The usability of a computer-based

tatistics Data and
tory Library in the
outh African context

A research essay

Presented by

Elizabeth M Basson

Submitted in partial fulfillment of the requirements for the degree

Magister Educationis
In
Computer-Assisted Education

Faculty of Education
University of Pretoria

October 2001

Supervisor: **Prof. Dr. J.G. Knoetze**

Abstract

Key words:

Computer assisted education, the usability of, usability, statistics, Statistics data and story library, statistics questions, statistics database of questions, database design, web page design, computer-based statistics

Vista University is known in South Africa as a historically disadvantaged or black university. It is a multi-campus university (it has eight campuses throughout South Africa) and caters for learners from historically disadvantaged backgrounds. The Department of Mathematics and Statistics holds an annual meeting to coordinate the activities in the department across all eight campuses. Attendance is compulsory for all lecturers from all the campuses. Every year the same problem arises, which is to have examination papers drawn up that will be of a uniform standard across all the campuses. It is a very frustrating task for the compiler of the papers to get contributions from the lecturers that are submitted on time, in the agreed format and of an acceptable standard. During the 2000 meeting it was unanimously agreed that the long-term solution to the problem would be a **database of questions** in the agreed format and of an acceptable standard. Because the lecturers are spread over South Africa, this database must be available through Vista's Intranet.

The development of such a product would involve a great deal of time and energy, and the most important question to ask is whether the lecturers would use the product. The solution is to design a prototype of the product: a database with a Web-based portal populated with a sample of questions. The usability of such a database must be determined to ensure the effectiveness of the final product.

The aim of this study is, after a prototype of a Web-based **S**tatistical Data and **S**tory Library in the **S**outh African Context (in future referred to as **SSS)** has been implemented, to **determine the usability** of the product**.**

Opsomming

Die bruikbaarheid van 'n rekenaargesteunde Statistiek Data en Storie Biblioteek in die

Suid-Afrikaanse konteks

'n skripsie deur

Elizabeth Maria Basson

Leier   **Prof Dr JG Knoetze**

Departement   **Onderwys- en Opleidingskunde**

Graad

MEd (RGO)

Sleutelterme

Rekenaargesteunde onderrig, Die bruikbaarheid van, Bruikbaarheid, Statistiek, Statistiek data en storie biblioteek, Statistiek vrae, Databasis van statistiek vrae, Databasisontwerp, Web-bladsyontwerp, Rekenaargebaseerde Statistiek

Vista Universiteit bestaan uit agt kampusse versprei regoor Suid-Afrika en dien 'n deel van die Suid-Afrikaanse bevolking met 'n eie nie-Westerse kultuur en met Engels nie as moedertaal nie.

Die geografiese verspreiding van die universiteit het tot gevolg dat die opstel van vraestelle wat

- aan neergelegde standaarde moet voldoen,
- op vasgestelde keerdatums ingehandig moet word en
- alle betrokke dosente tevrede moet stel, 'n feitlik onbegonne taak is.

Tydens 'n departementele vergadering het die dosente van die Departement Wiskunde en Statistiek besluit dat die beskikbaarheid van 'n databasis van vrae 'n oplossing van die probleem mag blyk te wees. Sodanige databasis moet toeganklik vir al die dosente wees.

Op die Internet is soortgelyke databasisse reeds beskikbaar. Die groot nadeel van hierdie databasisse is dat meeste van die "stories" waarop die vrae gebaseer is, buite die beleweniswêreld van die Vista-studente met hulle eie kultuur en Engels-taalvaardigheid is. Waardetoevoeging tot 'n gebruikersvriendelike databasis van vrae sou vrae in 'n "Suid-Afrikaanse konteks" wees.

Die doel met hierdie navorsingsprojek was om 'n prototipe Internet-gebaseerde databasis te ontwikkel en die doeltreffendheid daarvan te toets. Die vraag was: sou die rekenaargesteunde "gereedskap" wel deur die dosente gebruik word?

Die resultate toon aan dat die databasis inderdaad aan die behoeftes en vereistes van die dosente voldoen.

Acknowledgements

I would like to express my special thanks to Professor Johan Knoetze for his professional guidance and support and to my husband for his patience with a wife who is "always at the computer".

TABLE OF CONTENTS

- o Web page-database interface design
  - ❖ Forms
- o Design: Final remarks
  - ❖ On the use of colour
  - ❖ On the use/misuse of fonts
- Stage 3: Development for usability
  - o Database development
  - o Web page development
    - ❖ Introduction
    - ❖ Development tools

  - o Web page –database interface development
    - ❖ Introduction
    - ❖ What is an operating system?
    - ❖ Examples of operating systems
    - ❖ What is a Web server?
    - ❖ Examples of Web servers
    - ❖ Operating systems and the required programming
- Stage 4: Evaluation/testing
  - o Introduction
  - o Testing database-driven Web sites
    - ❖ Introduction
    - ❖ Types of testing
  - o Testing Web page usability
    - ❖ Introduction
    - ❖ Pilot testing
    - ❖ To get started
    - ❖ Who to invite
    - ❖ How many?
    - ❖ Test procedure
    - ❖ Analysis

Chapter 3: Design and Development

- Introduction
- Database design and development
- Web page design and development
- Database-interface development

Chapter 4: Usability Evaluation

- Introduction
- Participants in the usability evaluation
- Feedback
- Test procedure
- Results
  - Presentation
  - Interaction
  - Information

Chapter 5: Conclusions and Recommendations

- Summary
- Recommendations
- Conclusion

References
Appendices

LIST OF ACRONYMS

ADO	ActiveX Data Objects
DSN	Data Source Name
HTML	HyperText Markup Language
http	Hypertext Transfer Protocol
IIS	The Internet Information Server
PWS	Personal Web Server
SQL	Structured Query Language
URL	Universal Resource Locater
VBScript	Visual Basic Script

LIST OF DEFINITIONS

ODBC	ODBC is a programming interface that enables applications to access data in database management systems that use Structured Query Language.
SQL	SQL is a standardised language that makes it easy to store, update and access information.

Chapter 1

Introduction

Background to the problem

At a departmental meeting …

Vista University is known in South Africa as a historically disadvantaged or black university. It is a multi-campus university (it has eight campuses throughout South Africa) and caters for learners from historically disadvantaged backgrounds. The Department of Mathematics and Statistics holds an annual meeting to coordinate the activities in the department across all eight campuses. Attendance is compulsory for all lecturers from all the campuses. Every year the same problem arises, which is to have examination papers drawn up that will be of a uniform standard across all the campuses. It is a very frustrating task for the compiler of the papers to get contributions from the lecturers that are submitted on time, in the agreed format and of an acceptable standard. During the 2000 meeting it was unanimously agreed that the long-term solution to the problem would be a **database of questions** in the agreed format and of an acceptable standard. Because the lecturers are spread over South Africa, this database must be available through Vista's Intranet.

The development of such a product would involve a great deal of time and energy, and the most important question to ask is whether the lecturers would use the product. The solution is to **design a prototype** of the product: a database with a Web-based portal populated with a sample of questions. The **usability of such a database must be determined** to ensure the effectiveness of the final product.

As one may expect, databases populated with questions already exist on the Internet. For example, DASL(The Data and Story Library) provides "data from a wide variety of topics so that teachers can find real-life examples that will be interesting to their students

Background to the problem (continued)

A scenario: a lecture in Statistics

The following scenario is one of many cases that illustrates that it is difficult, if not impossible, for most of the first-year Vista students to understand or relate to "stories" that are not part of their indigenous knowledge or experience:

The lecturer in Statistics at the Mamelodi campus of Vista University always stresses the fact that understanding the processes of statistics alone is of little practical value. In order to apply statistics and draw meaningful conclusions, a thorough understanding of the problem in which the technique is to be used is essential. In other words, the students must understand the "story" or setting of the problem before they can solve it. To illustrate a concept in regression analysis, the lecturer decides to use the classical text-book example: "…there is a very strong correlation between the number of storks nesting on the chimneys in London and the number of births in London". In keeping with her lecturing style, the lecturer first asks the class what they associate the word "stork" with. After quite a while spent pondering the question, one of the hundred-and-fifty students answers triumphantly, "Stork Margarine!"

The question arises whether the language of instruction (English), and the fact that the prescribed textbooks are written by mostly American authors, are obstacles to the thorough understanding of a question. If this is found to be the case, it will have to be taken into account when populating a database of questions that will be used to compile test/examination papers for the Vista student. It will also be a strong argument for preferably not using existing online sources of examination questions.

Background to the problem (continued)

A survey

A survey was done to investigate whether the language of instruction (English), and the fact that the prescribed textbooks are written by mostly American authors, could be obstacles to the thorough understanding of a question. The objective was to establish the need for a database of questions "in the South African" context for the first-year Vista student.

When compiling the test paper one of the exercises from the prescribed book was taken: "The following table gives the survival time of 50 guinea pigs in a medical study done in a laboratory. Draw a histogram..." and altered to read: "In the context of the paragraph, explain what you understand by the term "guinea pigs" and draw a histogram…"

Only three students (2,5%) gave the correct meaning of the word "guinea pig" and the rest of the answers varied from "wild pigs" to "pigs from the state of Guinea". Most of the students constructed the histogram correctly and could apply their knowledge of statistics without a thorough understanding of the problem.

Further results of the survey

The results of the survey are summarised in Appendix: survey, and indicate that the culture/background/understanding/experience of first-year Vista students makes it very difficult for them to identify with the "real-life" examples used in the existing online databases.

The aim of this project

The need for a database of suitable questions was already determined and noted during a meeting of the Department of Mathematics and Statistics at Vista University.

The aim of this study is, after a prototype of a Web-based **S**tatistical Data and **S**tory Library in the **S**outh African Context (in future referred to as **SSS)** has been implemented, to **determine the usability** of the product**.**

Research methodology

In order to reach this goal the following methodology is envisaged:
- Research the necessity of such an application
- Research sound principles regarding
  - database design,
  - web page design and
  - web page-database interface design

  that will result in a usable product
- Develop and implement a prototype of the SSS
- Evaluate/testing the usability of the SSS. The methods used are contextual inquiry and "talking aloud protocol"

The research problem for this project

To ensure the effective use of this database by Vista lecturers, the following research problem can be identified: What are the usability criteria for a database-driven Web site? This can be broken down in the following sub-sections: sound principles regarding
  - database design,
  - web page design and
  - web page-database interface design, as well as criteria for evaluating the usability of the product.

Chapter 2

Literature Review

Introduction

To determine the essential design specifications for a usable database-driven Web page, the literature study will focus on the design process:

1. Analysis
2. Design
3. Development and Implementation
4. Evaluation/Usability testing

Stage 1: Analysis

Before any application is developed, it is essential to ascertain whether such an application is really necessary. During a meeting of the Department of Mathematics and Statistics (Vista University) it was decided that a database of questions must be developed and made available on-line. As one may expect, such a database of statistics questions already exists on the Internet: DASL claims to "provide data from a wide variety of topics so that statistics teachers can find real-world examples that will be interesting to their students" and the question arises whether the language of instruction (English) and the culture/background of the first-year Vista student can be seen as major obstacles with the result that they cannot identify with these "real-life" examples. During the analysis stage it was consequently not necessary to research whether **the lecturers** need such a database but to study the literature to address the following questions: Where English is not the home language

- is English, as the language of instruction, experienced as an obstacle, and
- will the use of graphics, to "explain" textbook problems, be of any help?

Stage 1: Analysis (continued)

University of the Western Cape : A high correlation between home language and language of instruction

At the University of the Western Cape a very high failure rate was experienced in the computer literacy course attended by the Economics and Management Science students (this course was preceded by an introductory course in Statistics). Even though the way the course is presented has been revised each year, the low success rate remains a problem.

Venter and Blignaut (1996) did a thorough study, using both quantitative and qualitative methods, with the aim of understanding the factors that contributed most to the failure rate of computer literacy students.

Contrary to expectations, no correlation was found between the qualifying matric mathematics results, the results of the introductory statistics course and the more practical computer literacy course. Using sound statistical analysis, a distinct relationship became apparent between **home language**, the **language of instruction (English)**, the belief that the quality of life can be enhanced by computer technology and the success rate in computer literacy.

In both the qualitative and quantitative results, language ability was identified as being the most important factor contributing to the success rate of students.

An interesting remark was: "The software that is used to teach computer literacy at our university is still DOS-based. It will be interesting to see if **graphical user interfaces** such as Windows will alleviate the language problem in the practical applications to some extent."

Stage 1: Analysis (continued)

University of the Western Cape: A follow-up study

In a follow-up study by Blignaut et al (2000), a computer-based training (CBT) system was used to teach Computer Literacy. Students were able to pace their own learning according to their own ability and it was felt that with a CBT model, students would spend a considerable time at the computer both reading in English and practicing basic computer skills. The pass rate of the Computer Literacy students with this new approach increased from 42% to 75%.

The student profile has not changed dramatically since 1996 and the inability of many students to understand and speak English was again highlighted. The compact disk (CD) that accompanies the prescribed book contains video clips and presentations on each chapter and this might be a factor that contributed to the higher success rate: Pinnock (1986) showed that learners with low verbal ability learnt significantly better with material presented on video.

Comprehensive reading

In statistics the student must interpret the analysis done in terms of the problem. Most of the time the interpretation is written in disjointed, jumbled sentences. This agrees, even in 2001, with the findings of Lanham (1986): "…research shows that it is quite possible to go through the motions of reading and to apply the product of such reading by passing a conventional comprehension test based on a text which is actually nonsense; in other words, not really to understand the text."

Stage 1: Analysis (continued)

Different cultural and life experiences

The same author stresses the fact that comprehension in reading comes as much from the knowledge structure the reader brings to the text as from the text itself: "It means, for example, that the second-language reader will interpret what he reads in the text in terms of its relevance to, and closeness of, 'fit' with the components of his background schema. Because of different cultural and life experiences, this may not, in fact, amount to the message in the text. An even more important issue is whether or not the second-language reader makes any attempt to construct a background schema."

Graphics

The author also suggests that strategies to create background knowledge must be used: **pictures**, titles and **event-orientated words** in early sentences can help the reader to raise to a level of conscious awareness of the background knowledge needed for understanding the text.

Graphics: a word of warning

The moment the compiler of examination/test questions uses pictures to explain certain concepts or to convey certain ideas, the question arises whether the pictures are cultural universal. A picture of the lecturer entering a room in front of the student might signify to the compiler a show of good manners, whereas for the reader it might mean just the opposite!

Lawson (1987) conducted experiments to test whether ideas and information could be communicated from one culture to another using pictures, and claims that the results contradict the theory that visuality is both an inherent and universal human characteristic.

Stage 1: Analysis (continued)

Graphics: a word of warning (continue)

Basel (1995) in her empirical study conducted at the Adult Basic Education Centre in Pretoria, confirms that the benefits the learner gains from pictorial aids is affected by the learner's cognitive ability, environment, culture and/or past exposure to two-dimensional images. Not all learners benefited from having access to a picture, and some might even have been confused by it. She concludes that the 'reading' of pictures was a complex process.

These findings must be taken carefully into account when using graphics to explain difficult concepts in an examination question.

Reasons for difficulty in understanding English

The scope of this study does not cover research on the interaction between language of instruction and learning, or reasons why students experience difficulties with English textbooks and reading in general. Suffice it to mention the following:

After South Africa became fully democratic in 1994, a multilingual language policy was implemented, and South Africa became a country with eleven official languages. Mutasa (2000) discusses the problems related to the coexistence of English and African languages in South Africa. His study shows that, although both parents will communicate in their indigenous language, they will **insist that the children be sent to English-medium schools**. Some of the reasons cited were that:

- English is an international language.
- Globalisation requires the knowledge of English.
- Textbooks are written in English, etc.

Stage 1: Analysis (continued)

|	
Reasons for difficulty in understanding English (continued)	Wiles (1993) states that if the linguistic concepts, which are "central to children's overall intellectual and academic development", have been developed in the **first language**, they can easily be transferred to a second language, provided there has been adequate exposure to it. Boughey (1993) asserts that learners who are proficient readers in their first language will be able to transfer those skills to reading in a second language, provided that a threshold of language proficiency in the second language has been reached. Venter and Blignaut (1996) remarked that "Due to the limited literacy material in many African languages, proficiency in first language reading is difficult to attain. This may have a bearing on the difficulties students experience with textbooks and reading in general".

Stage 2:   Design/Design for Usability

Introduction   The design process includes the

- database design,
- Web page design, and
- Web page-database interface design

Schematically the design process will be colour-coded as follows:

Design		
Database Design	**Web page Design**	**Web page – Database-Interface Design**

Design		
Database Design	**Web page Design**	**Web page – Database-Interface - Design**
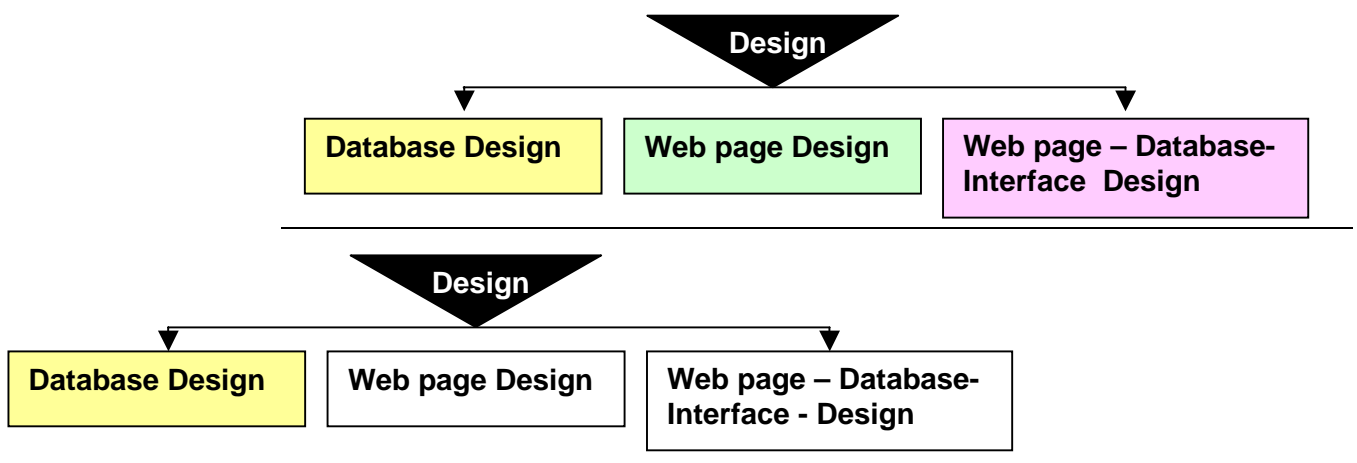
Basic steps   From the help files of Microsoft Access (Microsoft ® Access 2000) the following basic steps were suggested:

One should determine the

- purpose of the database,

- the tables that will be needed in the database, and

- the fields that will be needed in the tables.

- One should try and identify fields with unique values in each record, and

- determine the relationships between tables.

- The final step will be to refine the design and to

- enter the data.

11

Database Design (continued)

**The purpose of
the database**

The following steps that should be taken into account when designing a
database were adapted from the help files of Microsoft ® Access 2000:

- What information do you want from the database?
- Determine what subjects you need to store facts about (the
  tables).
- What facts do you need to store about each subject (the fields in
  the tables)?
- Talk to people who will use the database. Brainstorm the
  questions you and they would like the database to answer.
- Gather the forms you currently use to record your data.
- Examine well-designed databases similar to the one you are
  designing.

Roman (1999) has the following to say about database design: "The
problem of effective database design is a complex one. Most people
consider it an art rather than a science. This means that intuition plays a
major role in good design. Nonetheless, there is a considerable theory of
database design, and it can be quite complicated."

Because the main purpose of any database design is to efficiently access
information, Roman (1999) suggests that most databases should be
modelled as relational databases, rather than single-table flat databases.

Greenspan (1999) defines a relational database as follows: "A relational
database stores data in one or more tables, and these tables can be
joined in a variety of ways to efficiently access the information." He
further warned the designer to practice and to be prepared to make
mistakes because "relational database design is difficult conceptually and
even harder practically."

Database Design (continued)

Tables   Greenspan (1999) emphasizes the fact that a table should not contain duplicate information, and that information should not be duplicated between tables. When each piece of information is stored in only one table, it needs to be updated only in one place. Where the same information would have to be changed in more than one record, he refers to it as an "update anomaly". He also mentions the "deletion anomaly" as the problem that arises when one deletes a record and loses information in the process. He stresses that when each table contains facts about only one subject, one can maintain information about each subject independently from other subjects and avoid these anomalies.

Greenspan (1999) suggests the following process to construct tables:

- Build one big table that includes all the information needed for the application.
- Remove repeating groups of information and move each group out into its own table.
- Look at the different tables in terms of dependencies.

According to Greenspan (1999) it is absolutely vital to have a solid structure with, as far as possible, no anomalies: : "If you start out with poorly arranged data, you could be in big trouble down the line, trouble from which you might never recover".

Database Design (continued)

Fields

In the help files of Microsoft Access (Microsoft® Access 2000), a field is defined as an element of a table that contains a specific item of information, such as a last name. A field is represented by a column or cell in a datasheet and contains individual facts about the table's subject. It further states that a field should:

- relate directly to the subject of the table,
- include all the information you need, and
- store information in its smallest logical parts (for example, First Name and Last Name, rather than Name).

Roman (1999) classified fields into three groups:

- those that are strictly for identification purposes,
- those that are strictly for informational purposes, and
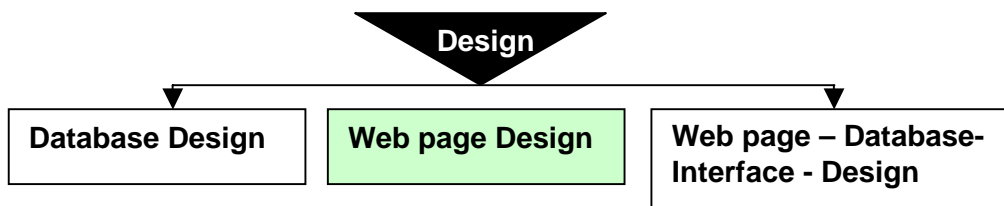- those that are used for both identification and informational purposes.

The Primary key

Greenspan (1999) expands on the idea of fields "for identification purposes" by defining the primary key: In order to connect information stored in separate tables, each table in the database must include a field or set of fields that uniquely identifies each individual record in the table. Such a field or set of fields is called a primary key.

Relationships

After information has been divided into tables and primary key fields have been identified, relationships are a way to tell the database how to bring related information back together again in meaningful ways. According to Greenspan (1999), the one-to-many is the most common type of relationship in relational databases.

```
                              ▼ Design
        ┌──────────────┐  ┌──────────────────┐  ┌──────────────────────┐
        │ Database Design │  │ Web page Design │  │ Web page – Database- │
        │              │  │                  │  │  Interface - Design  │
        └──────────────┘  └──────────────────┘  └──────────────────────┘
```

Introduction

When the development of a product involves many technical issues, one easily neglects the design issues. Where the front-end of the database is Web-based, it should conform to all the design issues that will help and encourage users to get the information they want. Boling and Sousa (1993) state that: "If people **cannot** use what is being delivered to them, or if they **will not** use it because it fails to support them in crucial ways, the promise of technology is subverted before it can begin to be fulfilled".

"Designers are communicators, possessed of an almost magical ability to express ideas at the multiple levels of the individual visual element, the overall page layout, and the narrative flow of visitor movement." - Zeldman (2001). Not all of us mere mortals may have the "magical ability" he assigns to designers, but we are communicators and one must ask oneself how best to convey the information to the user.

Again referring to the "magical ability" Zeldman mentioned, one might blanch at the idea of using prescribed building blocks/design rules when designing a Web site. In this regard Kirsner (1998) quotes a successful designer, Claudio Luis Vera: "It's like book design. Over the years, people decided the preface should be in the front, and the page numbers here, and the index there. It benefits the reader and the publisher. Three or four years ago, when you built a Web site, it took a whole strategy team to figure out what it should contain. But now, people have settled into some basic grooves, and that lets them, and us, focus on some of the higher-level aspects of developing sites. You can spend more time writing the book."

Stage 2: Web page design(continued)

The same author discusses 12 items as must-haves in Web design namely:

- A "What's New" section
- A search engine or site map
- A feedback mechanism
- Consistent navigation
- Security information
- Linking instructions
- Privacy policy
- Location
- Affiliate program
- Easy-to-use tools for updates
- Style guide
- Simple traffic reports.

When designing a "simple" Web site, Zeldman's list of 12 "must haves" for designing a "good" site appear rather daunting. A much more "user-friendly" approach is given by John Shiple of Squishy Designs, an Internet consulting company in Venice, California, specialising in information architecture, collaborative system strategies, and advanced user interfaces for Internet-based content. An on-line course in Web design is summarised below.

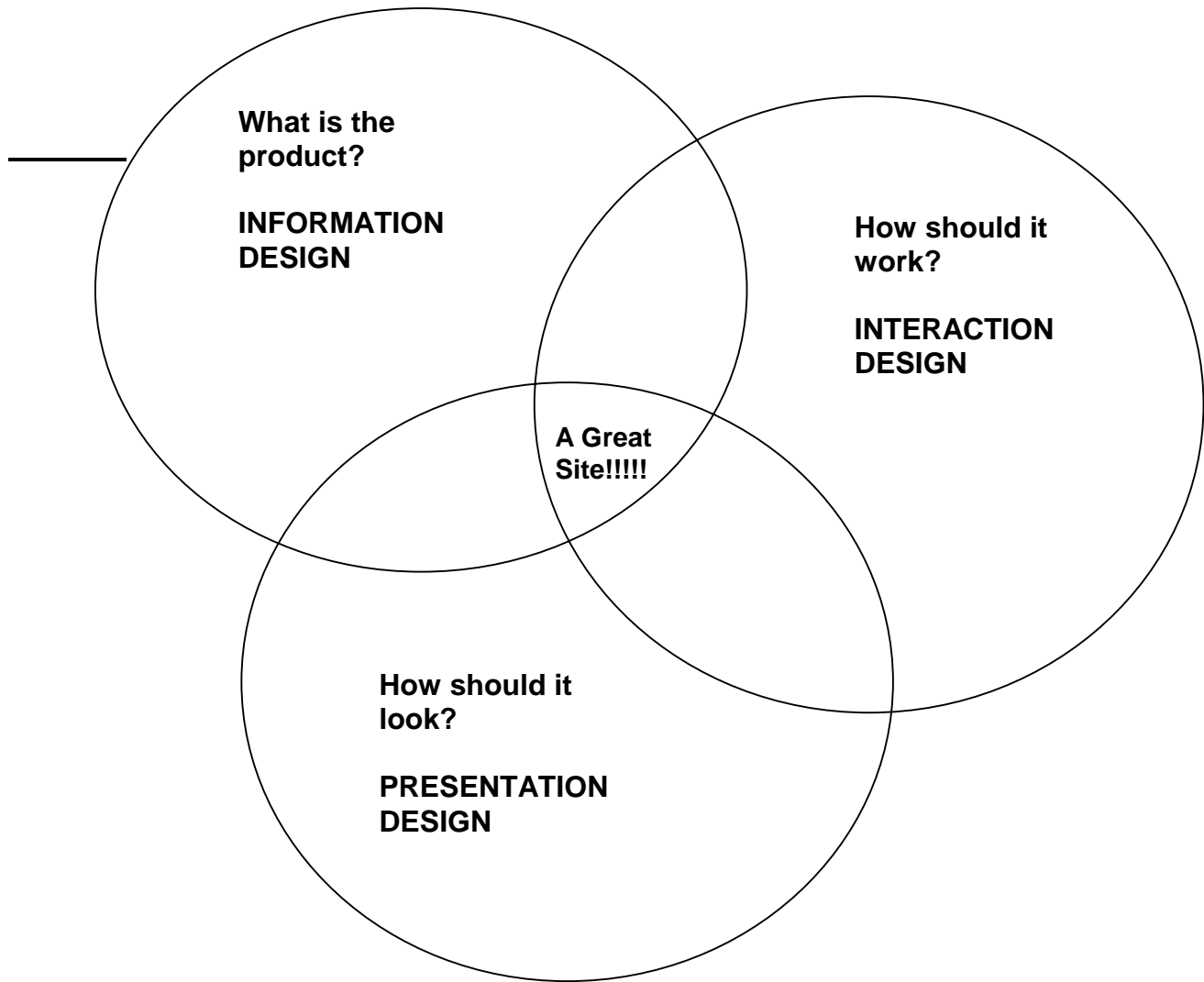Another very useful site for Web design is: "Design basics" by Jim Frew, who teaches Web design at the Royal School of Science in Nuku'alofa.

Stage 2: Web page design: The Design Process

A summary adapted from the online course by John Shiple

What is the product?

INFORMATION DESIGN

How should it work?

INTERACTION DESIGN

A Great Site!!!!!

How should it look?

PRESENTATION DESIGN

Information Design: WHY do you want to put information on the Web?
(Adapted from the online course by [John Shiple](#))

Promote sales and marketing	Many companies are using the Web to: ▪ promote sales and expand their markets, ▪ provide product information, ▪ gain greater visibility, and ▪ personalise the channel of communication between the customer and the company.
Create a company presence	Many companies are using the web to: ▪ communicate public relations messages, ▪ post news and press releases about new products, new business, awards and promotions, and ▪ generate a positive image.
Improve access to information	Many companies are looking to the Web to improve access to information by making it quicker and easier to: ▪ browse, ▪ search, or ▪ scan through vast amounts of information.
Reduce costs	Putting information on the Web may result in reduced costs related to the printing or shipping of paper documents.

Information Design: WHY do you want to put information on the Web?
(Adapted from the online course by John Shiple)

|	
Improve distribution	Putting information on the Web improves and expands the distribution of information to new audiences and enables multiple users simultaneous access to the most current information available.
Reuse information	Information maintained on the Web eliminates the need to repeat the same units of information in several documents, and thus enables you to link many users to a single information source without the need for multiple versions of multiple documents.

What have we done?
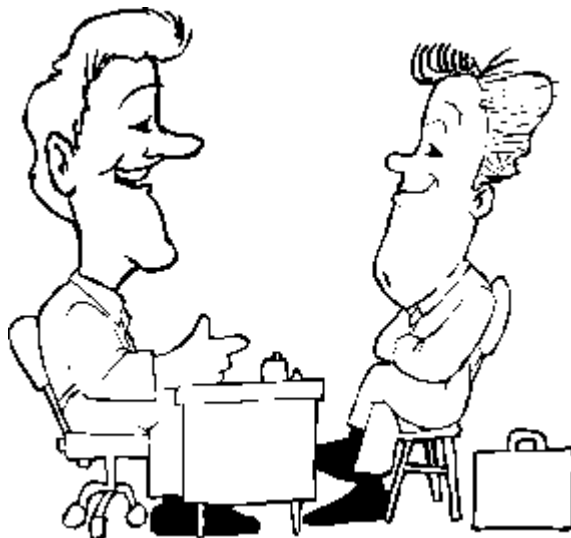
- ✓ We defined goals and purpose based on:
  - User needs
  - Information/content
  - **Company requirements**/wishes

Information Design: Analyse your audience

(Adapted from the online course by John Shiple)

Introduction

"It is critical that you analyse your users and maintain your focus on them throughout the design, development, implementation and maintenance of your Web site."

Three levels of audience analysis

The level and the corresponding method you select depend on your needs.

- ❑ Formal: Conduct a survey or a focus group.
- ❑ Informal: Hold conversations or network with colleagues.
- ❑ Rely on your knowledge of your audience and input from your fellow team members.

Analysis

The analysis involves examining your audience's

- ❑ background:
  - ▪ Who is your audience?
  - ▪ What are the different groups within your audience?
  - ▪ What jobs, functions, or activities do they perform?
- ❑ requirements for using and/or accessing information:

  Will they use it to
  - ▪ provide or acquire product information?
  - ▪ locate related resources?
  - ▪ gain new knowledge or skill?
  - ▪ perform procedures?
- ❑ knowledge of the content:
  - ▪ Is the content new to them?
- ❑ and technology:
  - ▪ What is the audience's level of experience of using the Web?

20

Information Design - Tools/Technology

(Adapted from the online course by John Shiple)

_____
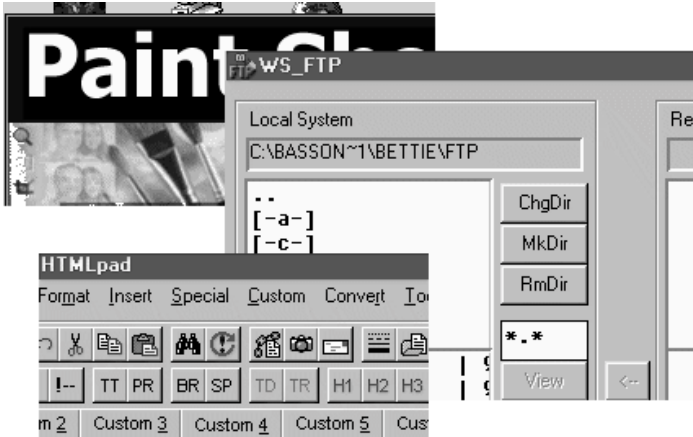
It is important to determine at this stage whether you may need to locate additional staff (a graphic designer?) to meet development requirements.

Software requirements

To analyse the software development requirements, answer the following questions:

- ❑ What browser technology are you going to support?
- ❑ Will the selected browser support your design requirements?
- ❑ What graphics packages will be required?
- ❑ Is file conversion software needed (i.e. Adobe Acrobat to convert files to a pdf format)?
- ❑ Will additional programming tools be needed (i.e. Java, CGI, ASP)?
- ❑ Will additional multimedia viewers be required?
- ❑ Are you going to PDF files - will user names and passwords be required for access to the Web server?

Hardware requirements

- ❑ Is any other equipment (such as a scanner/modem) needed?
- ❑ What are the hardware requirements for:
  - ▪ disc space
  - ▪ memory
  - ▪ network connectivity
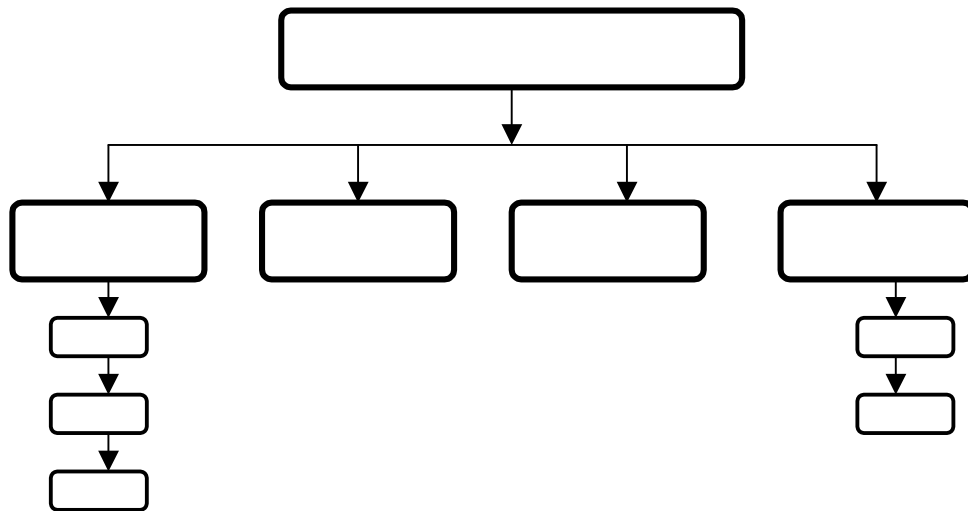 - ▪ sound/video cards, etc.

Information Design – Planning

_____

Introduction

Most clients will overwhelm one with large quantities of information in all possible formats and the online course by John Shiple teaches one methods and principles to order the information.
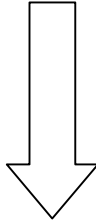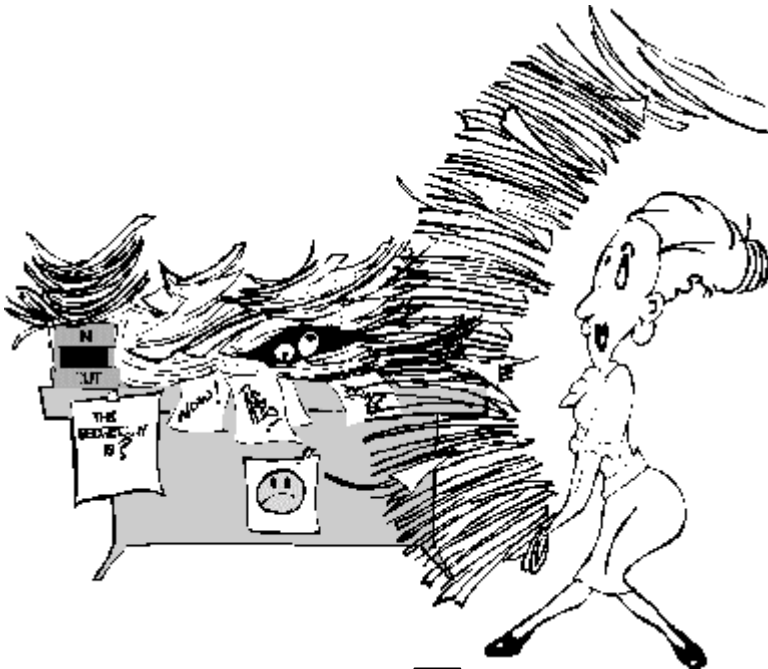
From an "overload" of information to a thoroughly planned outlay.

Information Design - Planning

(Adapted from the online course by John Shiple)

The chunking principle

- ❑ Group information into small, manageable units/chunks.
- ❑ Make sure that everything in one chunk relates to one main point, based on the purpose of the information for the audience.
- ❑ Only items that logically belong together should be put in one unit.

Benefits

By applying the chunking principle, the user

- ❑ can easily pick out the main point and identify the priorities and critical items,
- ❑ does not have to "shift gears" while interpreting the information,
- ❑ does not have to filter out extraneous information, and
- ❑ does not need to create his or her own rationale for how information fits together.

Starting from scratch

When one starts a Web site from scratch and does not know what should go in and what not, one should start a "content inventory".

- ❑ Take into account company goals and audience needs.
- ❑ Browse the Internet to see what other people include.
- ❑ Ask team members/colleagues to add to the list

Shiple cautioned on the use of an evolutionary approach…"Rome was not built in one day!"

Information Design – Planning (continued)

(Adapted from the online course by John Shiple)

Group and label content

- Write each element of the content inventory on an index card.
- Take the cards and organise them into groups (you will want a big table to do this).
- When you are satisfied with how you have grouped things, name (**label**) each group.
  - identify the purpose of the information, or
  - describe the contents of the "chunk" of information,
  - avoid being "long-winded".
- Record the name of each group and the elements within it.
- Repeat this process with everyone involved. It is important to record how each person organises the information and names each group.
- Discuss the pros and cons of each layout.
- Decide on the final groupings and names, and use them as the basis for defining the major sections of the site and the names of each section.
- Create a flow chart - this is your site structure.

Flow chart of site structure
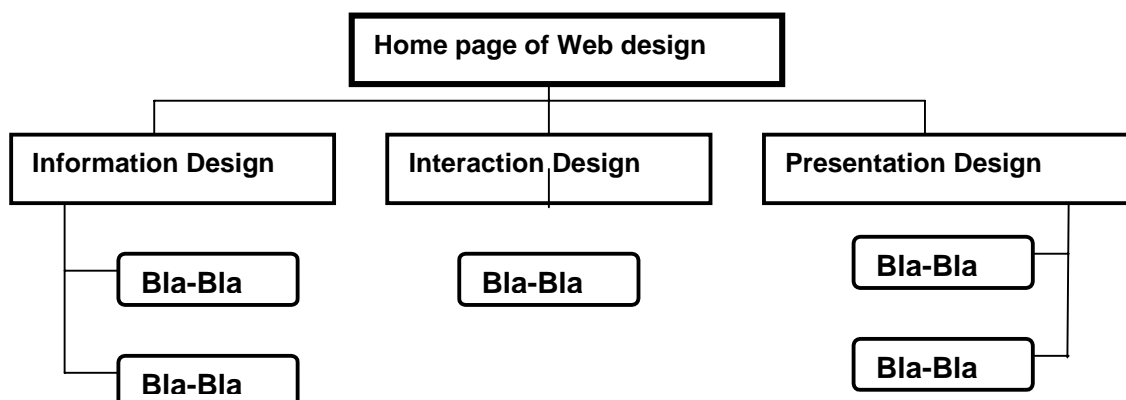
Interaction Design

(Adapted from the online course by John Shiple)

Navigation   How will users use the site? How will they get from one place to another? How do you prevent them from getting lost? Navigation design is about predicting the actions of your site's users and building a site that will support them. Experts will devote about 40% of their time to create a really good navigation scheme.

A navigation scheme must:

- be intuitive
- be predictable
- be consistent
- be highly visible
- require economy of action and time
- offer clear and understandable labels
- be appropriate to the site's purpose.

When one takes a look at the site structure one should be able to easily recognise the major sections. These are excellent candidates for the global navigation system that appears on every page of the site and enable users to quickly jump between sections. One should try to limit the number of global navigation elements to between **five and seven**. A common practice on the Internet is to incorporate the branding of your site - your corporate logo - into the global navigation as part of the link back to the site's home page.

Presentation design

(Adapted from the online course by [John Shiple](#))

The Home Page   All Web sites are organised around a "home page" that acts as a point of entry into the complex of Web pages in the site.

The top of the home page will be the first thing Web users see when accessing the site (or your whole company, in the case of corporate Web sites), so the proper design of home pages is crucial to the success of the site.

Design strategies for home pages vary, based on the function and needs of typical users of the site, the aesthetic and design goals for the site, and on the nature and complexity of the organisation of the Web site as a whole.

The most basic layout decision one will make about the home page to what extent one will use graphics on the page. Most corporate, institutional, and educational home pages display at least a small banner across the top of the home page.

The decision between slow-loading but attractive graphics-based home pages and fast-loading but prosaic text-based home pages also reflects the need to address different audiences with different expectations.

Presentation design (Adapted from the online course by John Shiple)

Goals and Purpose

The goals for most Web sites are:

- the transmission of internal information (to students, employees and existing clients), and
- communicating with potential clients and the general Web-browsing public.

If you cannot afford a graphic designer, keep the Web pages simple and consistent.

Kodak has opted for graphic home page design, but the layout is carefully designed so as not to exceed the dimensions of the average office monitor. By keeping the graphic moderate in size the page loads reasonably quickly for a graphic menu.

Example: Graphic-intensive

Presentation design(continue)
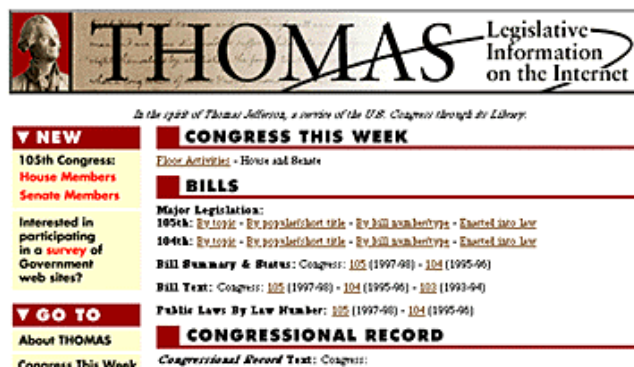
(Adapted from the online course by John Shiple)

Example:

Text-based

The relatively plain, mostly text-based home page for the W3C offers a very efficient ratio of links per kilobyte of page size, but at some cost in pure visual appeal. The page is fast-loading and well designed for its audience of Web specialists, but would not attract the average browser through presentation alone:

Example:

Try and have it both ways

Another approach is to place a graphic banner at the top of the home page, followed by a dense set of text-based links. The Library of Congress's Congressional information Web site "Thomas" reflects this dual approach, with a moderate graphic topping a dense but well-organised set of text links:

Presentation Design- Know your audience

(Adapted from the online course by John Shiple)

Novice and occasional users

These users depend on:

- clear structure, and
- easy access to overviews that illustrate how information is arranged within your Web site.

Novices tend to be intimidated by complex text menus and may be tentative about delving deep into the site if the home page is not graphically attractive and clearly arranged.

According to Sun Microsystems' Jakob Nielsen, less than 10% of Web readers ever scroll beyond the top of Web pages.

Infrequent users benefit from:

- overview pages,
- hierarchical maps, and
- design graphics and icons that help trigger memory about where information is stored within your site.

These users depend on your site to obtain information quickly and accurately. Expert users are very impatient with multiple low-density graphic menus that only offer two to six choices at time.

Expert and frequent users

Expert and frequent users generally have very specific goals in mind, and will appreciate detailed text menus, site structure outlines, or comprehensive site indexes that allow fast search and retrieval.

Presentation Design - Metaphors

(Adapted from the online course by John Shiple)

Introduction

To begin exploring metaphors can be very tricky and will demand definitive graphic design.

Three types of metaphors are discussed:

Organisational metaphors

Organisational metaphors rely on the existing structure of a group, system, or organisation. For example, if you are creating a site to sell groceries, your metaphor could be a supermarket, where products are grouped logically by type.

Functional metaphors

Functional metaphors relate tasks you can do on the site with tasks you can do in another environment. Look at the menu bar of your word processor. You can figuratively "cut", "copy", and "paste" as though you were using real-world scissors and glue.
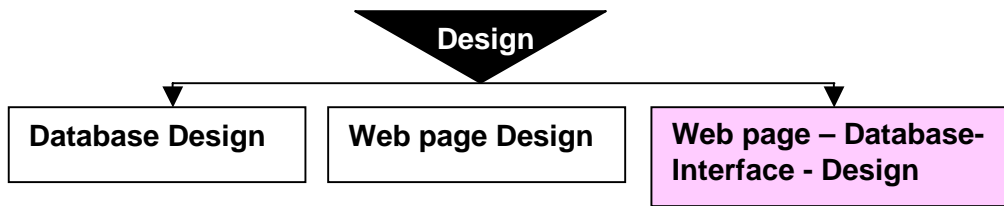
Visual metaphors

Visual metaphors are based on common graphic elements familiar to most people. If you are designing a music site that allows users to play songs, you might want to use the traditional "start", "stop", and "pause" icons found on all CD players.

Go to the drawing board

Remember to consider the following elements:

- branding
- advertising and sponsorship
- navigation
- page titles
- header graphics
- footers/copyright/last update.

```
                              ▼ Design

  ┌─────────────────┐  ┌─────────────────┐  ┌─────────────────────┐
  │ Database Design │  │ Web page Design │  │ Web page – Database-│
  │                 │  │                 │  │  Interface - Design │
  └─────────────────┘  └─────────────────┘  └─────────────────────┘
```

Forms   Ray and Ray (1999) had the following to say about forms: "Within the scope of plain HTML - as opposed to extensions such as JavaScript, Java applets, and other embedded programs - **forms** are the only method of two-way communication between Web pages and Web sites". When the user is submitting information to access the database (that resides on the Web server), even selecting a line from a drop-down menu, a form is being used and one must take into consideration design aspects concerning forms.

Good form design is a form that is
- visually appealing,
- graphically helpful, and
- consistent with the remainder of the site Ray and Ray (1999) .

The same authors give the following useful guidelines:
- Use a background image. Forms with some texture tend to be less form-ish and more friendly.
- Be sure that it's clear which check boxes and fields go with the associated descriptive information.
- Use headings to announce each new group of information.
- Visually separate groups, e.g. use horizontal rules.
- Don't make your users scroll horizontally.
- Use text emphases to draw the audience's attention to important information.
- Make all the text entry fields the same width and put them on the left – that way all the text will align vertically and look much better.
- Use tables to align and organise text fields/check boxes/radio buttons, etc.

Design – Final Remarks

On the use of colour

In an on-line book review of her own book "Color My World", Molly E. Holzschlag has the following to say about the use of colour in Web design: "The way color is used in a worldwide context is a profound issue that's often misunderstood or overlooked by Web designers. How it's used on the screen is made more challenging by the fact that the perception of color depends not only upon our ability to see that color, but also on our ability to interpret it within the context of our emotional and **cultural realities**."

A few examples from this discussion:

- Blue is the most globally accessible color and is safe in almost every culture.
- In Catholic Europe, purple is a symbol of death and crucifixion and in some Middle Eastern cultures purple signifies prostitution.
- Red, in China, is a symbol of luck and white is bad luck.
- Brown is usually quite neutral and associated with nature.
- Orange: Symbolises that a product is inexpensive in the United States

On the use/misuse of fonts

Kirsten Windbigler, in her on-line article: "Look Ma! 15 fonts!" concludes that the golden rule for the use of fonts in Web design is: **Simple is almost always best.**
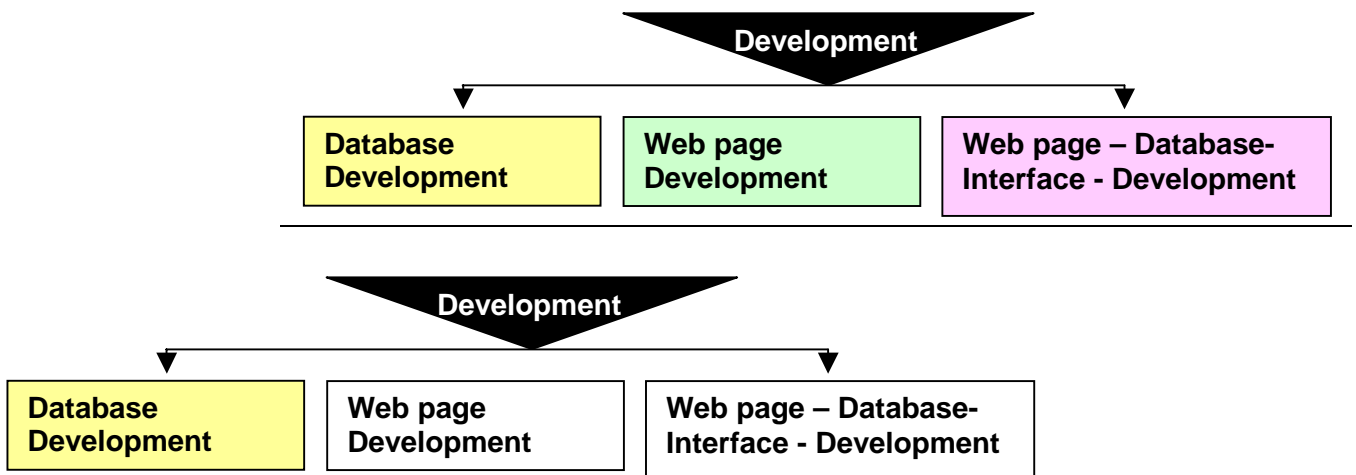
Stage 3 :   Development for Usability

Introduction   The development process includes the development of the:

- database,
- Web page, and
- Web page-database interface.

Schematically the design process will be colour-coded as follows:

Development		
Database Development	**Web page Development**	**Web page – Database-Interface - Development**

Development		
Database Development	**Web page Development**	**Web page – Database-Interface - Development**

When one develops reasonably small database applications on a Unix platform, one can disregard the giants such as Oracle. MySQL, a multi-user (can be used on a Unix or Windows platform) SQL (Structured Query Language) database server, might be a better choice.

When one is working on a Windows platform, Microsoft Access or Corel DBase provides a very user-friendly database server.

Stage 3 : Development for Usability(continued)

```
                    ┌──────────────────┐
                    │   Development    │
                    └──────────────────┘
      ┌──────────────────┬──────────────────┬──────────────────┐
      ▼                                      ▼
┌──────────────┐  ┌──────────────┐  ┌──────────────────────┐
│ Database     │  │ Web page     │  │ Web page – Database-  │
│ Development  │  │ Development  │  │ Interface - Development│
└──────────────┘  └──────────────┘  └──────────────────────┘
```

Introduction	Fresen(1998) emphasizes the necessity of flowcharting and storyboarding as an integral part of the design and development process of computer-based material.

She defines a flowchart as a diagram showing the logical flow of the product and a storyboard as "mock-ups" of each page lay-out showing text, graphics, navigation, etc. The purpose of the flowchart is to give a bird's eye view of the lay-out and functionality of the product and the storyboard to thoroughly plan the site on paper.

Development tools

Ray and Ray (1999) p9-12 say that there is no "right" kind of tool or "right" approach to developing Web documents, but that it depends on you – your needs, preferences and budget. They categorise development tools that are summarised in the following table:

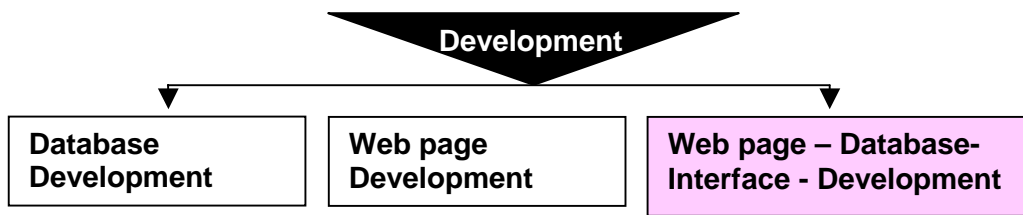| Tool	Advantages	Disadvantages
Text Editors	- No extra cost. Text editors, such as Notepad/Simple Text, are part of Windows/Macintosch. - Because HTML tags and attributes are manually entered, they give you total flexibility and control over the document you create. - Developers can immediately incorporate the latest HTML specifications. - You can easily add advanced effects, such as JavaScript or Active Server Pages to your documents. - Enhanced editors, such as HotDog, give you editing capabilities with a click of the mouse.	- Knowledge of basic and advanced coding. - Time-consuming

Web page Development (continued)

Web Page Development Tools (continued)

Adapted from **Ray and Ray (1999) p9-12**

Tool	Advantages	Disadvantages
"What You See Is What You Get" (WYSIWIG) editors e.g. Netscape Composer	▪ You can create HTML documents about as fast as you can type. ▪ HTML effects can be added by choosing options from drop-down menus. ▪ Because you see the text and formatting, and not the code, it's easier to concentrate on the content.	▪ The WYSIWYG aspect is somewhat misleading. The display in the preview and the one in the actual browser are most likely to be somewhat different. ▪ WYSIWYG editors commonly produce **non-standard code** in order to provide the effects most users expect. Non-standard code might not work in all browsers. ▪ New specifications entail an update of the software. ▪ No easy way to add effects with, for example, JavaScript.
High-end WYSIWYG editors, e.g. Dreamweaver/ FrontPage	▪ Great control over formatting. You can click and drag elements around on the page and place them where you want. ▪ Big variety of templates. ▪ Provide site management services, which help you see how pages in the site connect and relate.	▪ These editors can be rather expensive.

Web page Development (continued)

```
                          ▼ Development ▼
    ┌──────────────┐   ┌──────────────┐   ┌──────────────────────┐
    │ Database     │   │ Web page     │   │ Web page – Database-  │
    │ Development  │   │ Development  │   │ Interface - Development│
    └──────────────┘   └──────────────┘   └──────────────────────┘
```

Introduction   To develop the communication between a Web server and a database, a certain language must be used. The choice of language depends on the Web server, and the choice of Web server depends on the operating system. To properly understand this "communication", it must be understood what is meant by an **operating system,** a **Web server** and the **language** that allow communication between the database and the Web server.

What is an operating system?   The engineering department of Ohio State University designed a Web page (Operating System Technical Comparison) that compares and contrasts operating systems. They defined a **computer system** as a system consisting of seven layers of software (top to bottom): programs; system utilities; command shell; system services; user interface; logical level; and hardware level. According to them, only the **bottom two levels are the operating system**, although even technical people will often refer to any level other than programs as part of the operating system.

The same authors give a brief summary of operating systems. (summaries of operating systems).

Examples of operating systems   UNIX, Windows NT, Windows 98, MS-Dos, Macintosh, Linux.
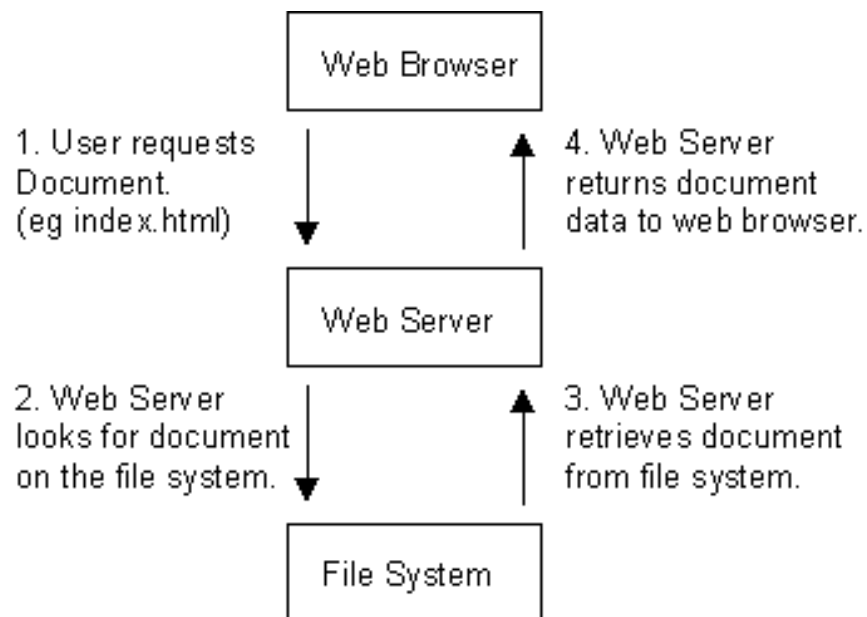For a complete list of operating systems visit:
http://www.indexos.com/OS/Operating_Systems/

Database - Interface – Development (continue)d

What is a   A Web server "serves static content to a Web browser at a basic

Web server?   level" ([Hughes and Birznieks](#)).

The authors demonstrate the function of a Web server in the
following workflow:

The authors further explain that there is much more to this simple
arrangement, which allows the serving of static content such as
HyperText Markup Language (HTML) and image files to a Web
browser This was the initial concept behind what is known as the
World Wide Web and has led to much more complex information
exchanges between browsers and Web servers.

Examples of   For a comprehensive list of Web-servers and the operating

Web servers   systems they run on, visit http://Webcompare.internet.com/

Database - Interface – Development (continued)

Operating systems and the required programming

| Operating System	Recommended programming
Macintosh	Filemaker Pro offers a good Web-database solution.
Unix/Linux	Greenspan recommends that one should get to know PHP when working on a Unix platform: "If you're heading for Unixland, I'd recommend that you get familiar with PHP, which is a great open-source scripting language." The interested reader should visit the PHP Web site, do the introductory course on PHP and have a look at the excellent on-line course by Merrall on PHP.
Windows 95/98/NT	"Server-side" programming will generate script that will be executed by the server BEFORE the page is sent to the browser. According to Cooke, server-side programming used to be pretty difficult because it required knowledge of programming languages like Perl and C, but Microsoft changed all this when they introduced Active Server Pages (ASP). Essentially, ASP pages are normal HTML with scripts (like VisualBasicScript or JavaScript) embedded in them. The real advantage of ASP for this application is the ability to "call" other programs like Microsoft Access to execute certain commands, in a nutshell to use databases with Web pages. Online courses like Cooke's "Introduction to Active Server Pages" and Greenspan's "Your First Database", teaches the necessary SQL (Structured Query Language), VBScript (Visual Basic Scripting) and Microsoft's ADO (ActiceX Data Objects) to allow you to reach your goal: **A Web page and database communication (**see Appendix: database**).**

Stage 4: Evaluation/Testing/Usability

Introduction   The process includes the

- testing of database-driven Web sites, and
- testing Web page usability.

Schematically the evaluation process will be colour-coded as follows:

Evaluation/Testing/Usability

| Testing Database-driven Web sites | Testing Web page Usability |

Evaluation/Testing/Usability

| Testing Database-driven Web sites | Testing Web page Usability |
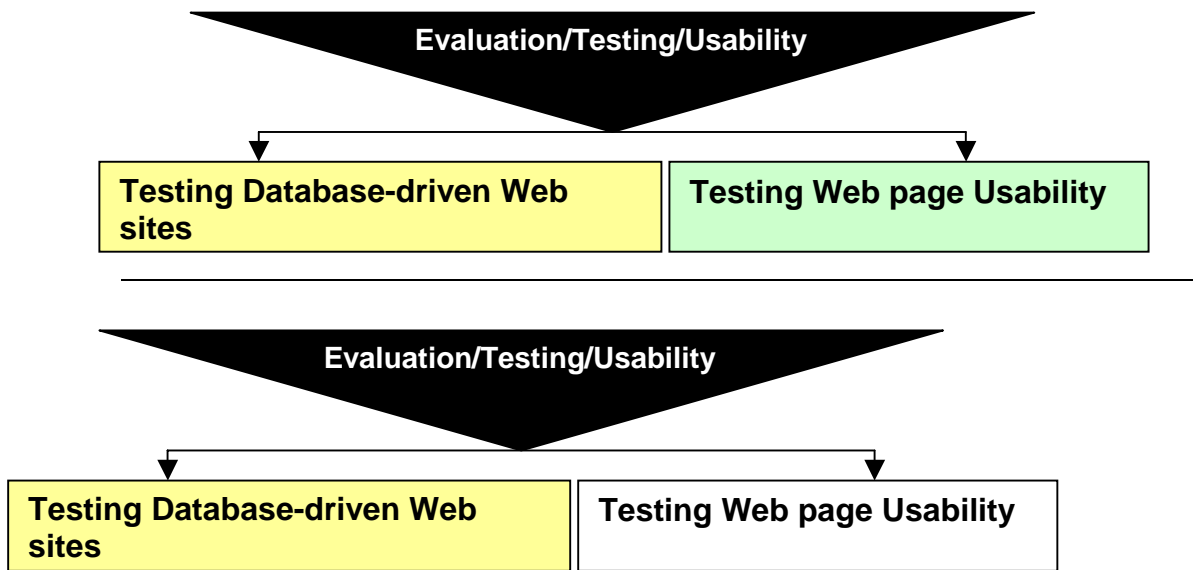
Introduction   According to [Hower](#), database-driven Web sites can involve a complex interaction among Web browsers, operating systems, plug-in applications, communications protocols, Web servers, databases, CGI programs, security enhancements, and firewalls. Such complexity makes it impossible to test every possible dependency and everything that could go wrong with a site.

A very important question to ask is: Will the test scenarios closely mimic real-life users, Internet connections, modems, communications, hardware, clients, loads, data, database table sizes, and so on? For example, is it realistic to test the site at 02h00, when Internet traffic is at its most favourable?

39

Testing of database-driven Websites (continued)

When testing a database-driven Web site, Hower identified the following types of testing:

Type of Testing*	Description*
Validation or functional testing	Sites utilising database-driven page generation will often require more extensive validation or functional testing than static-page Web sites.
Load testing	If there is a large number of interactions per unit time on the Web site, one may want to carry out testing under a range of loads to determine at what point the system's response time degrades or fails. The Web server software and configuration settings, CGI scripts, database design, and other factors can all have an impact. One would probably want to test the entire system under various conditions to get realistic results, but may also want to consider separate testing of database response, server response, applet responsiveness, and other areas if the application is especially complex.
Stress testing	This refers to testing system functionality while the system is under unusually heavy or peak load. This requires making some predictions about expected load levels of the Web site.
Usability testing	Is the intended audience the general public? In-house Intranet users? Computer experts? School children? The intended audience will determine the "usability" testing needs of the Web site. Additionally, such testing should take into account the current state of the Web and Web culture, because these will influence user expectations (for example, Web site navigation is expected to be extremely intuitive -- Web users do not expect to read manuals or help files).

*Adapted from Hower's "Beyond Broken Links"

Testing of database-driven Web sites (continued)

Type of Testing*	Description*
Security testing	If the site requires firewalls, encryption, user authentication, financial transactions, or access to databases with sensitive data, one may need to test these and also test the site's overall protection against unauthorised internal or external access.
Unit and integration testing	Unit testing of code modules, objects or discreet application functions is a standard part of testing any client/server or distributed application; integration testing may be needed to determine if various modules, other applications, and other parts of the site work together properly.
Regression testing	If the project is large and complex, one may need to continuously retest everything as the site is initially developed and code is reworked to accommodate changes and bug fixes. Smaller, less complex projects may have minimal regression testing needs.
Link testing	This type of testing determines if the site's links to internal and external Web pages are working. A Web site with many links to outside sites will need regularly scheduled link testing, because Web sites come and go and URLs change. Sites with many internal links may also require frequent link testing.
HTML validation	The need for this type of testing will be determined by the intended audience, the type of browser(s) expected to be used, whether the site delivers pages based on browser type or targets a common denominator, and how strictly one wants to adhere to HTML.
Reliability and recovery testing	Depending on how critical the Web site is, one may want to simulate various "emergency" scenarios (such as failure of a hard drive on the Web or database server, or communication link failures) in a test system to be sure that the production system will handle them successfully.

*Adapted from Hower's "Beyond Broken Links"

Evaluation/Testing/Usability

Testing Database- driven Web sites	**Testing Web page Usability**
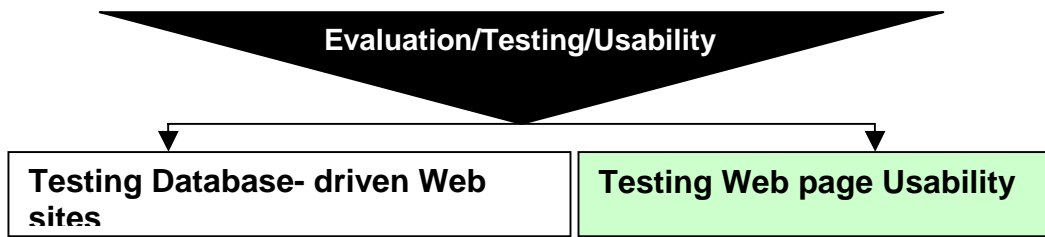
Introduction: Why should you test?

A designer once said that when you create a Web site, regardless of how good you are, you will suffer from "disease of familiarity". You should get a fresh perspective and the best way to do it is to test your site.

The Usability-Architects (2000) remarks that the major benefit of usability is satisfied customers who find the product is intuitively easy to use, appropriate to the task and accommodates their needs.

The next question is: What method to use? When browsing through "Usability Inspection Methods" by Nielsen and Mack (1994) and one is confronted with "heuristic evaluation, cognitive walkthrough and pluralistic walkthrough," one tends to agree with Veen (1997):

"Forget about the jargon-laden disciplines of cognitive psychology and behaviourism. While they offer hard, scientific methodologies for understanding how people comprehend and process information and tools, you're just interested in common sense. Sitting users down in front of your designs and watching them use your site will uncover the countless mistakes you overlooked while putting your pages together. And, rest assured, you made them."

In answer to the question of how you can know that the design you've stressed over for so long is appropriate, Veen (1997) suggests that feedback is one way – you must pay attention to the e-mail from people who take the time to write. According to him a more powerful solution is actually watching people use the site, asking them simple questions as they surf, and then changing the design accordingly.

Testing Web page usability (continued)

Ray and Ray (1999) p404 define usability as "how easily a visitor to your site can find and use information" and suggested that, when testing for usability, one should consider the following:

- How long do pages take to download? They stress the fact that the pages should be tested using a dial-up Internet connection. It should also be asked whether the benefits of added enhancements (e.g. JavaScript) outweigh the extra download time.
- Are navigation tools readily available and consistent from page to page?
- It is crucial that links should be tested and they suggest that Web-based tools be used that can help check links automatically.
- Test for readability. Here Ray and Ray (1999) specifically refer to the font, font sizes, emphasis and colours used. It must be remembered that images and headings stand out and should be used to emphasize important information.
- Test content. Information on the site should be up to date and accurate.

Pilot Testing   When testing for usability, Ray and Ray (1999) identify two methods, namely contextual inquiry and the "talking aloud protocol":

During contextual inquiry visitors are observed in their own environment. Everything they do should be quietly noted, including which information they refer to, which links they use most, and in what order they visit pages.

During the talking aloud protocol the user is given a specific task with the instruction to talk out loud throughout the execution of the task. The recorded results will be "fairly disjointed but rich in information".

43

Testing Web page usability (continued)

To get started:
Adapted from
Fleming's "User
Testing"

- You will need a user, a computer, and a pencil and paper for note taking.
- Some usability consultants use video cameras, tape recorders, one-way mirrors or other high-tech tools.
- Fleming stresses that when one is testing for usability it should be kept simple and that more time should rather be spent focusing on users' behaviours and less time concentrating on the zooming capabilities of the video camera.

Who to invite:
Adapted from
Fleming's "User
Testing"

- Choose people who match the target audience. It goes without saying that they will be people who are familiar with the Web.
- Eliminate bias: Choose people who don't have preconceptions about your product.
- Take the time to find participants who can be brutally honest if necessary. Friends/colleagues might not give completely honest answers.

How many?

Kunjavski says: "Most designers feel you can flush out the majority of problems in an interface by showing it only to a couple of people. I've also found this to be true. Four to five people seems to be the optimal number; you see most of the problems you're going to see and you can do the evaluation quickly."

Fleming's opinion is that the best way to run a user test is one-on-one: one user with one facilitator. With a group test the chance of observing them all in any meaningful way is very small.

Testing Web page usability (continued)

Test procedure:
Adapted from
Fleming's "User
Testing"

- Before taking the test, tell the user what the purpose of the test is. At this point one should be careful not to prejudice people. Try to explain briefly that you are interested in discovering what they think of the site, both good and bad. Reassure the user that you are an objective observer and won't be insulted by anything they say. Ask them to "talk out loud" about what they see and experience as they move through the site. Avoid simply guiding them through the site. You may have to give users a task to get them started.
- Try and sit behind the user where you can take note of their actions.
- Write down as much as possible of what they do and say.
- When time runs out, one can ask the user more specific questions. If problems are mentioned, you may want to ask for suggestions on solving them. Clarify why they did some of the things they did.

Analysing the results
Adapted from
Fleming's "User
Testing"

Unfortunately no statistical methods can be applied. No formal questionnaires can be analysed. When comparing notes, watch out for patterns and the commonly occurring remarks or observations. Weed out individual reactions and focus on the common issues that were raised.

A good idea is to summarise your notes as soon as possible after the test. You may have to use your short-term memory to help you decipher what you have recorded.

A last word:

Instone stresses the fact that user testing is not the be-all and end-all of the design process: "You still need to make judgment calls about what a product is supposed to do and what your target market wants to see."

Chapter 3
Design and Development

Introduction   The **S**tatistical data and **S**tory library in the **S**outh African context (SSS) consists of a database on the one side and a Web front-end communicating with the database on the other side. The design and development aspect was therefore two-fold: the design and development of a database that will be populated, over time, with questions to which the Vista first-year student can relate, and the Web page that will be the portal to the database.

Database design and development   A detailed report on the design and development of the SSS database is given in Appendix:__database. The report is written in such a manner as to help the novice through all the frustrations/pitfalls/anxiety experienced when one knows what one wants (a database and a Web site communicating with it) but doesn't have an idea where to start.

The following specifications were followed during the process of designing and developing the database:

Specifications	Results
Communicate with the first-year Statistics lecturers to determine what information they want from the database. Because the lecturers are spread over many campuses, facilitate a "chat group" in order to come up with realistic requests. Emphasise the fact that one can start small and add options as the product matures.	The lecturers requested information on: ■ The statistical method, e.g. ANOVA ■ The level of examination (at this stage the database is targeted only at first-year students, so this was left out) ■ Grading of the questions (Easy/Moderate/Difficult). The emphasis of this product is on supplying the "story" and "data", with "model questions" on that information. It is up to the lecturer to customise it to his/her needs. ■ A choice of topics such as health/crime, etc.

Database Design Specifications (continued)

Specifications	Results
Determine what groups are needed to store facts about (the tables in the database) e.g. methods/topics/levels.	Initially there will be three tables: ▪ "Questions" that will accommodate the actual questions. ▪ "Method" that will be a list of the Statistical methods. ▪ "Topic" that will be a list of the topics.
Determine what facts need to be stored about each group (the fields in the tables).	▪ In the "Questions" table there will be the following fields: MethodID, TopicID, Storyname, Story, Pdf , Doc, Picture. ▪ In the "Method" table there will be the following fields: MethodID, Method. ▪ In the "Topic" table there will be the following fields: TopicID, Topic.
Determine the relationship between the tables.	This will be a one-to-many relationship, connecting the "Questions" table, via the MethodID and TopicID, to the "Method" and "Topic" table.
Study well designed databases similar to the one that is going to be designed.	"Your First Database" by Greenspan was carefully studied as well as the existing "Data and Story Library" (DASL) on the Internet. The SSS does not have all the options of DASL, but DASL has its own powerful search engine and SSS uses basic query language.

Design and Development (continued)
Web page Design

Web page design　The portal to the database (the page) should comply with the following
Specifications　specifications:

- Clearly state what the SSS is.

- Because the target group might be novice Internet users, clear
  instructions must be given on how the user will access the
  database. This should be clearly visible on the first screen without
  having to scroll down.

- Navigation should be intuitive, predictable, consistent and highly
  visible.

- Use a sans serif font that is easily readable.

- Use colour/graphics/text to create a user-friendly environment. The
  "look-and-feel" should be consistent throughout the site. Because
  "Statistics" and "South African Context" appear in the title, graphics
  depicting some statistical concept, say a histogram with ethnic
  colours, will be appropriate. Because "forms" are used to access
  the database information, a background image can be used to
  make it less intimidating.

- Use text emphases (larger font/different colour) to draw the
  audience's attention to important information.

- Both Internet Explorer and Netscape should support the design
  requirements.

- Contact/feedback information must be available.

- "Other links" should have links to other similar, on-line
  applications, e.g. DASL. The lecturers should recognise ownership
  of this product and help to add value to the site by surfing for
  additional links to relevant information.

Design and Development (continued)
Database-interface Development.

Specifications

- Choose the operating system
  - ✓ Windows 98
- Choose a server that runs on the Windows operating system and that supports Hypertext Transfer Protocol, Active Server Pages and ODBC-driver.
  - ✓ The initial development was done on the Personal Web Server which is part of the Internet tools of the Windows environment.
  - ✓ The final product will be loaded on the Internet Information Server of Vista University.
- A basic knowledge of the following is necessary:
  - ✓ HTML: Basic coding and forms or the use of an HTML – editor.
  - ✓ Microsoft Access to develop the database.
  - ✓ Active Server pages.
  - ✓ Structured Query Language.
  - ✓ VisualBasic Script.

Development   A detailed report on the development of the database-interface is given in Appendix: _database.

49

Chapter 4
Usability Evaluation

Introduction

The initial testing of the product was done on the developer's Personal Web Server. Although this testing **mimicked** real-life situations, factors such as Internet connections, modems, and users' hardware were not taken into account. This presented a disadvantage. Another problem experienced was the fact that the target group, namely Vista lecturers, were scattered all over South Africa and the product was operating on the developer's PC in Pretoria. These problems were overcome by uploading the product on the developer's site: http://bbasson.jaywalk.com/library.asp

Participants in the usability evaluation

Three groups participated in the usability evaluation:

A. The envisaged end-users: Vista lecturers in Statistics (as far as Bloemfontein and Port Elizabeth).

B. People who matched the target audience: Lecturers in Statistics at the University of South Africa.

C. People who did not match the end-user profile but who were Internet literate.

Feedback

With group A, feedback via e-mail and telephone had to be relied on, but with groups B and C the participants could actually be watched using the site.

Test procedure Group A

During March and April Vista lecturers had to compile examination papers. Three lecturers who had to set questions on Descriptive Statistics, Analysis of Variance and Regression Analysis were asked to access the SSS for contributions and to give feedback on:

- The ease of use of the product.
- The time it took to download the Word documents and whether they experienced problems viewing the documents in pdf format.
- Frustrations and problems experienced.

50

Usability Evaluation (Continued)

Participants in the usability evaluation: Group B

The prerequisites for choosing participants for group B were:

- They had to match the target audience.
- They should not have a preconceived notion about the product.
- They should be, if necessary, brutally honest.

In order to observe the user closely, a one-to-one test was run, one user with one facilitator. Before accessing the site, the user was informed of the purpose of the test. Before the evaluation of the product started, the facilitator gave the participant a specific task, namely to compile a question on descriptive statistics within 10 minutes.

The different participants were asked to articulate what they saw and experienced as they navigated the site. Notes were made of the key remarks and how the participants conducted the test.

After completion of the test the participants were asked specific questions, e.g. whether they experienced any anxiety when navigating the system and whether they found the product user friendly.

Participants in the usability evaluation: Group C

Participants in group C did not have to be statisticians but had to be Internet-literate.

The same test procedure as for group B was followed.

Usability Evaluation: Results

Introduction   The usability evaluation was done on the following product:

The results are classified under the following headings:

- Presentation: The opinion of the end user on the "look –and feel" of the site.
- Interaction/Efficiency:
    - The ease of use of the product in helping end users to accomplish their critical tasks.
    - The extent to which a casual user can remember how the product works and retain proficiency with it.
- Information: The completeness and appropriateness of the product in achieving end-user goals.

Results of Usability Evaluation: Presentation

Group A

The following comments were received by e-mail from a lecturer at the Soweto campus on the home page: "What I've seen looks impressive. I think it is good that on the Web site itself you do not say that it is a database of questions that black South African students can relate to. They must not be made to feel that there is a special statistics course for them as blacks. The way you put it on the Web site is good, that is without specifying any racial group."

A lecturer from the Bloemfontein campus was particularly thrilled about the "look –and feel" of the home page and her comment, given over the telephone in Afrikaans, was: "Die etniese uitleg is verskriklik oulik ... ek is mal daaroor" (The ethnic layout is very appealing…I'm crazy about it).

Another lecturer said that the histogram on the home page made him feel "at home", but that students might experience the site as "boring".

Group B and C

Initially Group B and C participants didn't comment at all on the "look and feel" of the site, but were more concerned about the use of the product. The reason might be because they were given a specific task and experienced it as a "test" that must be "passed". When they were specifically asked about the presentation design they would noticeably relax, sit back and exclaim that it was "nice", "soothing", "tasteful", etc.

Results of Usability Evaluation: Interaction/Efficiency

Introduction   To choose "All topics", a radio button had to be checked first and then the user could proceed with the choice submission (because of a lack of programming knowledge, the author could not make the "All topics" option part of the drop-down menu). To make the user aware of the procedure to access the database, the method was described in a box with a different background and a different font colour.

Feedback   In the feedback received from group A no problems/difficulties were mentioned regarding access to the database. Groups B and C **immediately** clicked on the drop-down menus **without** reading the instructions and consequently got an error message. The advantage of being able to observe the participants became quite clear and it can only be assumed that group A had the same difficulty, realised that they had to follow the instructions and were too ashamed to mention it.

When Groups B and C were specifically asked why they did not read the instructions, the answer was that it is not common practice to have instructions on the Internet and that they are use to clicking on drop-down menus to make their choices. This posed a major problem and the only solution was to gain the necessary knowledge to obviate this problem. This resulted in the changes as presented in the following figure:

Results of Usability Evaluation: Information

Group A   To get to the information, i.e. the actual questions, a Word document had to be downloaded and the major concern was the downloading time. Fortunately the feedback from the Vista lecturers was that, even during peak time, the downloading time was reasonably fast.

Group B   In group B one of the lecturers from the University of South Africa became very particular about the contents, e.g. was Regression a statistical "method"; should one refer to "pap and vleis" as it appeared in one of the questions, etc. She was reminded that the goal of the exercise was to test the usability of the product and that the next stage would be to look closely at the content of the database.

Group C   Group C was not concerned about the actual information and was quite satisfied that the product was appropriate for achieving the end user's goal.

Chapter 5
Conclusions and recommendations

Summary

A prototype was developed to fulfil the need for a database of questions that must be accessible through the Internet. The usability of the product was ensured by reducing the design criteria to the following key criteria:

- Presentation
- Interaction/Efficiency
- Information.

Vista lecturers used the product to compile an examination paper and it was found that it had the following advantages:

- It eliminated the frustration of contributions not being received by the deadline.
- It eliminated the need to motivate why certain contributions could not be used.
- It was already in the prescribed format.
- It took only a fraction of the time it usually takes to compile a paper.

The feedback from the users was that the time it took to download the questions did not pose a problem and that the product was fun to use. Their immediate need was for solutions to the questions to be available.

The major disadvantage of the product is its dependence on the Web server, but fortunately the chance that the server will be down is sufficiently small.

Recommendations

The following recommendations are made for the improvement of the SSS prototype:

- The number of choices can be extended to include, for example, the level of difficulty of the questions.
- Choices should be included that cater for specific statistics, e.g. biometry or econometry.
- The questions in the prototype focused on first-year students. The product can be extended to include questions for second- and third-year students.
- Answers to the questions should be made available.
- An "SSS committee" should be appointed which would supervise the standard of the questions that will be allowed in the database.
- An "SSS master", similar to a Web master, should be appointed who would be responsible for updating the database.

Conclusion

Usability testing proved that the SSS prototype is intuitively easy to use, appropriate to the task and meets the needs of Vista University lecturers.

References

Usability Architects, Inc. 2000. *The components of usability*. [Online], Available:
http://www.usability-architects.com/ [2001, Jan. 15]

Basel, B. 1995. *The use of pictures in English second language learning in adult basic education: A Descriptive Study*. Mini-dissertation. University of Potchefstroom.

Blignaut, R.J., Venter, I.M. and Cranfield, D.J. 2000. *Fast tracking students from disadvantaged backgrounds into main stream Computer Science*. South African Computer Journal /SART, No 26, 2000. pp 228 – 229.

Boling, E.S., and Sousa, G. *Interface design issues in the future of business training*. Business Horizons, Volume 36, No 6, p 54.

Boughey, C. 1993. *A schema theoretical view of the reading process. In language across the curriculum*. University of the Western cape. Academic Development Centre. Occas. Publ. 2, pp 1 – 15.

Cooke, K. 1998. *Introduction to Active Server Pages.* [Online], Available:
http://hotwired.lycos.com/webmonkey/98/39/index2a.html [2001, Jan. 5]

DASL 2000. *The data and story library.* [Online], Available:
http://lib.stat.cmu.edu/DASL [2000, Jul. 15]

Filemaker Pro. [Online], Available:
www.filemaker.com/support/mac_os_10.html [2001, Feb. 5]

Fleming, J. *User testing.* [Online], Available:
http://www.ahref.com/guides/design/199806/0615jef.html [2001, Feb. 5]

For a comprehensive list of Web servers and the operating systems they run on, visit ...
http://webcompare.internet.com/ [2000, Jun. 15]

Fresen, J. 1998. *Design and development of CBT: Flowcharting and storyboarding*. Course notes (not published): Brain Waves Research and Training cc.

Frew, J. *Design basics.* [Online], Available:
http://hotwired.lycos.com/webmonkey/html/97/05/index2a.html [2001, Jan. 5]

Greenspan, J. *Your first database.* [Online], Available:
http://hotwired.lycos.com/webmonkey/99/13/index0a.html [2001, Jan. 5]

Holzschlag, M.E. *Color my world.* [Online], Available:
http://www.webtechniques.com/archives/2000/09/desi/ [2001, Jan. 5]

Hower, R. 1997. *Beyond broken links.* [Online], Available:
http://www.dbmsmag.com/9707i03.html [2001, Jun. 5]

Hughes, C and Birznieks, G. *Serving up Web server basics.* [Online], Available:
http://webcompare.internet.com/webbasics/index.html [2001, Jan. 5]

Instone, K. *Conducting your first user test.* [Online], Available:
http://www.webreview.com/1997/05_30/strategists/05_30_97_8.shtml [2001, Jun. 5]

Kirsner, S. 1998. *Content that keeps visitors coming back. Must-haves.* Business Magazine,
August.

Kodak. [Online], Available:
http://kodak.co.uk [2000, Jan. 8]

Kunjavski, M. *Why user testing is good.* [Online], Available:
http://hotwired.lycos.com/webmonkey/98/14/index3a.html [2001, Feb. 5]

Lanham, L.W. 1986. *Another Dimension of Readiness to learn in the Second Language.*
HSRC Education Research Programme No. 6.

Lawson, S. 1987. *Communication with pictures.* ESL Adult Literacy Bulletin, Vol, 1. No 5.

Levey, M., Hodgkinson, C.A. , and Erikson, A. 1989. *CBT: Courseware Development 1 – A
Working Guide.* Course notes (not published): Parktown, SA Interactive Education Systems
cc.

Merrall, G. *PHP/MySQL Tutorial.* [Online], Available:
http://hotwired.lycos.com/webmonkey/99/21/ [2000, Nov. 5]

Mohnike, C. *SQL Statements.* [Online], Available:
http://hotwired.lycos.com/webmonkey/99/03/index2a_page3.html [2000, Nov. 5]

Mutasa, D.E. 2000. *Language policy and language use in South Africa: an uneasy marriage*.
South African Journal of African Languages. Vol. 20, No 3, pp 217-225.

Nielsen, J. and Mack, R.L. 1994. *Usability inspection methods*. John Wiley & Sons, New
York, NY, 1994.

Operating System Technical Comparison. [Online], Available:
http://www.osdata.com/index.htm [2000, Nov. 5]

Operating system summaries. [Online], Available:
http://www.osdata.com/kinds/summary.htm [2000, Nov. 5]

Ray, D.S. and Ray, E.J. 1999. *Mastering HTML 4*. SYBEX Inc.

Shiple, J. *Information architecture tutorial.* [Online], Available:
http://hotwired.lycos.com/webmonkey/98/28/index1a_page4.html [2000, Feb. 12]

Roman, F. 1999. *Access database design & programming, 2nd Edition.* O'Reilly &
Associates, Inc.

Stodel, C. 1987. *The effectiveness of film on learning and attitudinal change in young adults*.
Unpublished MEd thesis. University of the Witwatersrand.

The Microsoft site for definitions and products to develop Active Server Pages. [Online],
Available:
http://msdn.microsoft.com/library/ [2000, Nov. 18]

Thomas. Legislation information on the Internet. [Online], Available:
http://thomas.loc.gov [2000, Jan. 8]

Veen, J. 1997. *Test your designs - on people!* [Online], Available:
http://hotwired.lycos.com/webmonkey/tools/97/39/index0a.html [2001, Feb. 18]

Venter, I.M. & Blignaut, R.J. 1996. *Approach to computer literacy education in a Third World setting.* Computers Education Vol.27, No.1, pp 23-29.

W3C. *World wide web consortium.* [Online], Available: http://www.w3.org [2001, Jan. 5]

Why use Linux? [Online], Available: http://www.linuxlinks.com/Local/why.shtml [2001, Jan. 5]

Wiles, S. 1993. *Language and learning in multi-ethnic classrooms.* Language and Learning: An Interactional Perspective. Imago Publishing.

Windbigler, K. *Look ma! 15 fonts!* [Online], Available: http://hotwired.lycos.com/webmonkey/html/96/46/index2a.html [2001, Jan. 5]

LIST OF APPENDICES

Appendix: Survey

Appendix: Database

Appendix: Survey

- [Question paper](#)
- [Analysis of results](#)
- [Comments by students on questions 1 and 2](#)
- [Comments by students on questions 3 and 4](#)

Read through the two paragraphs (**A** and **B** below) and answer the following questions:

1.1   In the context of the paragraph, explain what you understand by the term "guinea pigs" .

1.2   Explain what you understand by the term "lobola".

1.3   If you have to answer only ONE of the questions A) or B), which one would you have chosen? **Clearly motivate why you would have made that choice.**

A. The following table gives the survival time of 50 guinea pigs in a medical study done in a laboratory. Draw a histogram …..

B. The following table gives the amount 50 men were prepared to pay for lobola to marry an educated woman. Draw a histogram …

2.1   List the words, if any, that you do not understand in the sentence below.

2.2   Which one of the following bar charts will you include in the article **(A or B)**:
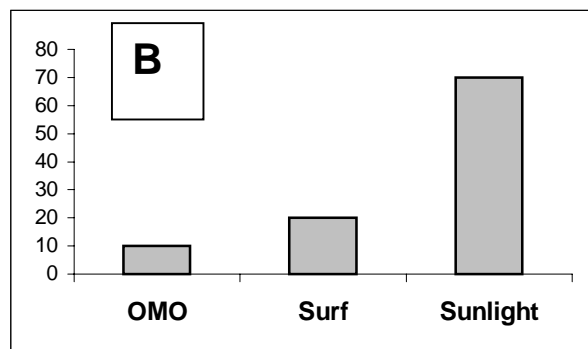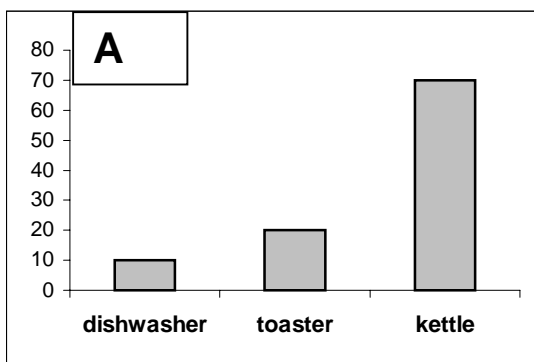
Sentence:

"You are writing an article for a consumer magazine based on a survey of the magazine's readers on the reliability of their household appliances."
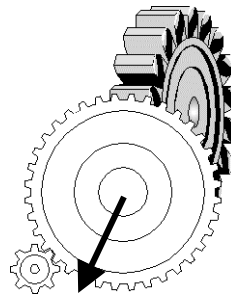
3. If the following two paragraphs (**A** and **B**) were part of a question given in a test, which presentation would you have preferred, **A)** or **B)**? **Clearly motivate why you would have made that choice.**

A)

An automatic grinding machine in a factory prepares gears with an average target inside diameter of 40 millimeters (mm) and a standard deviation of 3 mm.

B)

gear inside diameter

An automatic grinding machine in a factory prepares gears with an average target inside diameter of 40 millimeters (mm) and a standard deviation of 3 mm.

4. If the following two paragraphs (**A** and **B**) were part of a question given in a test, which presentation would you have preferred, **A)** or **B)**? **Clearly motivate why you would have made that choice.**

A)

The following table presents the hijacking statistics in two suburbs of Pretoria, namely Mamelodi and Lynnwood. Draw bar charts………

B)
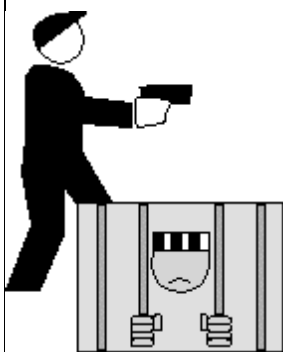
The following table presents the hijacking statistics in two suburbs of Pretoria, namely Mamelodi and Lynnwood. Draw bar charts………

Analysis of Questions 1 - 4

Understanding of the word in the context of the sentence
Guinea pig versus Lobola

Guinea pig: 5%
Lobola: 100%

Preference: "Guinea pig" question versus "Lobola" question

Guinea pig: 0%
Lobola: 100%

Words students did NOT understand

survey: 42%
reliability: 11%
appliances: 5%
consumer: 5%
none: 38%

Distribution of Question 2.2

67%
33%

☐ Bar chart A: Household aplliances
☐ Bar chart B: Washing pow ders

Question 3: "Inside diameter of gear"

w ith picture: 95%
w ithout picture: 5%

Question 4: "Hijacking"

w ith picture: 77%
w ithout picture: 23%

Comments on Question 1 and Question 2
(These comments are unedited feedback from the students)

	1.1 Guinea pig	1.2 Lobola	a) or b)	Reason	Words not understood	A or B
1	√	√	b)	…has to do with my culture	None	A
2	….know they aren't really pigs but forgot what they really are	√	b)	…I understand the question in every sense	None	A
3.	…are sick pigs	√	b)	……an issue of lobola is quite interesting and easily understandable. We hear about lobola daily and after all it is our culture therefore I should precisely understand it	survey	A
4	-	√	b)	…I understand the whole question **and I can interpret it**	survey	A
5.	…pigs that are used for food making	√	b)	…it is traditional for men to pay a lobola for the wife when he wants to marry her	reliability survey	B
6	…pigs that earn money	√	b)	…an educated women is intelligent that is why men will pay to marry her.	Household appliances	A
7	-	√	b)	…easy to understand	Survey	B
8	-	√	b)	…part of life	Survey Reliability	B
9	Don't know	√	b)	…something I understand, something I have a knowledge about. It is my culture, something I have experience and learned about		A
10	big pigs	√	b)	…know the meaning	None	B
11.	…pigs that have to go to the slaughter house	√	b)	…understand clearly what is meant by the term lobola	Survey	A
12	…are old pigs	√	b)	…I understand most	• Survey • Reliability • Consumer magazine	A

Comments on Question 3 and Question 4
(These comments are unedited feedback from the students)

	a) without picture or b) with picture	Reason	a) with picture or b) without picture	Reason
1	b)	…give a clear idea or indication to what's going on	b)	**The statement is not complicated** just by reading I can clearly understand what they are talking about
2	a)	…**no one can say they don't know what an inside diameter is. They would have passed their matric by mistake**	b)	**…I don't need a picture to know what hijacking is**
3	b)	…I believe that without the picture I wouldn't have had a clear picture of the gear with an inside diameter. Which means it would have been quite difficult for me to imagine the question.	a)	…you don't have to think too much about the story and can start on the analysis even before reading any further.
4	b)	…can easily understand what we are writing about	b)	**Even without drawings I can understand the question**
5	b)	…gives you knowledge of what the question is all about	a)	…you immediately know what it is all about
6	b)	..the picture gives you guidance even if you don't understand the question	a)	…you will easily answer the question
7	b)	…without the picture it is going to be difficult for me to answer the question	a)	…easy to answer
8	b)	…gives us light by putting a picture	-	-
9	b)	…more easy to understand what you are talking about	a)	..easy to understand
10	b)	…have a clue what it is about	a)	I know how to answer the question
11	b)	…if you do not understand clearly the words, picture may come up with a clear vision to you, so that you can understand much more		
12	b)	…by looking at picture you understand	a)	…there is a **Chinese proverb that say a small picture can explain more than hundred words.**
13	b)	…with the picture I can see and realize that the diameter is the middle	a)	..indicates that there is criminal offences that has occurred.

	a) without picture or b) with picture	Reason	a) with picture or b) without picture	Reason
14	b)	…easy 6to understand	a)	…help me to understand…without it will take **time** to understand…**will be afraid of hijacking because I will go to jail.**
15	b)	…if you misunderstood the question the picture could highlight you about the question	a)	…could inlight you
16	b)	…understand better and will help with the answering	a)	Understand better
17	b)	…get a clear understanding of what is going on	a)	I prefer the pictures
18	b)	…show me what I am dealing with	a)	…gives me a clue
19	b)	…help you understand when you are struggling	a)	…shows me what is happening
20	b)	…explain what is inside –diameter	a)	…guide me to understand
21	b)	…would be seeing what I am talking about	a)	…I wouldn't struggle by imagining the picture.
22	b)	…gives me guidance of what the question means.	a)	…supports the question
23	b)	…understand better	a)	…understand better
24	b)	…suppose I have forgotten about the diameter, **then I will recall quickly**.	b)	…can easily understand**. Picture wastes time.**
25	b)	…easy to understand something that you see with your eyes	a)	…because of its vividness, **great impact on reader**
26	b)	…help me to understand	b)	**…were not necessary.**
27	b)	…depics what they are exactly talking about…clear understanding	b)	**…is clear even if there are no pictures. How they hi-jack is not relevant.**
28	b)	…help to understand	b)	**…everyone knows what crime is. Picture is useless**
29	b)	…helped to understand	b)	**…can understand information without picture**
30	b)	…help me to identify and understand	a)	…if I didn't understand hi-jacking

	a) without picture or b) with picture	Reason	a) with picture or b) without picture	Reason
31	b)	…gives as the story clearly	b)	**…does not clearly described the hijacking method**
32	b)	…make it more understandable	a)	…know what it is all about even before reading it
33	b)	…more understandable	a)	…more understandable
34	b)	…it gives me a light of what the question is talking about	a)	…prefer the picture
35	b)	-	a)	-
36	b)	…guides me…clearly understand	b)	**…understand what hi-jacking means**
37	b)	…easy to understand	a)	…easy to understand
38	b)	…it appears practically and I understand it better	-	-
39	b)	…gives me a clue to the question	a)	…make it interesting and easier to understand
40	b)	…I know what the question is all about before reading	a)	Same reason
41	b)	…understand the question more better than I would have done without it	a)	…easy to understand
42	a)	**…will confuse me**	a)	…picture is eye-catching
43	b)	…**our African languages don't have words for things we read in questions**	a)	…gives a clue what the question is all about
45	b)	…without the picture I would not have a clue what it is all about	a)	…easier
45	b)	…shows what it is all about	b)	**…picture does not show/presents hijacking statistics**
46	b)	…understand better	a)	…know what it is all about before reading.
47	b)	…faster thinking	a)	…really tell us
48	b)	…understand what is given	a)	…can clearly see
49	b)	…get a clear picture and then calculations become more easier	a)	…more understandable

	a) without picture or b) with picture	Reason	a) with picture or b) without picture	Reason
50	b)	…more understandable	a)	…gives me an idea…see what is happening
51	b)	`…helps to give a meaning of the statement which **helps big time** during the **stress** of the test	a)	…better understanding
52	b)	…help understand…sometime you find that you don't know that particular thing they are talking about	a)	…gives a better idea
53	a)	**…takes my mind off thinking. I start looking at the picture and sometimes think of something else irrelevant to the question**	b)	**I will have to concentrate on what will I do rather than looking at pictures**
54	b)	…easy to understand	a)	…easy to understand
55	b)	…understand better	a)	**…see somebody in jail, it tells us that if you do crime you can result in jail for the rest of your life**
56	b)	…I want to know the thing they are talking about	a)	…Better understamding
57	b)	…understand what it is all about	b)	**…no need for picture**
58	b)	…I will answer the question with a better idea what I am talking about	b)	**…I know what hijacking is**
59	b)	…show clearly what it is about	a)	..shows clearly…
60	b)	…help to understand	a)	…help to understand

	1.1 Guinea pig	1.2 Lobola	a) or b)	Reason	Words not understood	A or B
13	Will have to look up "guinea" in dictionary	√	b)	…it is something that I normally knows and hear most in my life. **Because many people don't talk about such deep words(guinea)**	-	A
14	-	√	b)	…natural thing	Survey	A
15	-	√	b)	-	Survey	B
16	-	√	b)	…something we come across most of the time	Survey	B
17	…they are pigs, but I don't know much about them	√	b)	…some of my family members have gone through the process	-	A
18	Don't understand	√	b)	…is our African culture	Reliability	A
19	…pigs that are not healthy	√	b)	…understand the term more than "guinea pigs"	Reliability	A
20	…pigs with big mouth and tall tail	√	b)	…I agree in paying lobola to the educated woman	Understand all	B
21	…pigs that need checking	√	b)	…I know much more about lobola than guinea pigs	Survey	A
22	…pigs found in bushes	√	b)	…I know about lobola and when coming to guinea pigs **I know nothing at all.**	• Survey • Consumer • reliability	A
23	…wild pigs	√	b)	…I know lobola better	None	B
24	√	√	b)	…ask about things we know and are happening in our daily life…it is tradition	-	A
25	…wild animal	√	b)	…African tradition…have seen it practiced in my culture	-	A
26	…pigs that stay in forests	√	b)	..I would like to see many educated women in this country still prefer men to pay lobola. **The other thing is I hate pigs in general.**	-	A
27	…no idea	√	b)	…easier to answer	-	A

	1.1 Guinea pig	1.2 Lobola	a) or b)	Reason	Words not understood	A or B
28	…look like pigs…are found in oceans	√	b)	…in my tradition is something which happens often. **Unlike guinea pigs, I have seen them only on TV**	-	A
29	…pigs	√	-	-	Survey	B
30	…healthy pigs	√	b)	…I am a male human and finally I have to marry and marrying is all about paying lobola.	Survey	B
31	…don't know	√	b)	…understand it better…traditional thing…see it practically with my eyes	Survey article	A
32	-	√	b)	…I don't live on a farm. Lobola is **something that happens in our everyday lives.**	-	A
33	…wild pigs	√	b)	…I have always been popular with the word "lobola"	Survey	B
34	…little pigs living in the sea "penquins"	√	b)	-	Survey	A
35	-	√	b)	…when I was still growing, my grandmother told me that if I want to marry… it is the traditional thing to do	Survey	B
36	……explain the pigs that were used…	√	b)	…more familiar	Survey	A
37	…pigs from the country Guinea	√	b)	…a real life thing, **so I can tackle this with knowledge**	-	A
38	-	√	b)	…is our tradition	-	B
39	…animals in rural area	√	b)	…we use to do it in my family and culture	Appliances	A
40	…wild pig	√	b)	…what we think about when we want to marry	-	A
41	…ordinary pigs	√	b)	…because I use it or I hear about it almost everyday…it is our culture	-	A
42	…different kind of	√	b)	…easier to draw the frequencies	-	A

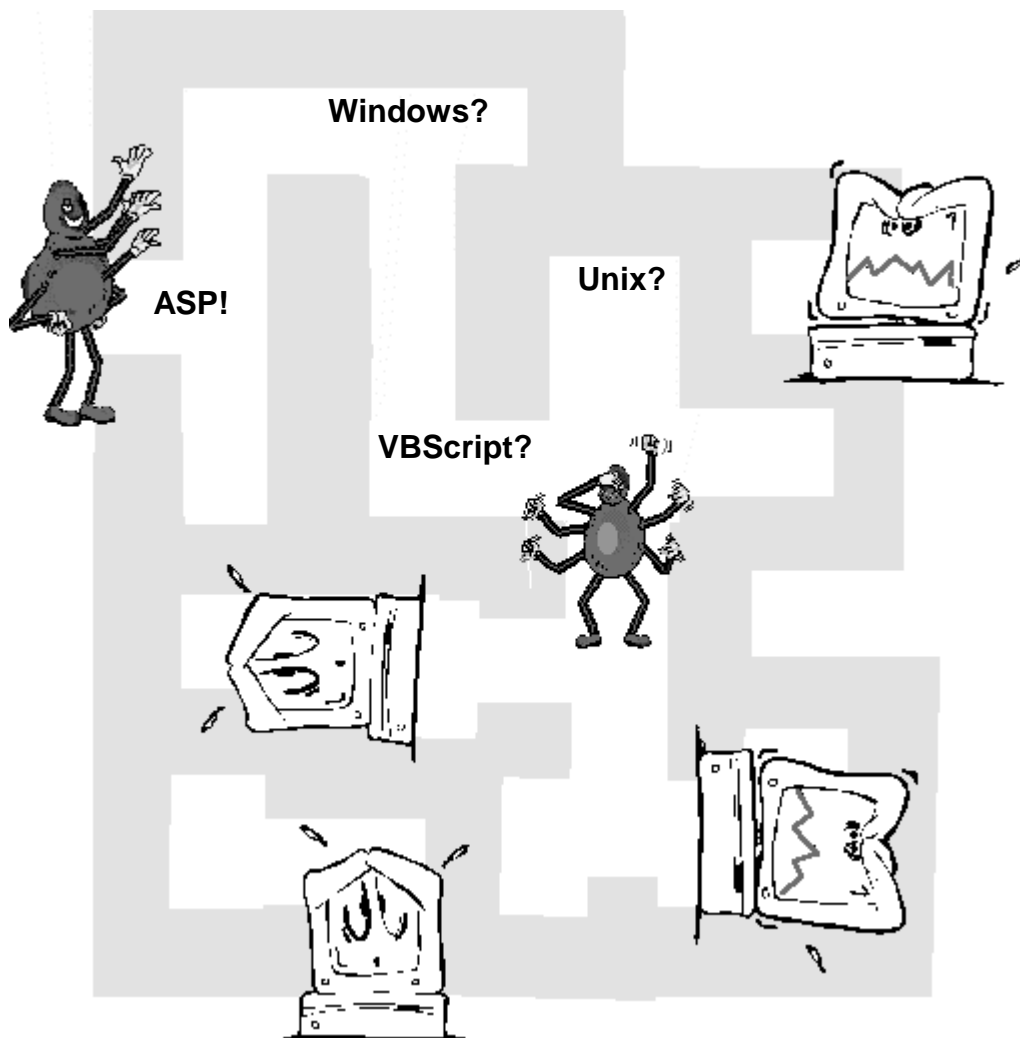|	1.1 Guinea pig	1.2 Lobola	a) or b)	Reason	Words not understood	A or B
	breed of pigs					
43	-	√	b)	…is the African thing	Survey	A
45	-	√	b)	…things that happen in our family	Survey	A
45	√	√	b)	…part of my religion	Survey	B
46	√	√	b)	…black tradition	Survey	A
47	…type of pig	√	b)	…clearly understandable	Consumer	A
48	-	√	b)	…happens in my culture	Survey	A
49	-	√	b)	…our tradition…understand it more	-	B
50	Wild pig	√	b)	-	Appliances	B
51	…pigs from Guinea	√	b)	…because I do not know what a guinea pig is	-	A
52	…pigs that have a problem in their survival	√	b)	…understand the most	-	A
53	…small pigs	√	b)	**…familiar with terms, at least it will stop me thinking what the term means.**	-	A
54	-	√	b)	…easy to understand	Survey	B
55	…pigs with diseases	√	b)	…I have experienced it	-	A
56	…pigs with mental problems	√	b)	…understand better	-	B
57	…pigs that are not healthy	√	b)	…traditional thing…**simple for me to answer…**	Survey	A
58	…pigs that are endangered	√	b)	…understand better	Reliability	A
59	-	√	b)	…know what it is about	Survey	B
60	-	√	b)	…understand	-	B

Appendix: Database

A Report on the development of the SSS

Introduction   This is an attempt to guide the complete novice through the knowledge
necessary to develop a relational database that is accessed from a Web
page.

Windows?

ASP!

Unix?

VBScript?

Table of Contents

Operating systems

What is an operating system?

An operating system is the most fundamental program that runs on the personal computer and serves as a communication link between the user and the hardware.

Apart from coordinating the operation of all parts of the computer, it also runs software programs and controls how a software program interacts with you.

Operating systems may be used for a wide variety of purposes including networking, software development and as an end-user platform.

Examples of operating sytems

UNIX
Windows NT
Windows 98 and up
MS-DOS
Macintosh
Linux, and many more

Why is knowledge of the operating system important?

- To be able to "communicate" between a Web server and a database one needs to use a certain language.
- The choice of language depends on the Web server, and
- The choice of Web server depends on the operating system.
- The operating system(OS) is the **engine that drives** the Web servers.
- A fast Web server on a slow OS will still be a slow operating system at its base, and the fast Web server can only make up so much for this lack of speed.

Operating systems (Continued)

What operating system did I choose and why?

When you develop Web pages using basic HTML 4, you work 'off line' and only the final product needs to be transferred to your Service Provider. The situation changes when you have to 'connect' to a database from your Web page.

Now you have to make use of Active Server Pages (ASP), that is a **server side technology**. Although ASP pages are essentially only HTML with scripts, written for example in VisualBasic, embedded in them, these pages are executed by the Web server BEFORE the page is sent to the browser.

Conclusion: I cannot test my development "off-line"

Result: Huge telephone bill

Solution: Use the Windows98 Operating System

How can Windows98 Help you?

Microsoft has this new functionality that makes your existing Windows 98 operating system a platform for sharing information on a personal Web site.

This was a tailor-made solution to my problem. Now I have my own Web server and I can develop and test my application without extra cost and inconvenience.
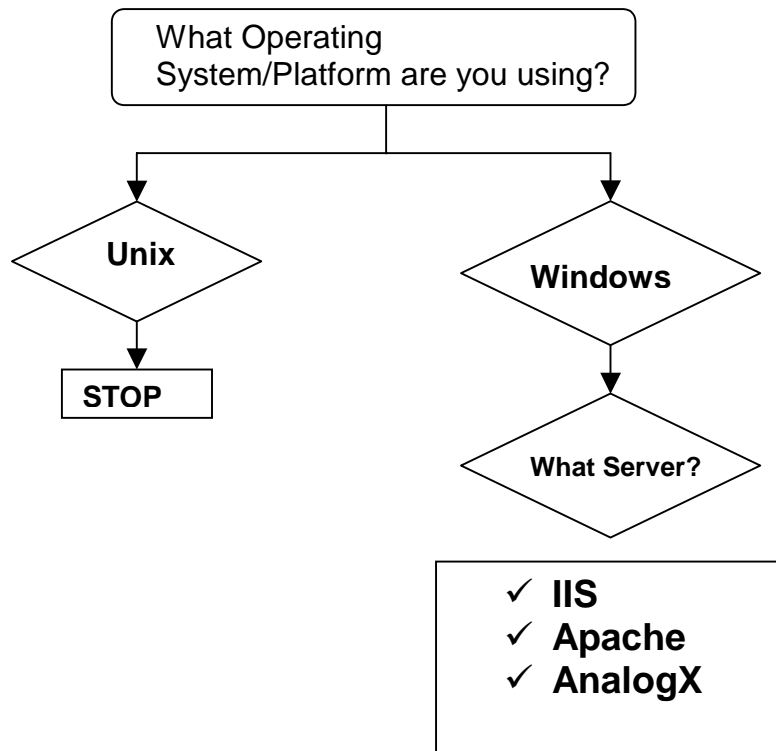
Consequence

My Service Provider must use a Windows operating system.

Operating systems(final word)

Summary

```
          ┌──────────────────────┐
          │   What Operating      │
          │ System/Platform are   │
          │    you using?         │
          └──────────────────────┘
            │                  │
            ▼                  ▼
       ◇ Unix ◇            ◇ Windows ◇
            │                  │
            ▼                  ▼
       ┌────────┐        ◇ What Server? ◇
       │  STOP  │               │
       └────────┘               ▼
                         ┌──────────────┐
                         │ ✓ IIS         │
                         │ ✓ Apache      │
                         │ ✓ AnalogX     │
                         └──────────────┘
```

What about Linux?

With Linux becoming more and more popular as a platform to run Web servers, it is worth mentioning.

Because we are not Service Providers we are not interested in all the good qualities of this system (see http://www.linux.org for more information). What we need to remember is that Linux is a Unix-type operating system and as such we will not be interested in it.

Web servers

Introduction

A protocol is a set of semantic and syntactic rules and conventions governing the way in which data are exchanged between two entities. Hypertext transfer protocol (http) is that set of rules that allows the transfer of hypertext files. A Web server is the platform that allows this transfer of hypertext files. In other words a **Web server** is an **http server**.

What are we looking for?

- A server that runs on the Windows operating system.
- A server that supports
    - HTTP
    - Active Server Pages (ASP)
    - Includes based on HTML comments
    - ODBC driver

IIS and other servers

The Internet Information Server (IIS) is one of many servers that comply with the above specifications and because it is free with Windows NT, it is most likely your service provider will have it.

For a quick comparison between different servers visit:
http://webcompare.internet.com/cgi-bin/quickcompare.pl

Web-to-database application
Before we start

Assumptions

- ✓ You are running Windows 98 and up
- ✓ You use Microsoft Access to develop your database
- ✓ You do know how to construct a relational database
- ✓ You have a basic knowledge of HTML. Make sure that you can code "forms" in HTML

Tool Check

The plan is to develop and check the application on your own machine before serving it through a service provider to the world at large.

- ✓ Check to see if you have Personal Web Server (PWS) installed:

  Start→Programs→Accessories→Internet Tools →Personal Web Server

- ✓ Go to "Personal Web Manager" and note what your "home directory" is. The default will likely be something such as c:\Inetpub\wwwroot. **In future that will be the folder that will be serving out your pages**, in other words, you save your files in that root or subsequent folders.

- ✓ Browser URL will be

  http://localhost/your_page_or_subsequent_folder

  For example: My default is c:\Inetpub\wwwroot
  I created a folder in wwwroot called "sss" and in that folder I saved an ASP file called "library.asp".
  My address will be: http://localhost/sss/library.asp

- ✓ A good **text editor** is in the order in which you are going to develop your ASP pages.

Web-to-database application
Connecting to the web-server

What do we have?

Database   server
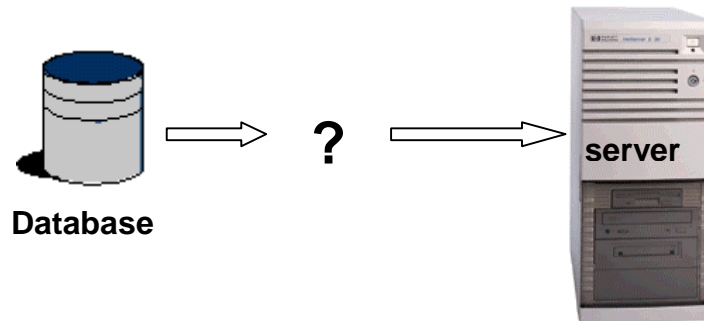
The missing link: a DSN-connection

Go to:

✓ Start→ Settings→ Control Panel

✓ Double-click on

ODBC Data
Sources (32bit)

✓ Click on Systems DSN tab

✓ Click on the "Add" button

✓ On the next screen, select the type of database you are using, in this case MS Access), then click "Finish"

✓ The next screen is where we will actually make the connection

✓ Where it asks you for the Data Source Name, enter the name of your database (in my example, I called my database "SSS")

✓ Click the "Select" button and choose the path to your database (in my case: c:/Inetpub/wwwroot/sss/sss.mdb)

✓ Click "OK"

What now?

The connection is made and we need to "call up" this connection and to do that we are going to use ASP-pages.

Web-to-database application
A last word on DSN

Introduction   A data source name (DSN) is precisely what it says: a name of the source where data lie, in our case the Access database file name.

ODBC is a programming interface that enables applications (our ASP pages) to access the data given in our DSN. We know that there is more than one way to indicate the "address" of data. There are also several ways any ASP script can connect to the actual database, but I will only mention system DSN and DSNless.

System DSN   The previous procedure was a system DSN and a procedure that works very well with your PWS. Remember, on your PWS you are the "server-master" and as such can set up your server, but the moment you make use of a service provider this can become a major headache and you will make use of a DSNLess set up.

DSNLESS   DSNLess requires NO server setup, just a carefully constructed connection string and the address of the data server. Armed with appropriate information supplied by your service provider, you could open a data source without a DSN.
The question to ask your service provider is: " I want to make a DSNLess connection, what is the path to my data file?"

Web-to-database application
Active Server Pages (ASP)

Introduction   Essentially ASP pages are just normal HTML with scripts embedded in
them. One can write scripts in VisualBasicScript, Javascript or any
language which is Active Script compatible. In this apllication
VisualBasicScript was used.

ASP is a **server side technology**, which means it works on ANY WEB
BROWSER, because all the work is done at the Web server end. The
script will be executed by the server BEFORE the page is sent to the
browser. If this make sense to you, you will understand why, when you
view the source code on the browser, you do not see any scripting!

The real advantage of ASP for this application is the ability to "call" other
programs like Access to execute certain commands- in a nutshell, to use
databases with Web pages.

**Definition from
the Mocrosoft
site:**   "Active Server Pages is an open, compile-free application environment in
which you can combine HTML, scripts, and reusable ActiveX server
components to create dynamic and powerful Web-based business
solutions. ASP enables server-side scripting for IIS with native support for
both VBScript and Jscript".

Web-to-database application
Active Server Pages (ASP) – continued

ASP Syntax
- ➢ Start of script: <%
- ➢ End of script: %>
- ➢ Do not put html between the two, or else it will break.
- ➢ The server will assume that anything between the above delimiters is code and will try to execute it.

VisualBasicScript
- ➢ <% **object**.**method()** %> or <% **object**.**property** %>
- ➢ Examples of **object**s:
  - o **Request –** to get information from the user
  - o **Response –** to send information to the user
  - o **Server –** to control the IIS
  - o **Session –** to store information about and change settings for the user's current Web server session
  - o **Application -** to share application-level information and control settings for the lifetime of the application
- ➢ For a complete list of available built-in ASP objects, with example code, visit the Microsoft site.
- ➢ Each of these objects has a collection of functions that it can perform, called "method s", and one or more properties.

Please Note
The aim of this guide is not to teach VisualBasicScript or SQL, but to give enough background information to follow the ASP scripting necessary for the application to function.

Web-to-database application
Active Server Pages (ASP) - continued

Exercise to test whether your set-up is correct:	In any text editor copy the following:

```
<% @Language=VBScript %>
<!--This line is optional. If you leave it out the server will assume you are using VBScript
-->
<html>
  <head>
     <title> Exercise using VisualBasicScript</title>
  </head>
  <body>
    <b style="font-family:Arial;font size:18pt;font-weight:bold;
    color:red">
   <!-- html4 inline style -->
    <% Response.Write("This is great!") %>
  </body>
</html>
```
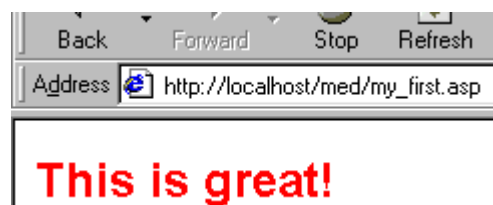
"save as"	"my_first.asp", please note the extension .asp NOT .html. Remember to save it in the folder indicated by your PWS. View your file in a browser.

This is what you should see:	I created a folder "med" in which my files are stored:

Back   Forward   Stop   Refresh

Address http://localhost/med/my_first.asp

This is great!

Web-to-database application
Active Server Pages (ASP) - continued

SQL:

Introduction
In this application I did not make use of FrontPage or Access Wizards because I wanted to understand the basic logic behind everything and therefore I had to understand what SQL was all about. Again I want to stress the fact that I used only those commands necessary for the application to function.

SQL
Structured Query Language is a database language that enables one to select certain records from database tables, using criteria you choose.

SQL Syntax
- **SELECT** records
- **FROM** a certain table in the database
- **WHERE** and now follow the criteria you choose**.**
  - Text fields must be enclosed in single quotes, i.e. WHERE name = 'Bettie'
  - Numeric fields need no special characters before and after, i.e. WHERE age = >20
  - Equality operators:
    - <>   not equal
    - >   greater than
    - <   less than
    - >=   greater or equal (at least)
    - <=   less than or equal (at most)

Web-to-database application
Active Server Pages (ASP) – continued

Problem:
How do I get the request from the user?

When you want to retrieve information from the database, you make use of a query in your SQL statement. Usually, when you create SQL statements, you make use of variables within the statement:
SELECT story FROM Questions WHERE
methodID=**variable_holding_methodID**

But how are we going to get that variable? We are going to use HTML forms **(link)** and a couple of lines of VBScript.

HTML form:
The form element

A form is designated by the following tag set:
<form **action**="url" **method**="get">
</form>
The **action** indicates what URL the submitted form should be sent to, in our case to an ASP page.
The **method**="get" will pass the information to a query string that will be discussed in the following section.

HTML form: The select element

The <select> </select> tag defines a set of options displayed by default as a drop-down or pop-up list box.

The <option> tag defines the options in the "select" list. Because the values of the options must be extracted from our database, we will be using VBScript.

Web-to-database-application
Active Server Pages (ASP) - continue

VBScript in the option tag

```
<select name="methodID">
<% 'Loop through the record set to make each entry in the   list. %>
<% do while not meth.eof %>
<option value = "<%= meth(1) %>"> <%= meth(0) %></option>
<%meth.movenext
      loop%>
</select>
```
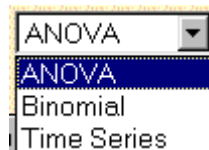
Those who are familiar with basic programming will recognize the loop. The "do while" statement will "loop" through the record set in the database to make each entry in the list.

The result will be the following drop-down menu:

Yes, there will be areas that will be unclear at this stage but the idea is to familiar yourself with all the pieces of the puzzle parts and the picture will eventually fall into place.

The query string   By submitting a choice in the drop-down menu the user has passed information to the "query string" and linked to an ASP page where the information from this query string will be used.
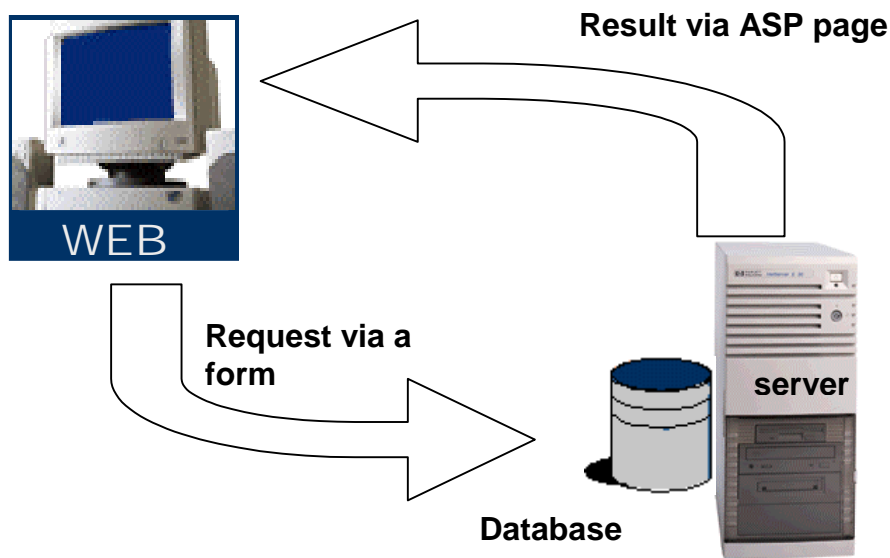
Web-to-database application

Summary   The following schematic outline summarises the process:

Result via ASP page

WEB

Request via a form

server

Database

Web-to-database application
Example

Introduction

I would like to work through my application with you and explanations will be inserted by using comments:

You will insert a comment into ASP by placing text after a single quote: <% 'This is comment %> For clarity, I am changing the colour to help distinguish between the ASP (red) and HTML (blue) coding.

Only the coding relevant to ASP will be discussed, not the HTML-formatting of the files.

The assumption is made that there is a DSN connection to the database called "SSS".

Extract from homepage:

```
<form action="sss2.asp" method="get">
   <table cellspacing=0 cellpadding="5" border=0 >
    <tr>
     <td valign="top">
       <b>Choose a topic:
         <% 'Get this information from includes. %>
      <!--#include file="topicdown.inc"--> <p>
       </td>
       <td valign="top">
       <b>Choose a method:
         <% 'Get this information from includes. %>
       <!--#include file="methoddown.inc"--><p>
     </td>
      <td valign="top">
       <b>Choose a level:
         <% 'Get this information from includes. %>
       <!--#include file="leveldown.inc"--><p>
     </td></tr><tr>
   <th colspan=3><input type="Submit" value="Submit your choice">
   </th></tr></table>
```

Web-to-databaseapplication
Example(continue)

What is the "include"?

<!--#include file="topicdown.inc"-->

This line tells the Web server to insert the lines that are written in the "include" file called methoddown.inc

The use of this include file is to make the coding less clustered and to explain ASP principles and for no other reason.

Topicdown. inc:

```
1   <%
2   'Request the name of method and the primary key from the topic table.
3   SQLtop="SELECT topic, topicID FROM topics"
4   set conntop = server.createobject("ADODB.Connection")
5   conntop.open "sss"
6   set top=conntop.execute(SQLtop)
7   %>
8
9
    <select name="topicID">
            <% 'Loop through the recordset to make each entry in the list. %>
            <% do while not top.eof %>
                    <option value = " <%= top(1) %>"> <%= top(0) %></option>
15          <%top.movenext
16          loop%>
17  </select>
18
19
20  <% conntop.close %>


23
```

Web-to-database application
Example (continued)

Lines 5 - 8	set conntop = server.createobject("ADODB.Connection") conntop.open "sss" set top=conntop.execute(SQLtop)

Remember, we have a database called "SSS" that must be connected to the Web server.

One of the five ASB objects (link) is the "server" object that is called in the code:

set conntop = server.createobject("ADODB.Connection")

This line creates a new connection object with the variable name conntop, which opens a connection to the server.

The next line, conntop.open "sss", uses the **open** method of the Connection object to establish a tie to the "SSS" database.

In the following line, set top=conntop.execute(SQLtop) , the conntop object is used to execute an SQL statement (which is stored in the variable created in line 4 called SQLtop) against the database.

|	
Note	The above connection is a systemDSN and is the one that you will use on your PWS. The only difference when you make use of your SP will be the following DSNLess (link) connection:

conntop.open **";Driver={Microsoft Access Driver (*.mdb)};" &**

"DBQ=c:\InetPub\vroot\bbasson\database\sss.mdb"

The SP must provide the path to the database.

Web-to-database application
Example (continued)

SSS database: To understand the logic behind the rest of the statements it will help to have a look at the database.
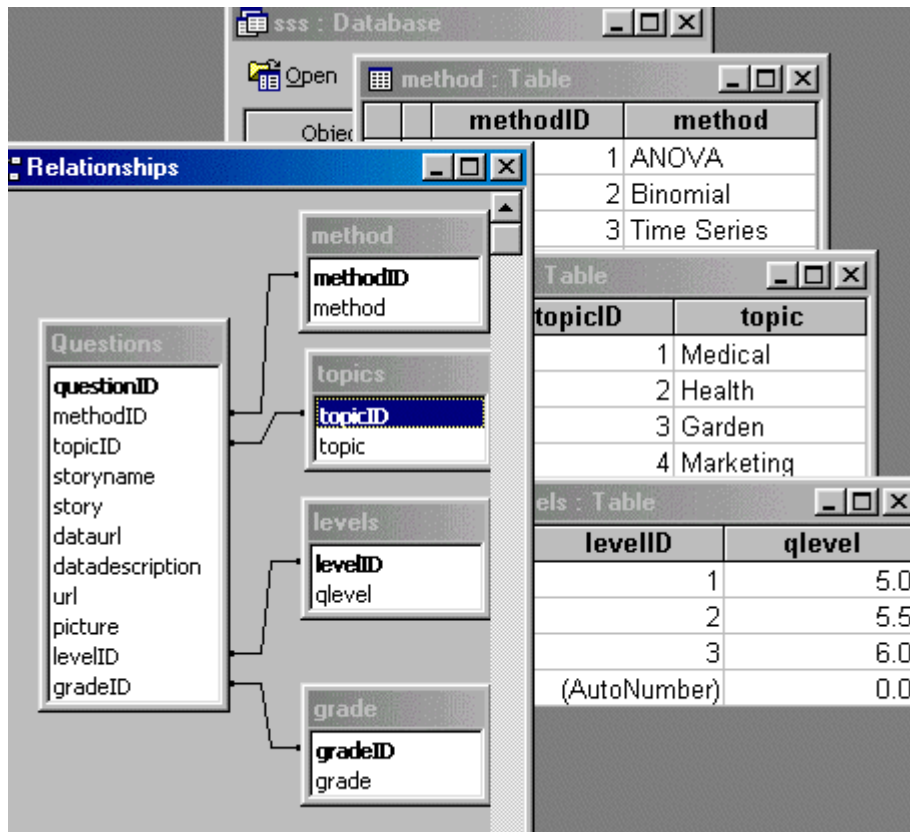
The Ralational database

A relational database stores data in one or more tables, and these tables can be joined in a variety of ways to efficiently access the information.

The different tables and their relationship can clearly be seen in the figure above.

Web-to-database application
Example (continued)

Line 4 and 16   SQLtop="SELECT topic, topicID FROM topics"

The SQL will go to the table named "topics" and select the record set in the sequence "topic" and then "topicID". In this array you refer to elements by their numerical position, starting with 0. Consequently "=top(1)" will list the value of the second record set, namely "tipicID".

<option value = " <%= top(1) %>"> <%= top(0) %> </option>
will result in the following (after the loop has been executed):

<option value = "1"> Medical</option>
<option value = "2"> Health</option>
<option value = "3"> Garden</option>

The query string   When the form is submitted the URL changes as follows:
http://localhost/sss/sss2.asp?topicID=1&methodID=1&levelID=1
Note:

> ➢ The URL of the page that loaded matches the **action** attribute of the form tag.
> ➢ The last part of the URL began with a question mark followed by the **name** attribute of the input tag. The text that follows the question mark is known as the query string.

The next step is to get the entered information from the query.string. This is done in the following ASP page called **sss2.asp**

Web-to-database application
Example (continued)

_____

```html
<html>
<head>
<title>The Data and Story Library in a South African Context
</title>
<style>
        b{font-size:10pt;color:black;font-weight:bold;font-family:Arial;}

</style>
</head>
<body background="images/back2.gif" topmargin="5" leftmargin="5" link="#c80000" vlink="#c80000">
<%@ Language = VBscript %>
<%
```

'Declare variables.
'It is not necessary but good practice to declare variables in VBScript.

```
Dim topicID
Dim methodID
Dim levelID
Dim SQLinfo
Dim conninfo
Dim info
```

'Grab variables from the querystring.

```
topicID=Request.Querystring("topicID")
methodID=Request.Querystring("methodID")
levelID=Request.Querystring("levelID")
```

'Get the information.

```
SQLINFO="SELECT picture,url,story FROM Questions "
SQLINFO=SQLINFO & "WHERE methodID= " & methodID
SQLINFO=SQLINFO & "AND topicID= " & topicID
SQLINFO=SQLINFO & "AND levelID= " & levelID

SQLMETH="SELECT method FROM method "
SQLMETH=SQLMETH & "WHERE methodID= " & methodID

SQLTOP="SELECT topic FROM topics "
SQLTOP=SQLTOP & "WHERE topicID= " & topicID

SQLLEV="SELECT qlevel FROM levels "
SQLLEV=SQLLEV & "WHERE levelID= " & levelID
```

'Connect Web server and Database

```
set conninfo = server.createobject("ADODB.Connection")
conninfo.open ";Driver={Microsoft Access Driver (*.mdb)};" & "DBQ=c:\InetPub\vroot\bbasson\database\sss.mdb"
```

'Or conninfo.open "sss" if you are working on your PWS.

'Define variables.

```
set info=conninfo.execute(SQLINFO)
set meth=conninfo.execute(SQLMETH)
set top=conninfo.execute(SQLTOP)
set lev=conninfo.execute(SQLLEV)
%>

<table>
  <tr>
   <td width="40%">
<b>
<font color="#c80000">Statistical Method:</font> <%= meth(0) %><br>
<font color="#c80000">Topic:</font> <%= top(0) %><br>
<font color="#c80000">Level:</font> <%= lev(0) %>
   </td>
   <td>
    <b><font color="#c80000">Please note that the link (the title that is underscored) will link you to a Word file. In
this file will be the question and you can edit it to fit your need.
   </td>
  </tr>
</table>
<hr color="#c80000">

<%
```

'Get a list of all the sories.

```
do while not info.eof %>
<b>

<%= info(0) %>
<%= info(1) %><br>
<%= info(2) %><p>

<%info.movenext
loop%>

<b>

<%
```
'Test to see if there are any matching records. If not, give a meassage.
```
%>

<%if info.bof and info.eof then

response.write ("No questions in this catagory yet")

End if

%>

<% info.close %>
```

Web-to-database application

Select and Update

The construction of this database of "real-life" stories needs careful consideration. One can either have someone responsible for updating the database or an automatic procedure.

In the first case the contact information will be an e-mail address of the "database manager" who will have total control over the content of the database.

In the second case there can be an on-line form and anyone can enter any information. A very simple SQL statement can insert this new record set and it will be immediately available.