# 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)

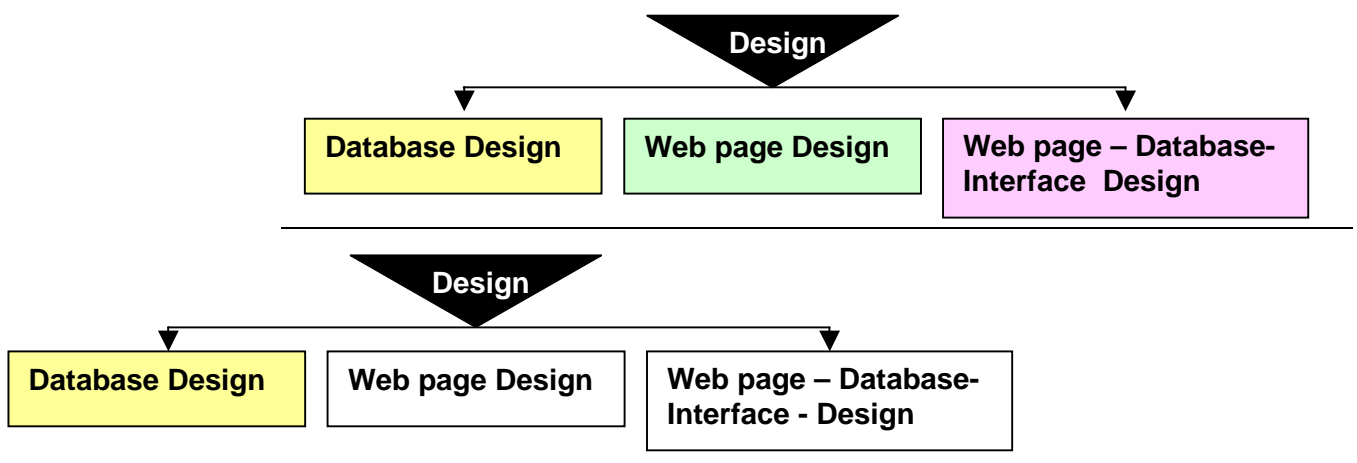| | |
|---|---|
| **Reasons for difficulty in understanding English (continued)** | Wiles (1993) states that if the linguistic concepts, which are "central to children's overall intellectual and academic development", have been developed in the **first language**, they can easily be transferred to a 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 1: Analysis (continued)

## 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.

## 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).

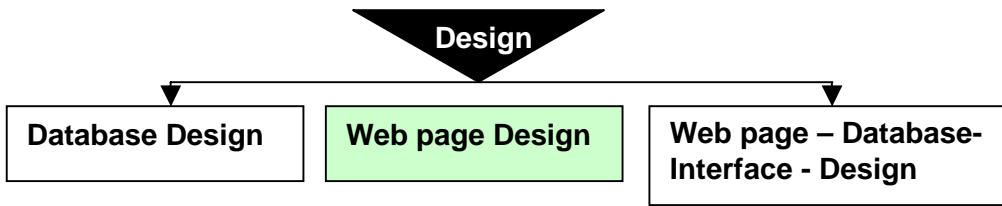Roman (1999) classified fields into three groups:

- 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)

---

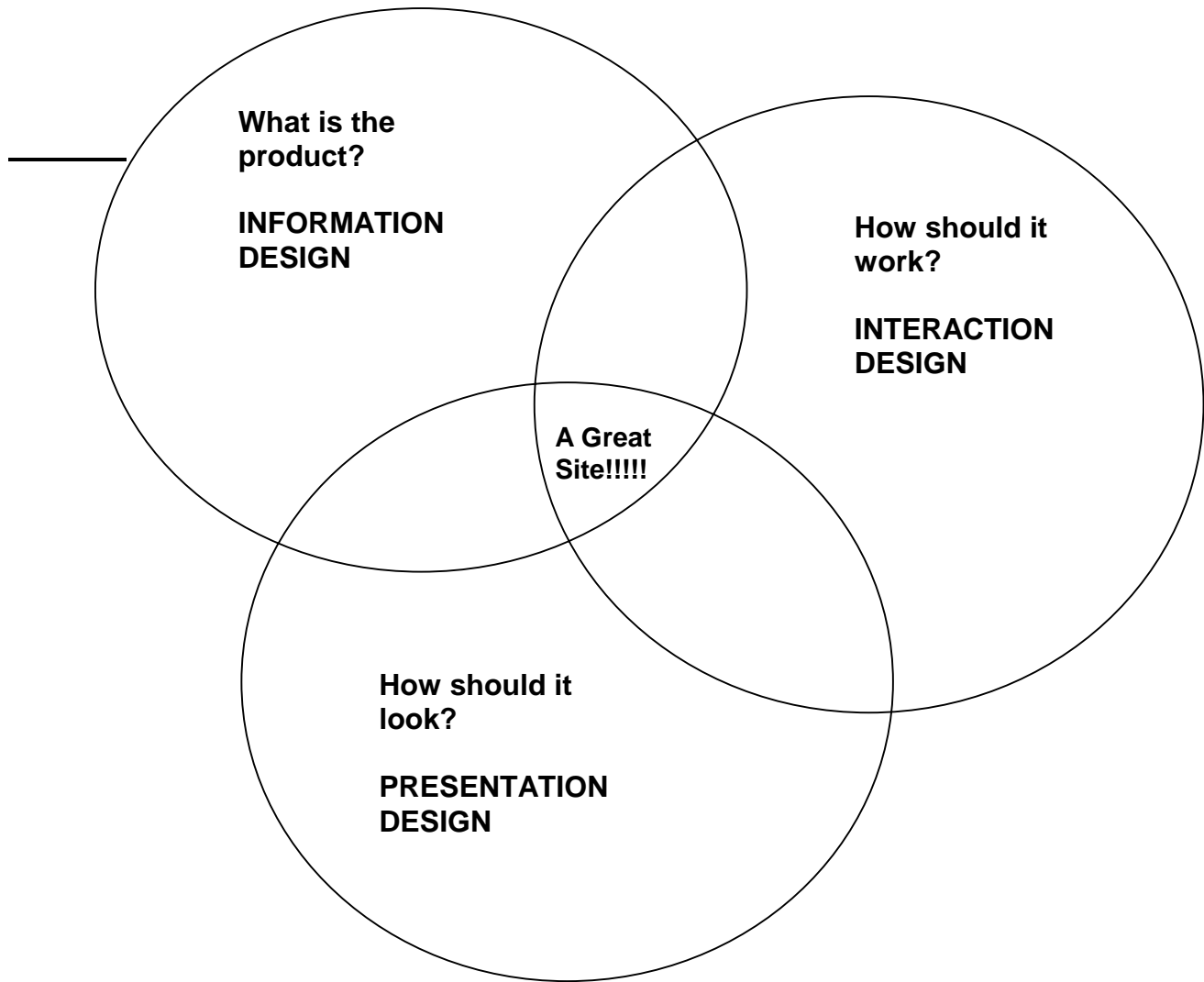The same author discusses 12 items as must-haves in Web design namely:

- 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

## 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)
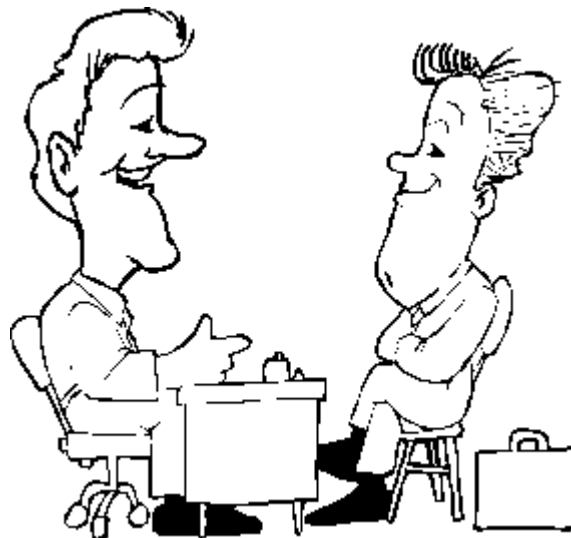
| | |
|---|---|
| **Improve distribution** | Putting information on the Web improves and expands the distribution of information to new audiences and enables multiple users simultaneous access to the most current information available. |
| **Reuse information** | Information maintained on the Web eliminates 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**

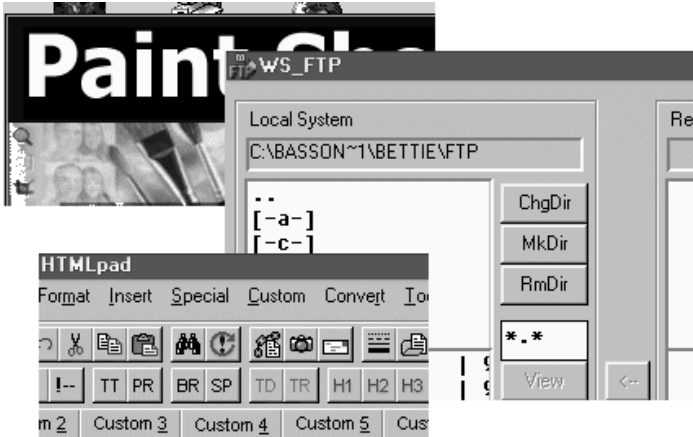The analysis involves examining your audience's

- ❑ 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?

---

## 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?
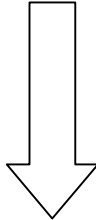
**Hardware requirements**

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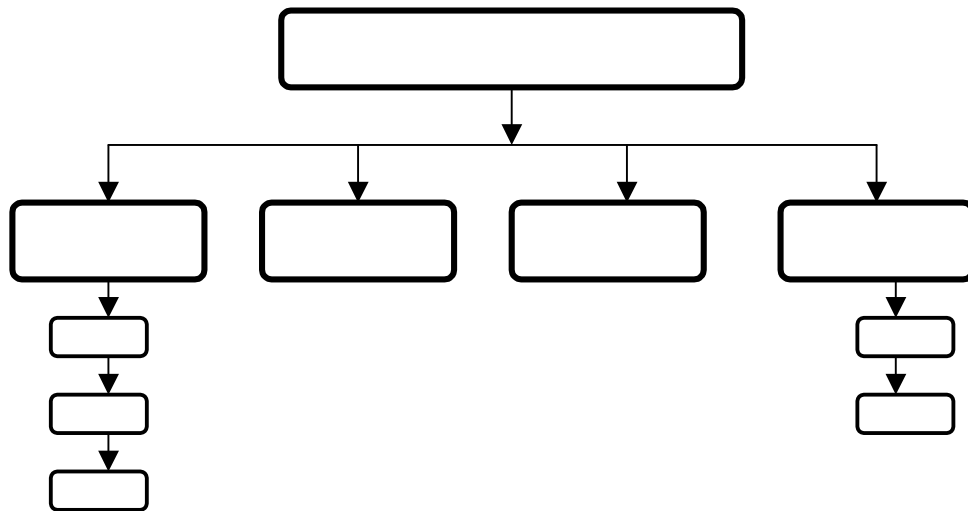  - ▪ sound/video cards, etc.

# 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.
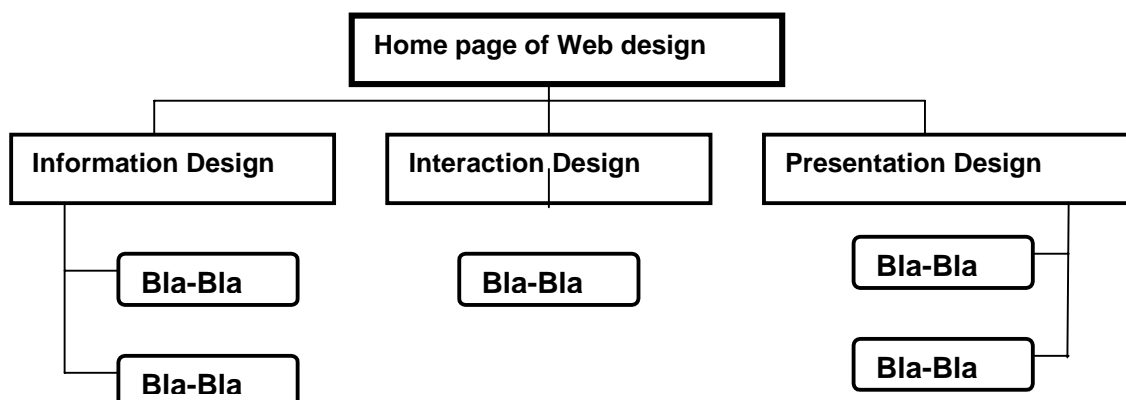
❑ Ask team members/colleagues to add to the list

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)

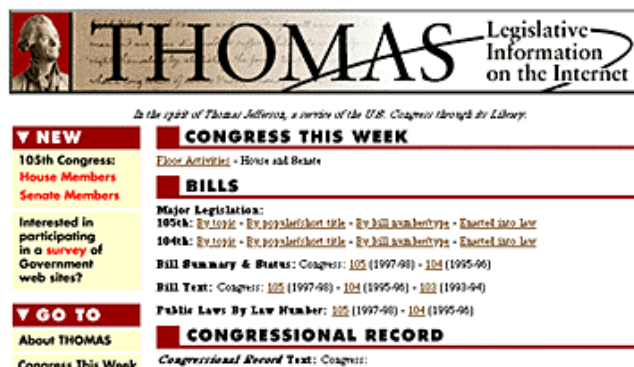### (Adapted from the online course by John Shiple)

---

**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.

---

29

## 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.
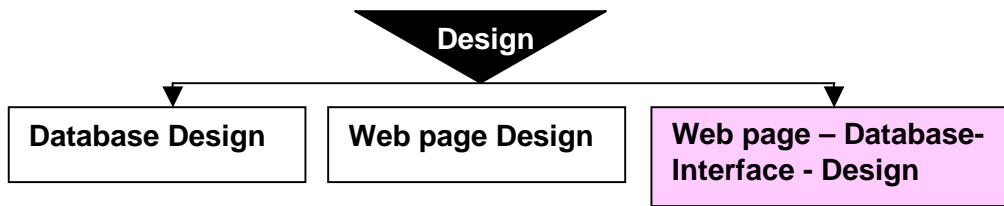
Three types of metaphors are discussed:

**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.**
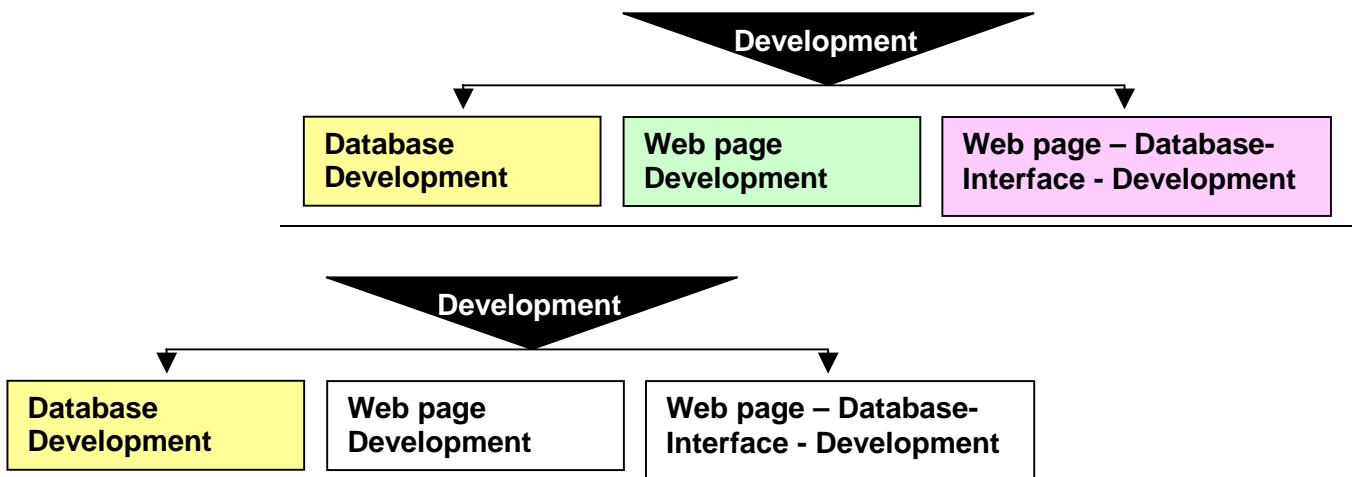
## Stage 3 :   Development for Usability

**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:



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:

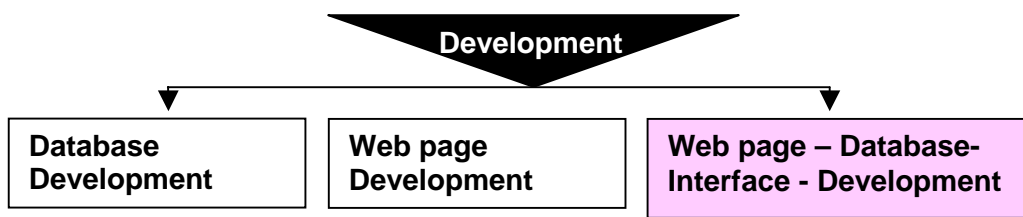| Tool | Advantages | Disadvantages |
|------|------------|---------------|
| Text Editors | <ul><li>No extra cost. Text editors, such as Notepad/Simple Text, are part of Windows/Macintosch.</li><li>Because HTML tags and attributes are manually entered, they give you total flexibility and control over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

# 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. <br> ▪ HTML effects can be added by choosing options from drop-down menus. <br> ▪ 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. <br> ▪ 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. <br> ▪ New specifications entail an update of the software. <br> ▪ 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. <br> ▪ Big variety of templates. <br> ▪ 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.
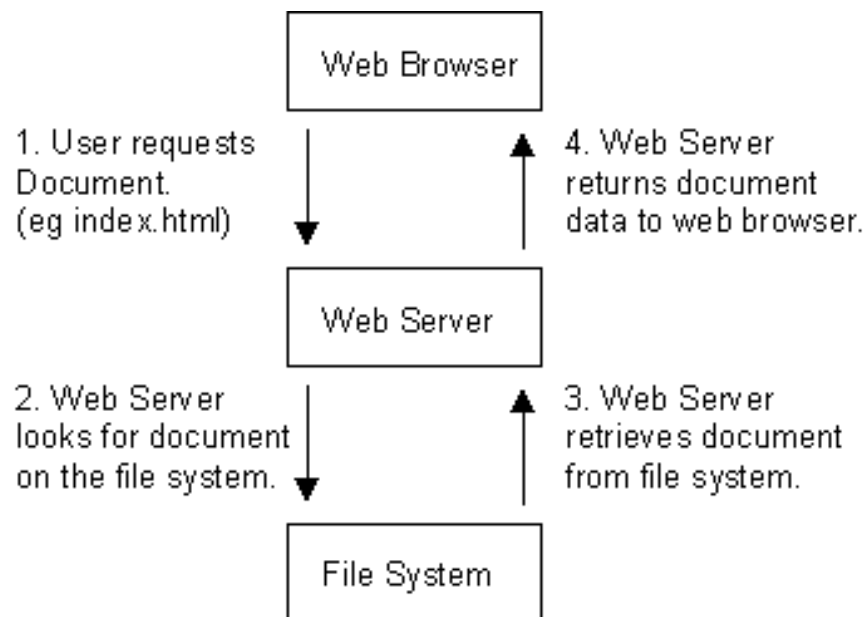
The same authors give a brief summary of operating systems. (summaries of operating systems).

**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 Web server?**   A Web server "serves static content to a Web browser at a basic 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 Web servers**   For a comprehensive list of Web-servers and the operating systems they run on, visit [http://Webcompare.internet.com/](http://Webcompare.internet.com/)

## Database - Interface – Development (continued)

**Operating systems and the required programming**

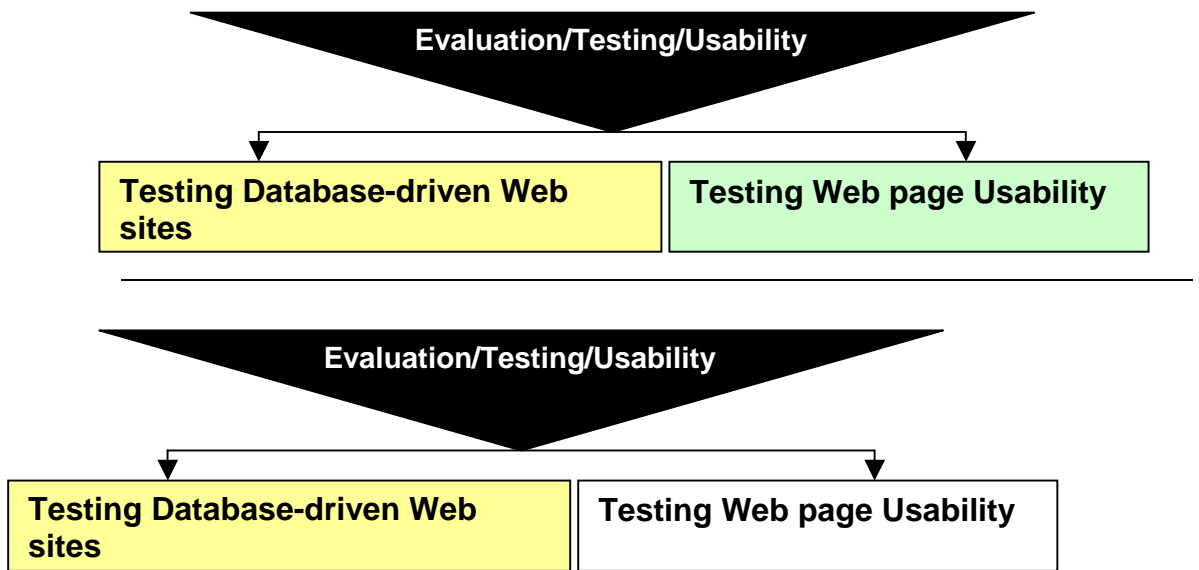| Operating System | Recommended programming |
| --- | --- |
| **Macintosh** | Filemaker Pro offers a good Web-database solution. |
| **Unix/Linux** | Greenspan recommends that one should get to know PHP when working on a Unix platform: "If you're heading for Unixland, I'd recommend that you get familiar with PHP, which is a great open-source scripting language."<br><br>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.<br><br>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.<br><br>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?

## Testing of database-driven Websites (continued)

When testing a database-driven Web site, Hower identified the following types of testing:
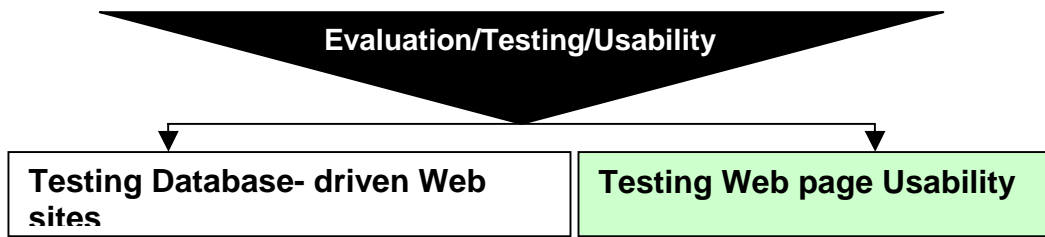
| Type of Testing* | Description* |
|---|---|
| **Validation or functional testing** | Sites utilising database-driven page generation will often require more extensive validation or functional testing than static-page Web sites. |
| **Load testing** | If there is a large number of interactions per unit 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".

## Testing Web page usability (continued)

| | |
|---|---|
| **To get started:**<br>Adapted from Fleming's "User Testing" | <ul><li>You will need a user, a computer, and a pencil and paper for note taking.</li><li>Some usability consultants use video cameras, tape recorders, one-way mirrors or other high-tech tools.</li><li>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.</li></ul> |
| **Who to invite:**<br>Adapted from Fleming's "User Testing" | <ul><li>Choose people who match the target audience. It goes without saying that they will be people who are familiar with the Web.</li><li>Eliminate bias: Choose people who don't have preconceptions about your product.</li><li>Take the time to find participants who can be brutally honest if necessary. Friends/colleagues might not give completely honest answers.</li></ul> |
| **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."<br><br>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."