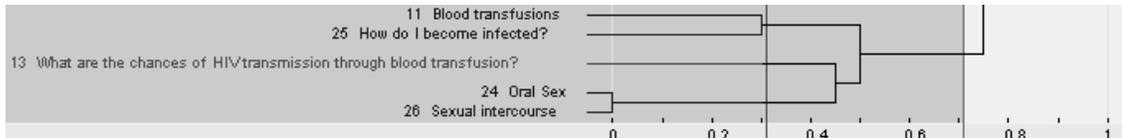
This is interesting since this is a group of cards that have a definite semantic relationship that was not sorted together. The level of agreement within the different clusters is not very strong - 30% and 40% respectively. It does seem, however that there is an explanation for this grouping. It seems like the first grouping was made based on the fact that they are all questions. This grouping is not based on semantic or thematic relation, but based on sentence type or function. In other words, the users in this group see this group as a FAQ section. The second cluster could be explained on the basis that tests are performed using blood and that HIV tests are done when donating blood. There is, therefore, a thematic link in a sense.

The coloured men are the only ones that made a strong low-level cluster with the two cards dealing with blood transfusions with a level of agreement of 80%.



**Figure 25 - Extract from tree diagram (coloured men)**

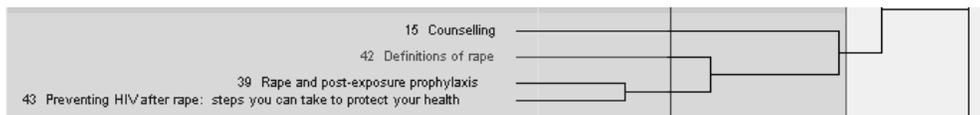
The white group sorted the two cards into the same high-level cluster, but different low-level clusters with a lower level of agreement between the two low-level clusters (50%). The overall theme of this cluster is modes of transmission, which is a thematic grouping.



**Figure 26 - Extract from tree diagram (white men)**

This is an indication that there might be a hierarchy when making clusters. It seems that a thematic relationship is the strongest and that a marked semantic relationship follows. In other words, if a thematic relationship is not apparent, the next possible choice would be a marked semantic relationship. Most often, these two types overlap, but sometimes they do not and then it seems that the thematic relationship is stronger.

Another interesting cluster is “counselling” and the section on rape in the white group. One would expect “counselling” to be clustered with services since it is a service that is being offered. The information on the “counselling” card specifically mentions the counselling services. One of the services is “crisis counselling” and rape counselling is a form of crisis counselling, so it makes sense that this relationship will be made. It is, however, important to note that the percentage agreement is only 30% meaning that only three of the 10 participants in this group made this connection. The black and coloured men sorted “Definitions of rape” with the semantically related cards “Rape and post-exposure prophylaxis” and “Preventing HIV after rape: steps you can take to protect your health”. This cluster has a level of agreement between 60% and 80% with the coloured group and 40% - 70% in the black group.



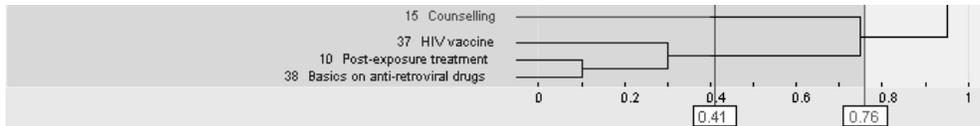
**Figure 27 - Extract from tree diagram (coloured men)**

The coloured men sorted “counselling” with “vision and mission” and “student health services” together. This is more in line with what may be grouped together on a website.



**Figure 28 - Extract from tree diagram (coloured men)**

The black men sorted “counselling” with “HIV vaccine”, “Post-exposure treatment” and “basics on anti-retroviral drugs”. This relationship is not very strong with a 25% level of agreement.



**Figure 29 - Extract from tree diagram (black men)**

It is clear that the white and coloured men show a stronger shared mental model than the black men. It is important to note that the black men’s structure is not wrong, it is just different but that there is not a very strong agreement between participants. It can, therefore, be assumed that the black group’s structure is not shared amongst the group. The white and coloured men’s mental models are quite similar, and can therefore mean one of two things:

- that the two groups are culturally closer together than for instance the white and black men; or
- that cultural differences do not have such a big role to play in the forming of mental models; it could be that experience (apart from culture) have a big role to play; or
- that language proficiency influenced the understanding of the cards and has a bigger role to play than cultural differentiation.

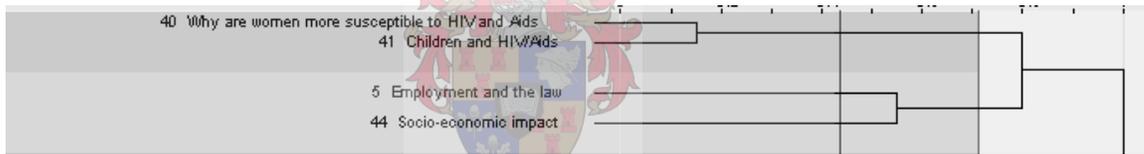
More research will be needed to deal with these issues.

#### **4.4.2 White women vs. coloured women vs. black women**

The threshold values for women were set at 0.44 and 0.71. The tree structure of the white women produced 12 high-level clusters and 21 low-level clusters. Many clusters were formed between an 80% and 100% level of agreement (three clusters at 100%). This is higher than any other group indicating that the shared mental model of this group is very strong.

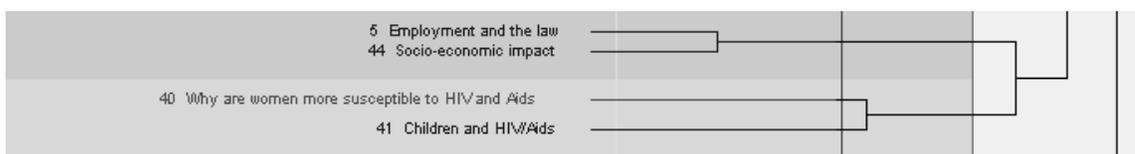
The tree structure of coloured women produced 13 high-level clusters and 23 low-level clusters. The biggest number of clusters was formed between the 50% and 100% level of agreement. There are also three clusters that show an agreement value of 100%. The tree structure of black women produced 15 high-level clusters and 27 low-level clusters. The level of agreement between participants in this group is not that high with the highest concentration of clusters made between 50% and 80%. There are only two clusters where the level of agreement is 100%. The cards forming these two clusters are “When do you use a condom?” grouped with “How to use a condom” and “Worldwide statistics” grouped with “South African statistics”. These matches are predictable because of their marked semantic relationships.

None of the white women sorted the cards relating to rape with or close to the effect of HIV/Aids on women and children even though the two topics have a thematic relationship. The two cards “Why are women more susceptible to HIV and Aids” and “Children and HIV/Aids?” show a closer relationship with the cluster containing the cards “Employment and the law” and “Socio-economic impact”.



**Figure 30 - Extract from tree diagram (white women)**

The coloured women show the same grouping as white women except that their level of agreement between the two cards is much lower (50%). The strongest link with another cluster is made at an 80% level of agreement. This cluster contains the same cards as the closest related cluster in the white group namely “Employment and the law” and “Socio-economic impact”.



**Figure 31 - Extract from tree diagram (coloured women)**

The black women also sorted the two cards together with a 50% level of agreement. The closest cluster that contains the cards “blood transfusions” and “what are the

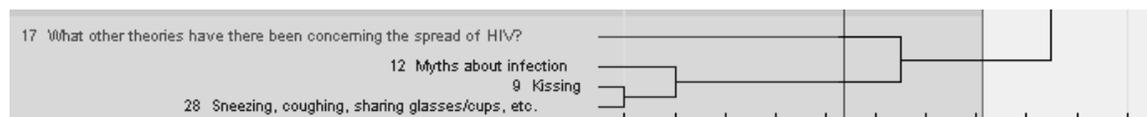
chances of HIV transmission through blood transfusion?” These two clusters are part of the same high-level cluster showing a 30% level of agreement.



**Figure 32 - Extract from tree diagram (black women)**

In the web site structure, the closest related cluster with the two cards “Why are women more susceptible to HIV and Aids” and “Children and HIV/Aids” is the section dealing with rape. This makes sense since there is a thematic link of how women are affected by the pandemic. However, the thematic link between the two clusters that the white and coloured women made is a focus on the community. This might be the reason why the white and coloured group sorted these two clusters together. It makes sense that women, who are community-driven, may make this connection.

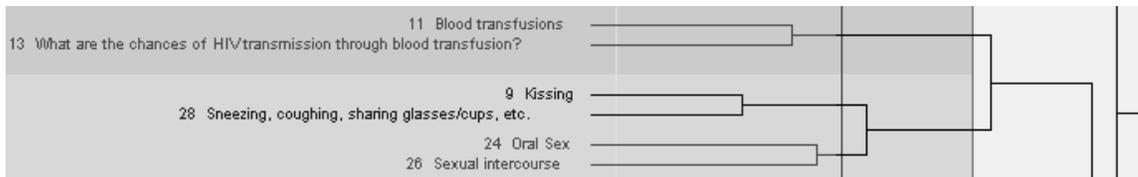
The white women sorted “Myths about infection”, “kissing” and “sneezing, coughing, sharing glasses/cups, etc” together in a very strong cluster with a 90% to 100% level of agreement. The closest related card forming a high-level cluster is “What other theories have there been concerning the spread of HIV?” This is a logical thematic grouping as theories are not proven fact and could fall in the same category as “myths”.



**Figure 33 - Extract from tree diagram (white women)**

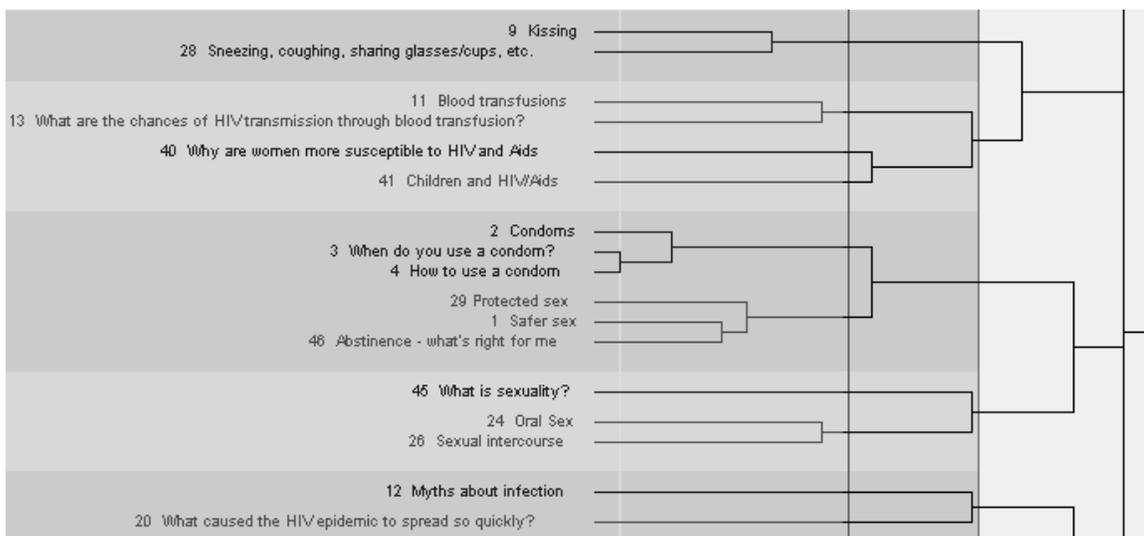
The coloured women grouped the two myths “kissing” and “sneezing, coughing, sharing glasses/cups, etc” with ways of transmission. The two cards showed a 50% level of agreement with “oral sex” and “sexual intercourse” and these four cards showed a 70% level of agreement with “blood transfusions” and “what are the chances of HIV transmission through blood transfusion?” There is a closer relationship between the first two and last two cards with a 50% level of agreement. The connection with blood transfusions is less clear (25% level of agreement). It is

interesting to note that the two myths have absolutely no link to “Myths about infection”. This indicates that none of the coloured women saw that these cards are myths, showing that their level of knowledge is, therefore lower.



**Figure 34 - Extract from tree diagram (coloured women)**

The black women also sorted the two cards, “kissing” and “sneezing, coughing, sharing glasses/cups, etc” together with a 70% level of agreement. They also sorted “blood transfusions”, “what are the chances of HIV transmission through blood transfusion?”, “why are women more susceptible to HIV and Aids” and “Children and HIV/Aids” together in a cluster. There is only a 20% level of agreement between the two clusters. They did not regard these two titles as myths because it shows no connection with “Myths about infection”. This group sorted the card “myths about infection” with “What caused the HIV epidemic to spread so quickly?” indicating that they see these two topics as thematically related. The level of agreement, however, is only 30% showing that only three participants in this group thought these two cards are related. The fact that it resulted in a cluster in the analysis, means that the highest number of participants agreed that the cards belong together. In other words, the other participants sorted these two cards with other cards, but they were all different, no one agreed.



**Figure 35 - Extract from tree diagram (black women)**

An interesting cluster in the black women’s tree structure is the first one dealing with rape. Despite the fact that there is a strong semantic relationship between the cards in this group, the level of agreement is not very high. “Rape and post-exposure prophylaxis” and “Definition of rape” show a 70% level of agreement and these two cards have only a 40% level of agreement with “Preventing HIV after rape: steps you can take to protect your health”. This cluster has no agreement with any other cluster in the tree structure.



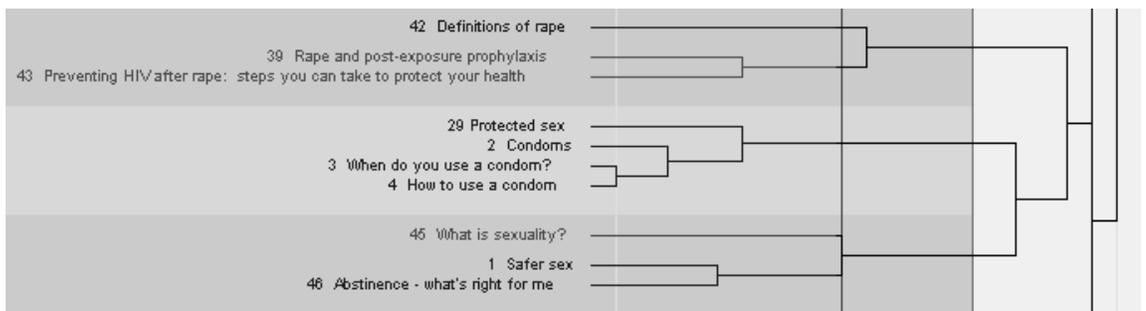
**Figure 36 - Extract from tree diagram (black women)**

The white women showed a much higher level of agreement in sorting these cards, ranging between 80% and 90%. The closest related cluster deals with sexuality and specifically, protection.



**Figure 37 - Extract from tree diagram (white women)**

The coloured women also sorted these cards to form a distinct cluster but the level of agreement is a little lower than the white women - 50% to 80%. The closest related clusters also deal with protection, as is the case with the white women. In this tree structure, however, the section makes two distinct clusters with a very low level of agreement between the clusters.



**Figure 38 - Extract from tree diagram (coloured women)**

It is clear, therefore, that the shared mental model of the white women is much stronger than any of the other two groups. It may be that this group is more aware of the topic because there are so many campaigns of safety and protection against rape on campus. It may be that this group feels more vulnerable and therefore have a stronger mental model on the subject.

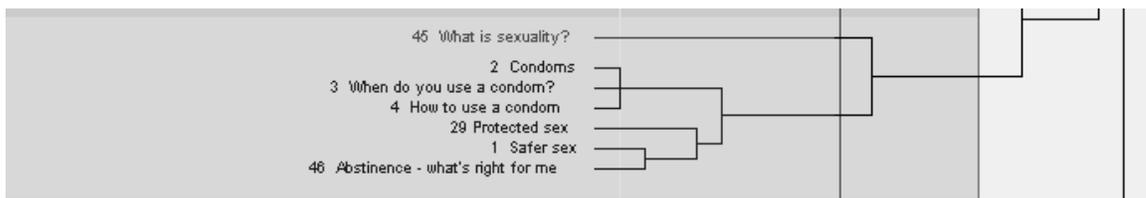
All three groups sorted the more organisational information like “Vision and mission”, “Student Health Services”, “statistics”, “Interactive poll” and “forum” together or closely related. This information typically appears in the “about us” page in a website. The level of agreement for the black women is not very strong, ranging between 40% and 60% while the coloured women have a much stronger level of agreement - 70% to 100%. The level of agreement of the white women is not as strong as the coloured group, ranging between 60% tot 90%.

The fifth cluster in the black women’s tree structure is the strongest in terms of its level of agreement which ranges between 70% - 100%. The cluster deals with protection, a topic which has a strong thematic relationship. The next cluster deals with sexuality, which is semantically related to items in the previous cluster; however only one person sorted items in the two clusters together. This is a high-level cluster that is the same for white and black women except for the card “What is sexuality” which is not sorted in this cluster for black women.



**Figure 39 - Extract from tree diagram (black women)**

The level of agreement for white women is quite strong with a level of agreement ranging between 50% and 100%.



**Figure 40 - Extract from tree diagram (white women)**

The cluster is divided into two high-level clusters in the coloured women's tree structure and ranges between 55% and 100% level of agreement.



**Figure 41 - Extract from tree diagram (coloured women)**

Although the range is smaller than for white women, the cluster is weaker because it has less low-level clusters that show a level of agreement higher than 80%.

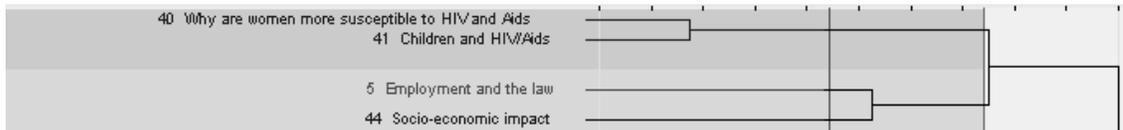
The white women and coloured women's tree structures show a lot more similarities with each other than the black women's. Although the similarities are not as strong as the white and coloured men, they are still markedly more similar than black women. It is also very interesting that the white women show the strongest structure showing the highest level of agreement. This means that they have a strongly developed shared mental model on the subject. The reason why white and coloured women's structures look more similar than black women is that their shared cultural experiences are much bigger - their cultures are a lot closer than black women.

#### **4.4.3 White population vs. coloured population vs. black population**

The threshold values for the different populations were set at 0.44 and 0.74. In the white population's tree structure, the result is 10 high-level clusters and 18 low-level clusters. The clusters are quite strong with most of the clusters forming between a 60% and 100% level of agreement. There were only two sets of cards that were sorted together 100% of the time but four sets of cards that showed a 95% level of agreement. The coloured population's tree structure produced 13 high-level clusters and 24 low-level clusters. This group did not show such a strong agreement between participants because the clusters appear much more elongated with only one pair of cards showing 100% agreement. The black population's tree structure produced 15 high-level clusters and 28 low-level clusters. This group did not show a high level of

agreement with only five low-level clusters showing over 80% agreement. The strongest clusters show either a thematic or semantic and thematic relation.

The first two clusters in the white population tree structure, although not very strong (50% - 85% level of agreement) has a thematic link - “how people are affected” and contains four titles.



**Figure 42 - Extract from tree diagram (white population)**

The level of agreement between the cards in the first cluster is higher than the other two tree structures. “Why are women more susceptible to HIV and Aids” and “Children and HIV/Aids” show an 85% level of agreement with the white population but only 55% with the coloured population.



**Figure 43 - Extract from tree diagram (coloured population)**

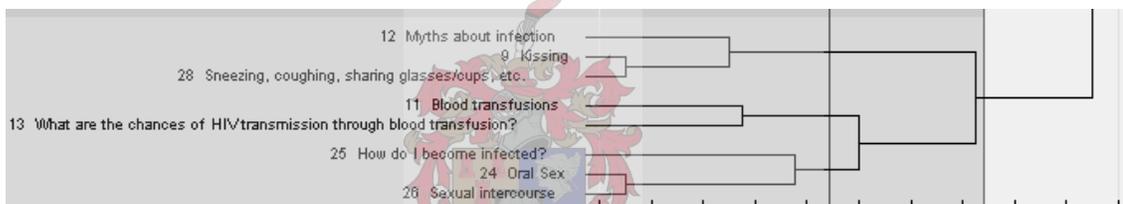
These two cards only show a 50% level of agreement with the black population. This group also sorted these cards with “Blood transfusions” and “What are the chances of HIV transmission through blood transfusions?” This is a strange combination and can be explained by the weak thematic link of the cards “What are the chances of HIV transmission through blood transfusions?” and "Why are women more susceptible to HIV and Aids". The thematic link that binds these two cards is the chance of transmission specifically in one group.



**Figure 44 - Extract from tree diagram (black population)**

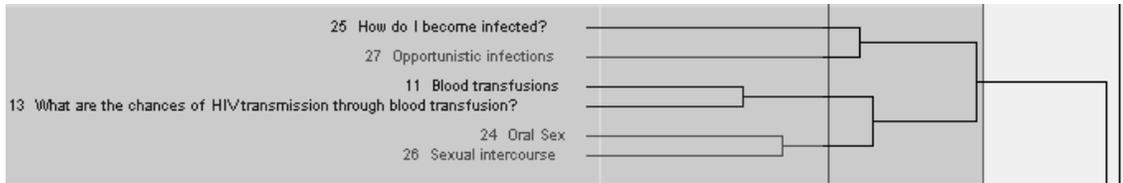
There are many similarities between the three tree structures but also many differences. The biggest differences are the level of agreement of the different clusters.

One of the biggest differences between the structures appears in the cluster dealing with modes of transmission. The level of agreement for this cluster is between 50% and 95%. What is interesting is that the white population grouped the myths with the section dealing with transmission. Although the level of agreement is not very high for this grouping, it is there meaning that some participants saw that the myths are modes of transmission. If one thinks about it, it does not make sense, because if it is a myth, then it cannot be a mode of transmission. However, it can be argued that a user will look for "Kissing" under modes of transmission when he/she wants to know whether or not it is a myth. It can, therefore, still be placed under this heading, but it must be made clear that this is not a mode of transmission.



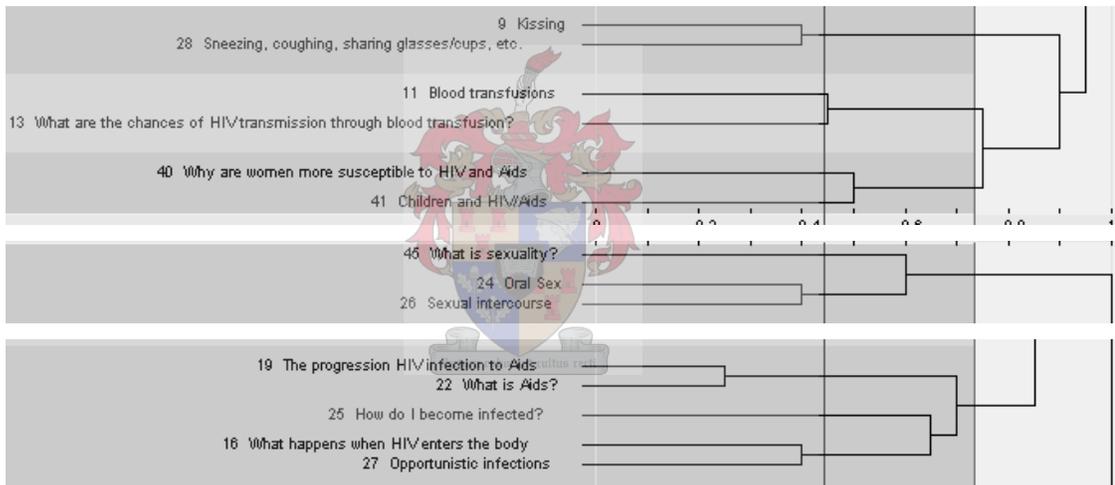
**Figure 45 - Extract from tree diagram (white population)**

The coloured population made the same grouping but removed the myths section and added "Opportunistic infections". The myths are in no way connected to the modes of transmission, making it clear that this group will not look for the information under modes of transmission. They would rather look up "Myths" to see whether "Kissing" is a myth or not. Their inclusion of "Opportunistic infections" is interesting since it has a semantic relationship with "How do I become infected?" (through the word infection) but it doesn't have a thematic relationship. It is obvious that the participants had trouble with sorting this card, and therefore opted to make a semantic link, rather than a thematic one.



**Figure 46 - Extract from tree diagram (coloured population)**

In the black population’s tree structure, “Kissing” and “Sneezing, coughing, sharing glasses/cups, etc.” forms a cluster on its own with a 40% level of agreement. It is connected to “Blood transfusions” and “What are the chances of HIV transmission through blood transfusions?” but only has a 10% level of agreement. “How do I become infected” is sorted with cards relating to the “how” of HIV and “Oral sex” and “Sexual intercourse” is sorted with “What is sexuality?”. The level of agreement in this last cluster ranges between 40% and 60% level of agreement.



**Figure 47 - Extract from tree diagram (black population)**

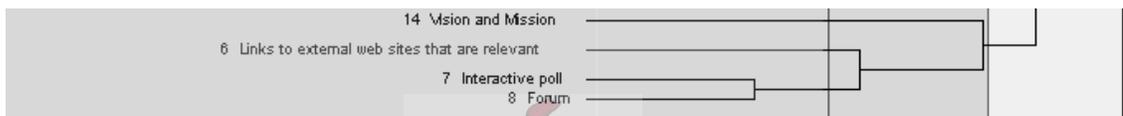
It is clear that the different groups were quite different in their ideas about which cards in this section belong together. This means that the information this section can be problematic regarding where users will search for the information.

#### **4.4.4 Men vs. women**

The threshold values of these groups were set at 0.44 and 0.74 resulting in 12 high-level and 23 low-level clusters for the men's tree structure and 13 high-level and 22 low-level clusters for the women's tree structure. The men's tree structure shows no clusters with 100% agreement with most clusters forming between 30% and 80%

level of agreement. The women's tree structure shows a few strong clusters with two sets of cards showing 100% agreement and 2 sets of cards a 95% level of agreement. This is a much stronger structure than that of men indicating that women have a higher level of agreement and therefore have a definite shared mental model.

The two tree structures are very similar. Most of the clusters formed by the men were also formed by the women with a few exceptions where individual cards were clustered with other cards. For instance the men sorted “Vision and mission” with “Links to external web sites that are relevant”, “Interactive poll” and “Forum”. There is a stronger relationship between the last three cards in this structure with a 50% to 70% level of agreement. “Vision and Mission” is grouped with this cluster at a 30% level of agreement.



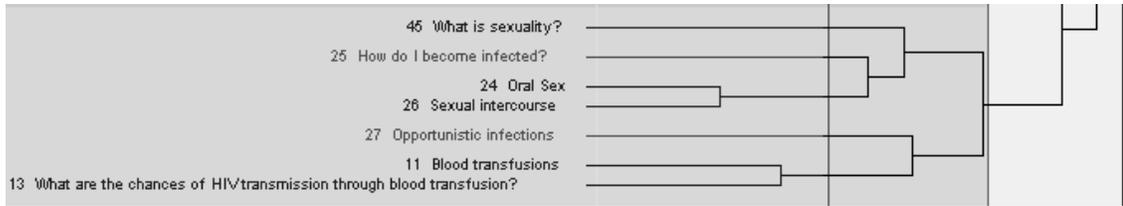
**Figure 48 - Extract from tree diagram (men)**

The women, however, sorted “Vision and mission” with “Counselling” and “Student Health Services”. They made the link that the “Vision and mission” must be of an organisation and “Student Health Services” would be a sensible choice. 50% of participants agreed that “Vision and mission” belongs with “Counselling” and “Student Health Services”.



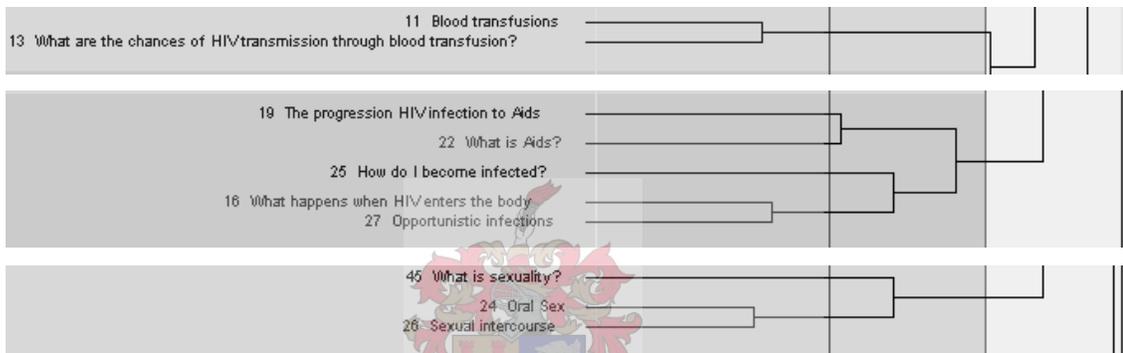
**Figure 49 - Extract from tree diagram (women)**

The other clusters that produced differences are those dealing with the facts surrounding the disease. The men sorted the modes of transmission to form a distinct cluster with a level of agreement between 40% and 75%.



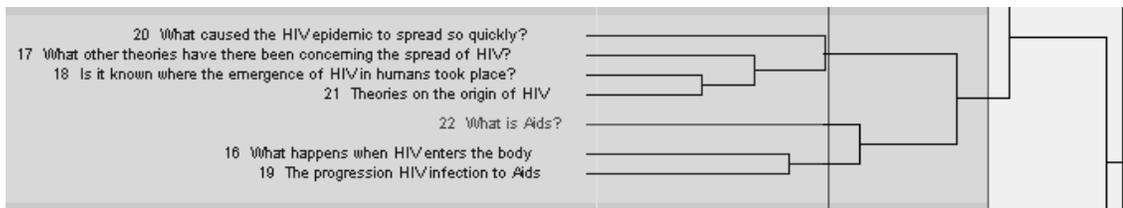
**Figure 50 - Extract from tree diagram (men)**

This grouping was broken by the women. They kept many of the low-level clusters formed by the men but did not sort all these cards in such a way to form one distinct cluster. The following shows how the women sorted the items in the cluster formed by the men:

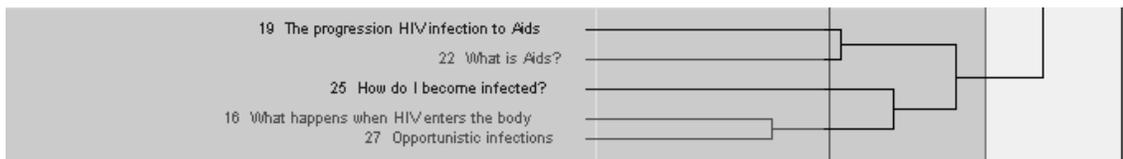


**Figure 51 - Extract from tree diagram (women)**

It is interesting to note that “What happens when HIV enters the body” and “The progression of HIV/Aids” are sorted together by the men with a 60% level of agreement while the women sorted “What happens when HIV enters the body” with “Opportunistic infections” showing a 70% level of agreement.



**Figure 52 - Extract from tree diagram (men)**



**Figure 53 - Extract from tree diagram (women)**

This is a clear indication of where the differences between the two groups lie regarding their mental models of the subject. The men sorted “What happens when HIV enters the body” in a group with an underlying theme of “how HIV/Aids works” while the women sorted the same card on the grounds of the “process of infection” – in other words, how does it work and how are you vulnerable. They do have a connection with “The progression of HIV/Aids” in that it occurs in the same high-level cluster but the level of agreement is only 35%.

#### **4.4.5 Whole population**

The threshold values for the whole population were set at 0.61 and 0.87 resulting in 8 high-level clusters and 16 low-level clusters. Although the clusters are very distinct, they are very elongated indicating that the level of agreement is not very high. There are, however, clusters that show a level of agreement of between 85% and 95%. The first of the two strongest clusters contain the cards “Condoms”, “When do you use a condom?” and “How to use a condom” and the second the cards “Statistics about Stellenbosch University”, “Worldwide statistics” and “South African statistics”. These are the cards that show the strongest semantic links.

Clear clusters were formed, with most of them between 50% and 80%. This means that there is a reasonably high level of agreement between participants indicating that there might be case for a shared mental model for the whole population.

#### **4.4.6 Whole population vs. FACT web site structure**

After all is said and done, it is important to see how the mental model of the users compares with the web site structure. Are there similarities and where do the differences lie and what effect these differences have. First we’ll look at the differences and similarities between the two tree structures.

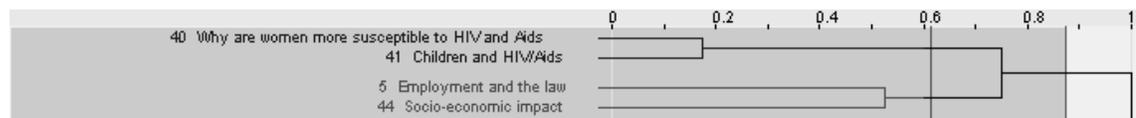
Because the information in the web site structure is not complete, the categories that were formed may not seem logical. However, in the context of the rest of the structure, it does make sense. Conversely, items that are located in different categories on the web site may seem to belong together because the other contextualising information is not there. For instance, “Employment and the law” is

located in a separate category from “Socio-economic impact”. In the web site, “Employment and the law” is located under the heading “Your rights” while “Socio-economic impact” falls under the heading “How Aids affect” and is grouped with “Gender, culture and Aids”, and “Children and Aids”.



**Figure 54 - Menu items "Your rights" and "How AIDS Affects"**

This is why the headings “Why women are more susceptible to HIV/Aids”, “Children and HIV/Aids” and “Socio-economic impact” are grouped together in the web site structure. In the structure of the whole population, “Employment and the law” is grouped with “Socio-economic impact” which seems to be the best fit given the information the participants had to their disposal.

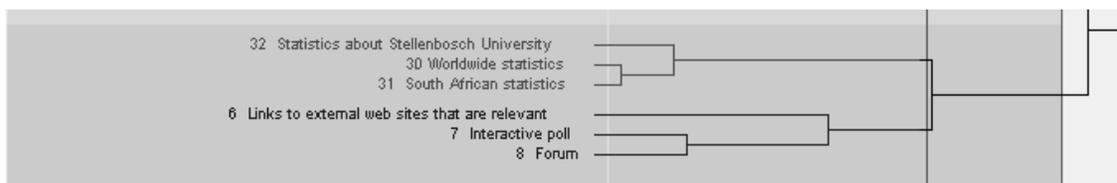


**Figure 55 - Extract from tree diagram (whole population)**

In retrospect, therefore, it would have delivered a better result if the information on the cards represented the sub-menu items only. This way, a better comparison between the web site structure and that of the target audience could have been made.

To compensate for this problem, only the items used in the card sorting exercise were used to represent the web site structure. The result is that many cards form categories of their own. However, the structure is now comparable to that of the whole population.

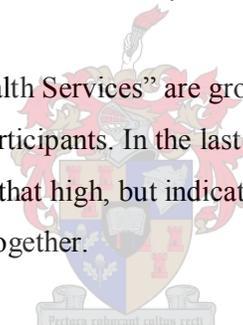
“Links”, “Interactive poll” and “Forum” are grouped together in the web site and also by participants. These items are typically interactive elements that you would find on a web site. It therefore makes sense that this grouping is made. What is interesting, however, is that the participants grouped this cluster with the three statistics items.



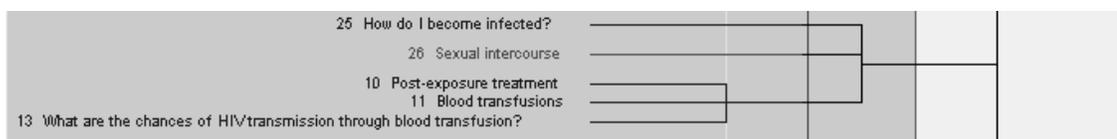
**Figure 56 - Extract from tree diagram (whole population)**

The level of agreement is not very high, however, but they still form a high-level cluster. In the web site structure, the statistics items are grouped with items relating to what Aids is, its history and the facts and myths surrounding it.

“Counselling” and “Student Health Services” are grouped together in the web site as well as in the structure of the participants. In the last case, the structure shows a 58% level of agreement which is not that high, but indicates that the majority of participants joined these items together.

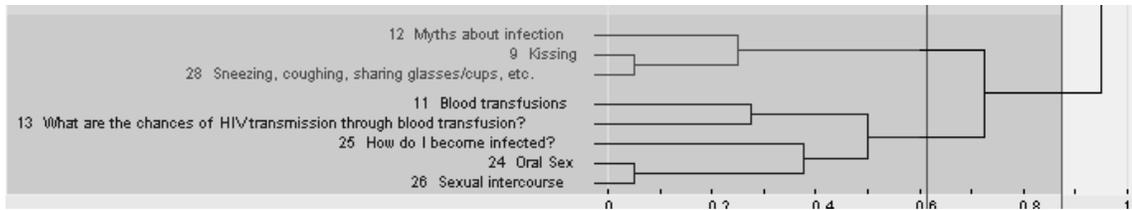


In the web site, the items “How do I become infected”, “Sexual intercourse”, “Post-exposure treatment”, “Blood transfusions” and “What are the chances of HIV transmission through blood transfusion?” are grouped together and can be found under the heading “How can I become infected”.



**Figure 57 - Extract from tree diagram (web site structure)**

The participants sorted heading “How can I become infected”, “Blood transfusions” and “What are the chances of HIV transmission through blood transfusion?” together in a low-level cluster. It is combined with the items regarding myths.

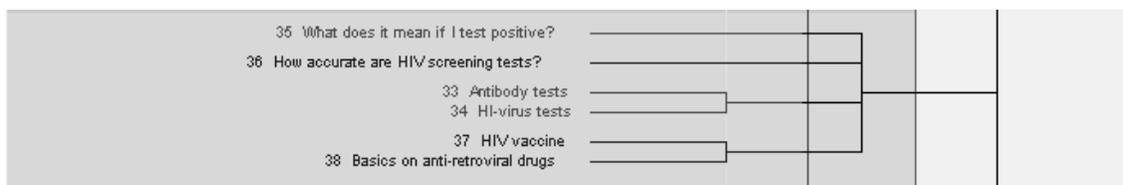


**Figure 58 - Extract from tree diagram (whole population)**

This section clearly also deals with modes of infection and the thematic link between the items in this section is therefore quite strong.

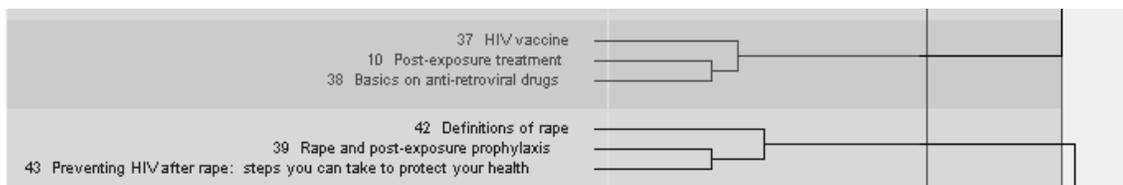
The odd inclusion in the web site structure for this group is the card “post-exposure treatment”. It does not make sense that an item about treatment should be included in this section where there is a section about treatment. Users looking for this information may not find it because it is not in a logical place. The participants grouped this card with “HIV vaccine” and “Basics on anti-retroviral drugs” (65% - 75% level of agreement). This is an indication where users will go to find the information which is a much more logical grouping considering the information seeking behaviour of users.

In the web site, “HIV vaccine” and “Basics on anti-retroviral drugs” is grouped with information about testing. The main menu item they fall under is called “testing and treatment” which makes sense and is a clear heading.



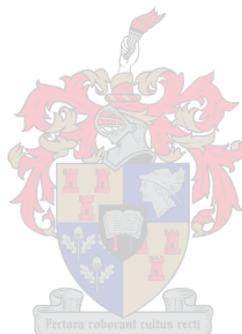
**Figure 59 - Extract from tree diagram (web site structure)**

The participants also saw this relationship and sorted the items on the tests together with the treatment items.



**Figure 60 - Extract from tree diagram (whole population)**

The participants also sorted the facts about the origin and progress of HIV into one group. This also reflects the structure of the web site. It should be clear that there are many similarities between the structure of the web site and that of the participants. The biggest differences between the two structures arose because not all the information that is part of the menu is represented in the cards. This is one of the most important drawbacks of this study and should be addressed in future studies.



## Chapter 5 - Discussion and conclusion

### 5.1 Participants

The results of this study show that there are quite a few differences between the groups of participants regarding their profiling information and how they experienced the exercise. Although there are differences, they are not consistent enough to attribute them to cultural affinity.

For instance, it was found that the black group had the biggest number of participants answering in the extreme when asked about the difficulty of the task. In other words, some indicated that it was extremely easy while others indicated that it was extremely difficult. The white and coloured group's answers, however, ranged between very easy and difficult (scores of 2 - 7). These two groups had only one participant that had an extreme opinion about the difficulty of the task.

On the other hand, the three groups' answers to how easy it was to see a structure were almost equal. This indicates that there is not a big difference between the races concerning this question. The difficulty is that it is related to the previous one, so one would expect that there would be a trend in the answers, but there were not.

Concerning the three groups' use of the internet, there wasn't a significant difference between them. Although the black group had the highest number of users who did not use the internet, the number that does use it more than four times a week equals that of the white group. There is, therefore, not a significant difference between the groups concerning their computer experience.

The HIV/Aids knowledge of the participants also showed that there is no significant difference between the three groups. Some of the questions more black participants answered correctly and with other questions the white and coloured groups had more correct responses. This means that on average, the participants in this study were more or less equal in terms of their computer knowledge and experience as well as their HIV/Aids knowledge. This is a good indication that one can expect that the mental models of the three groups are equally

developed regarding these two areas. This does not imply that they are the same; it is just to say that it can be assumed that the shared mental model of all three groups will be equally strong.

## 5.2 Structure

It is clear from the different tree structures based on the race variable that the white and coloured groups show greater similarities with each other than with the black groups. Although there are similarities in all three groups' structures, the black groups differ much more in their grouping of cards. The biggest similarities between the groups lie in the cards with a marked semantic relation - these seemed easier for the participants to group together than cards that were only related topically. It seemed that the black group had a bigger problem with the cards that were purely thematically related than the other groups.

However, when a comparison was made combining all the answers of the participants (whole population), it was found that a very logical structure was presented. Obviously the differences between the groups had an effect on the strength of the clusters that were made, but clear, logical clusters were formed.

The strength of the structures (based on the level of agreement) was a clear indication of the strength of the shared mental model of the participants. The white groups had the highest level of agreement with each other out of the three groups indicating that their shared mental model is very strong. The black group had the lowest level of agreement indicating that the choices they made may not have been culturally influenced. There may have been other factors that influenced the lack of agreement in this group. An issue such as the participants' proficiency in the language may have had an influence on the results of this group. English is not the first language of many of the black participants and their level of understanding and/or grasp of the nuances in the languages may have influenced their results.

This can be deduced since it was clear that their level of knowledge of the subject was not weaker than the other two cultural groups. They should have shown a stronger agreement and therefore a shared mental model.

The fact that the results of the white and coloured groups are so close to each other may be a cultural issue. These two cultures are a lot closer to each other than the black group and they

may, therefore, have more shared cultural experiences therefore making the probability that they share elements in their mental models more likely.

In the end, it is not possible to ascribe the differences that were found to cultural influences in the development of shared mental models on the topic of HIV/Aids. The topic itself may have been one that is not culturally differentiated or influenced to the extent that one can ascribe the differences between the groups to culture.

### **5.3 Quality of sorting data**

Participants were generally focused when performing the card sorting exercise. In other words, most of the participants took the exercise seriously and tried their best to find the best structure. However, it was found that in some cases, participants grew tired or were under time pressure (personal schedules) which may have influenced the quality of the groupings they made.

The effect would not be devastating to the results – it only meant that they would not spend too much time trying to find matches for odd cards. When these participants were asked about their grouping of odd cards, they were all able to explain why they sorted the cards together. One of the participants, for instance, grouped the odd items together in one cluster. Of course, this is a legitimate strategy because the participants were not given any instruction on what basis they were to group items.

Some of the participants were very quick in completing the exercise which begged the question if they just rushed or are these participants just able to see structures quicker than others. When asked, it became apparent that some of these participants only read the titles which were more than enough information to sort the cards. Other participants had to read the explanations as well to understand the content and sort the cards into a logical structure.

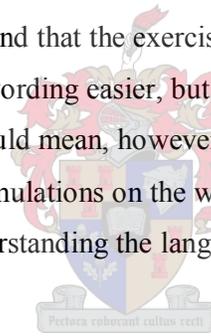
### **5.4 Issues of difficulty**

Many of the participants in the study reported that it took a lot of cognitive energy to complete the task. Some found the content too diverse to be able to structure it. This has some legitimacy since the content of the cards were chosen to be high-level items and headings on one page. This may have caused more problems than if only the menu structure

(greater structure) was used for the content of the cards. In this regard, the study could have produced better results had a better selection of content for the cards been made.

Other participants, particularly those who were considered experts, found that they were restricted by the content and the nature of the card sorting exercise. They found that piling cards into groups too general, they would have liked to have created a more complex hierarchical structure than the cards allowed. In this case, their knowledge and experience of the web and web design made the task more difficult for them.

Other participants, particularly some of the black women, struggled with the difficulty of the language. A title like "Post-exposure prophylaxis" may have caused them to spend more time on trying to decipher what it means than what was necessary. This meant that they had to spend time reading the description and then sort it into a group. When reviewing their groups, the process often had to be repeated to understand the content. This took a lot of cognitive energy and these participants all found that the exercise was extremely difficult. The problem could be overcome by making the wording easier, but then it would not be representative of the content of the web site. This could mean, however, that the owner of the web site might need to reconsider the technical formulations on the web site to include laymen translations so that students who have trouble understanding the language will be able to understand the content.



## **5.5 Ambiguous items**

Some of the items were difficult to place into a category because it is a topic that could easily fall under more than one topic. The category created the most problems is the one dealing with the "what of Aids". The cards concerned are:

- "What is Aids?"
- "Is it known where the emergence of HIV in humans took place?"
- "Theories on the origin of HIV"
- "Opportunistic infections"
- "What other theories have there been concerning the spread of HIV?"
- "The progression of HIV infection to Aids"
- "What happens when HIV enters the body?"
- "What caused the HIV epidemic to spread so quickly?"

- "How do I become infected?"

These cards were sorted in all sorts of combinations with other cards, indicating that they gave the participants some trouble in grouping them. It could also indicate that these titles should be accessible from more than one place in the web site since different users see the relationship of these cards differently.

## **5.6 The process of sorting cards**

There were two main methods of sorting cards that were reported by participants. Some of them indicated that they did not have a clear structure in their heads before they started the exercise – a structure developed as the exercise progressed. Other participants said that they did have a good idea about the possible content and therefore had an idea of what a structure should look like before they started sorting the cards. Participants in this last group generally found the exercise easier to perform than participants that 'figured it out' along the way. This can be attributed to the fact that the second group's mental model is more developed and accessible than the first group's mental model.

Most of the participants reported that they did a general 'first sort' and then revised and refined their groups before naming them. This process was most prominent with participants that 'figured out' the structure as they went along. They first had to get a general idea of the scope of the content before they refined their model. These participants were developing their mental model of the topic as new information was introduced to them.

Most of the participants found it a stimulating and educational experience where they were able to broaden their knowledge of the subject. For many of the participants, some of the cards contained new information that enabled them to learn while they were performing the exercise.

## **5.7 Card sorting method**

The card sorting method proved to be a very usable method to determine the mental models of participants. Definite structures resulted from the cluster analysis which indicated that at least some of the groups had a reasonable shared mental model of the topic.

It should be noted, however, that this method is not suitable for purely scientific purposes. It is not a purely statistical method and the results are left open for interpretation by the researcher. It does not profess to be anything else than an exploratory study method that will indicate general trends instead of hard and fast statistically realised and reliable results.

However, in the real world, this method would not be viable considering the practicalities. This study saw 60 participants taking an average of 30 minutes to complete the task (some up to an hour). This gives a total of 30 hours just conducting the card sorting exercise. In reality, participants would have to be remunerated for their time which will, of course be a costly exercise. This excludes the time preparing for the study, analysing the results and writing the report. This method may therefore not be a viable option for companies to use because of the staggering cost implications to conduct the study.

One option would be to cut down on the number of participants if a 'general idea' of the user's mental model is the outcome of the study. If a company does not care about statistical significance and having the right amount of participants to make the study scientifically viable, 5 participants per group would be enough to get started. But this would be a dangerous strategy to take, one that can hardly be justified scientifically. The method can however help designers in the early design stages of a web site by providing a broad consensus on underlying mental models.

The general structure of the whole population was quite logical and similar (except in a few cases) to the original structure. This means that the mental model of the expert that developed the structure of the web site is supported at least to a certain extent by the results. The few items that may get lost in the structure may not be so devastating and may be rectified using user feedback on the usability of the web site, rather than conducting an elaborate card sorting study.

## **5.8 Future study**

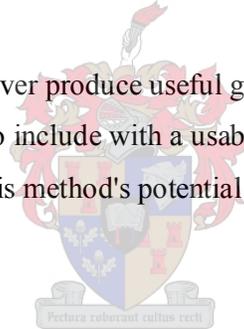
Although the card sorting method and the cluster analysis resulted in distinct tree structures, there were too many factors that were not anticipated that could have influenced the results. One of the most prominent factors was the language issue. There are clear indications that the use of English posed a problem to at least some of the participants, since they did not always understand the information on the cards.

The issue of the influence of culture is still not resolved. There is a marked difference in mental modelling between the white and coloured groups on the one hand and the black group on the other. However, it is not clear exactly what this should be attributed to; suggesting that more research is needed, among other things on the definition and the role of culture.

Another interesting outcome was the fact that the white and coloured groups demonstrated a very strong shared mental model. This could suggest a shared “cultural space”, but again no deductions can be made on the basis of this study except to say that it is the case. Again, more research is needed to confirm these results and (maybe) to explain them.

A future study would have to test the usability of the different structures. Only then will it be clear whether the different cultural groups searched for information in different places, confirming possible differences in mental models.

The card sorting method does, however produce useful guidelines in terms of information structures and would be beneficial to include with a usability test. All in all, there are still plenty of opportunities to explore this method's potential use.



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