15

Output Design and Prototyping

Overview

Chapter 15 is a technique chapter. It teaches students the important skill of output design and prototyping**.** Students learn the underlying system concepts that apply to output design, and then they learn how to design and prototype computer outputs. The chapter focuses most heavily on the design of screen-based outputs—the fastest growing medium for computer outputs. The chapter distinguishes between the most common types of charts used in graphic outputs.

Chapter to Course Sequencing

The sequencing of output and input design is a classic "chicken or egg" problem. We have designed Chapters 15 (output design) and 16 (input design) to be interchangeable. We elected to present output design first because that is the classical approach as follows:

1. Database design (Chapter 14) precedes output design to ensure that the source data will be available to produce desired outputs.
2. Output design (Chapter 15) validates the database design. In other words, output design seeks to ensure that all the data needed for the outputs is available in the database.
3. Input design (this chapter) validates both the output and database design. In other words, input design seeks to ensure that all the data needed to produce the outputs has been input to the database.
4. User interface design (Chapter 17) ties the inputs and outputs together (regardless of the order in which you designed those outputs and inputs).

It should be noted that, in practice, most systems analysts integrate the design of outputs and inputs.

Regardless of how you sequence Chapters 15 and 16, students should first read Chapter 10 to provide perspective for where output design fits into total systems design. It is also recommended that this chapter follow Chapters 13 and 14. Chapter 13 determines the application framework or general system design that serves as an outline for detailed design, inclusive of outputs. Chapter 14 covers database design. Input design and prototyping loads the database. If you are taking an object-oriented approach, you could cover Chapter 18 either before or after Chapters 15-17.

What's Different Here and Why?

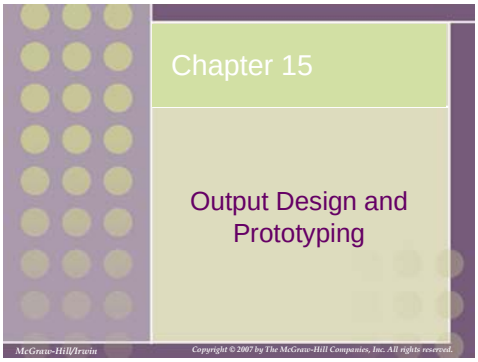
This chapter did not necessitate many changes from the sixth edition.

1. As with all chapters, we have streamlined the SoundStage episode into a quick narrative introduction to the concepts presented the chapter.
2. We updated all technology references throughout the chapter.

Lesson Planning Notes for Slides

The following instructor notes, keyed to slide images from the PowerPoint repository, are intended to help instructors integrate the slides into their individual lesson plans for this chapter.

Slide 1

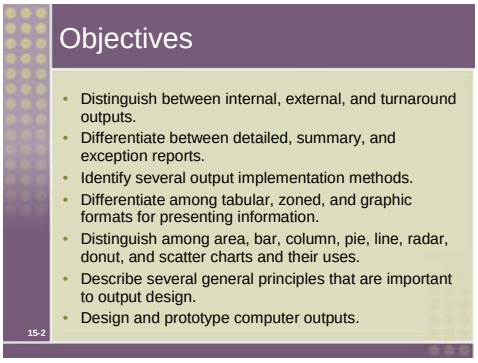


slide appearance after initial mouse click in slide show mode

This repository of slides is intended to support the named chapter. The slide repository should be used as follows:
Copy the file to a unique name for your course and unit.
Edit the file by deleting those slides you don't want to cover, editing other slides as appropriate to your course, and adding slides as desired.
Print the slides to produce transparency masters or print directly to film or present the slides using a computer image projector.

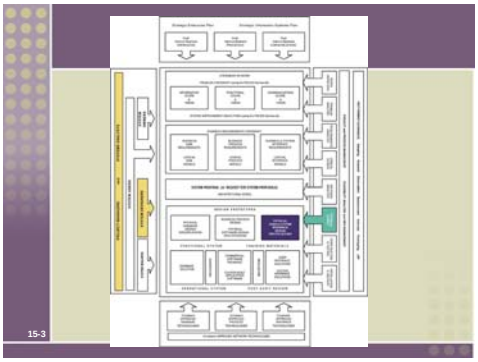
Each slide includes instructor notes. To view those notes in PowerPoint, click-left on the View Menu; then click left on Notes View sub-menu. You may need to scroll down to see the instructor notes.
The instructor notes are also available in hard-copy as the Instructor Guide to Accompany Systems Analysis and Design Methods, 6/ed.

Slide 2



No additional notes.

Slide 3



Teaching Notes
This slide shows the how this chapter's content fits with the building blocks framework used throughout the textbook. The emphasis of this chapter is with the physical design phase, focusing on COMMUNICATION. It involves system designers and systems analysts.

Slide 4

Taxonomy for Computer-Generated Outputs

Distribution / Delivery	Internal Output (reporting)	Turnaround Output (external; then internal)	External Output (transactions)
Printer	Detailed, summary, or exception information printed on hard-copy reports for internal business use.	Business transactions printed on business forms that will eventually be returned as input business transactions.	Business transactions printed on business forms that conclude the business transactions.
Screen	Detailed, summary, or exception information displayed on monitors for internal business use.	Business transactions displayed on monitors in forms or windows that will also be used to input other data to initiate a related transaction.	Business transactions displayed on business forms that conclude the business transactions.
Point-of-Sale Terminals	Information printed or displayed on special-purpose terminals dedicated to specific internal business functions.	Information printed or displayed on a special-purpose terminal for the purpose of initiating a follow-up business transaction.	Information printed or displayed on special-purpose terminals dedicated to customers.

Teaching Notes
This slide (and the next) is positioned after the definitions in the belief that students often learn better in lecture situations by first learning details and then seeing how those details fit together. If you prefer to teach structure first and then fill in the details, then move these two slides to just after the Chapter Map.
If this slide is difficult to read, refer students to Figure 15-1 in the text.
Note that these categories are not necessarily mutually exclusive.

Slide 5

Taxonomy for Computer-Generated Outputs (concluded)

Distribution / Delivery	Internal Output (reporting)	Turnaround Output (external; then internal)	External Output (transactions)
Multimedia (audio or video)	Information transformed into speech for internal users.	Information transformed into speech for external users who respond with speech or tone input data.	Information transformed into speech for external users.
E-mail	Displayed messages related to internal business information.	Displayed messages intended to initiate business transactions.	Displayed messages related to business transactions.
Hyperlinks	Web-based links to internal information that is enabled via HTML or XML formats.	Web-based links incorporated into Web-based input pages to provide users with access to additional information.	Web-based links incorporated into Web-based transactions.
Microfiche	Archival of internal management reports to microfilm that requires minimal physical storage space.	Not applicable unless there is an internal need to archive turnaround documents.	Not applicable unless there is an internal need for copies of external reports.

Teaching Notes
This slide (and the previous one) is positioned after the definitions in the belief that students often learn better in lecture situations by first learning details and then seeing how those details fit together. If you prefer to teach structure first and then fill in the details, then move these two slides to just after the Chapter Map.
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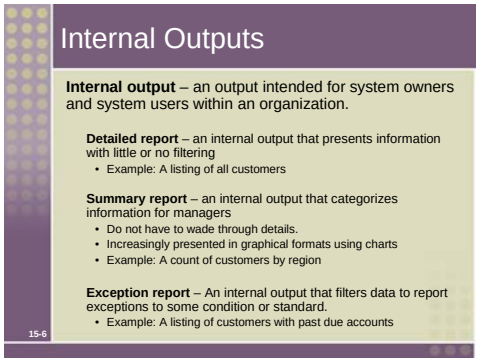
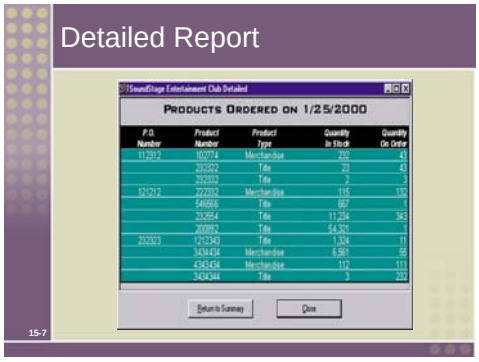
Slide 6



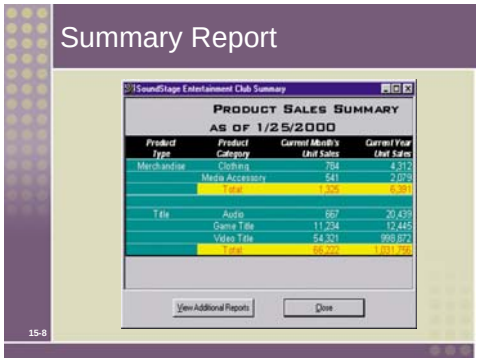
No additional notes.

Slide 7



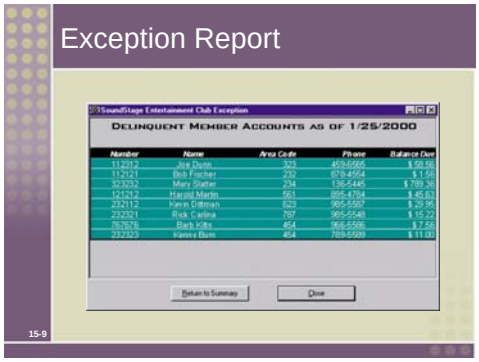
No additional notes

Slide 8



No additional notes

Slide 9



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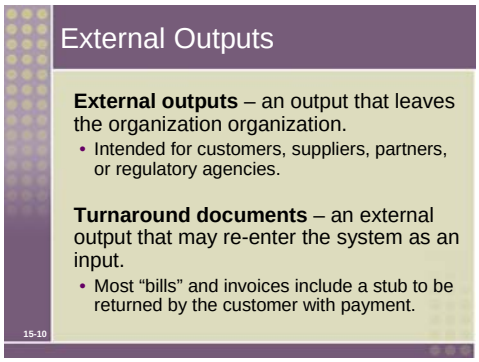
Slide 10



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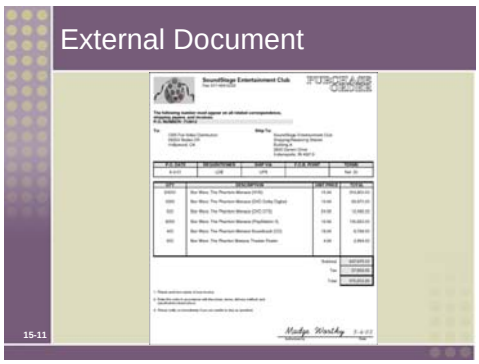
Slide 11



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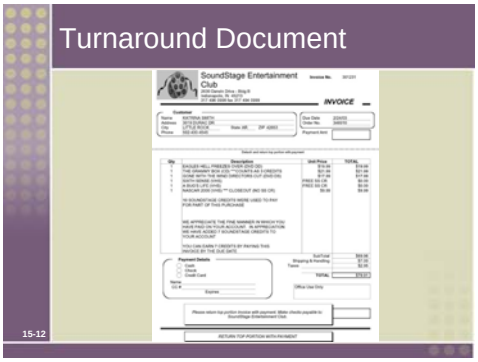
Slide 12



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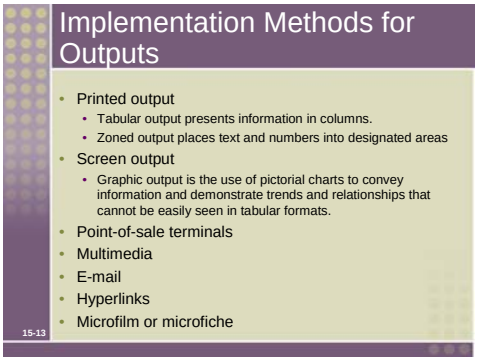
Slide 13



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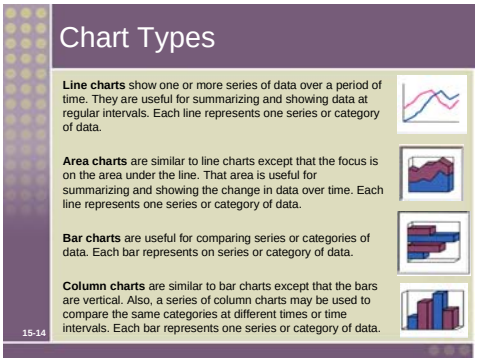
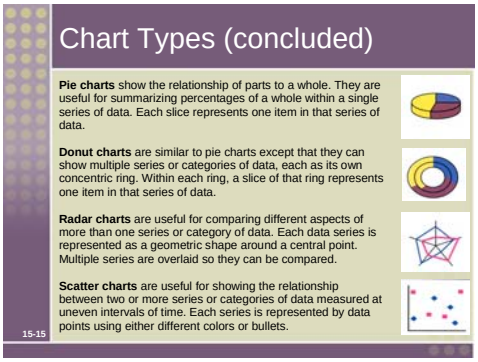
Slide 14



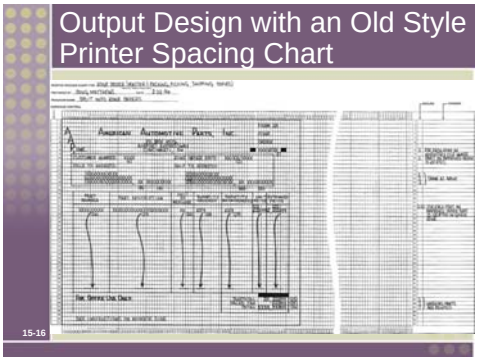
Teaching Notes
This is material from Figure 15-5. It has been pulled out of the figure so that the text can be larger and more readable.

Slide 15



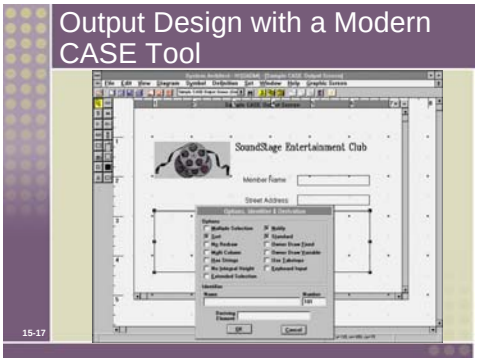
Teaching Notes
This is material from Figure 15-5. It has been pulled out of the figure so that the text can be larger and more readable.

Slide 16



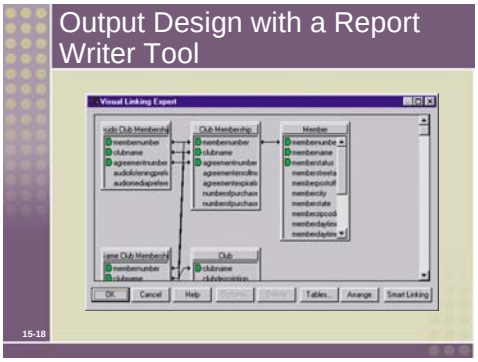
Teaching Notes
When all printouts were done on dot matrix and line printers with mono-spaced fonts (meaning that every character took the same horizontal amount of space), these charts were very useful in laying out charts.
Students can see that these charts can be considered "models" or even prototypes of reports. Today GUIs have changed the focus from character spacing to pixels, making these charts irrelevant.

Slide 17



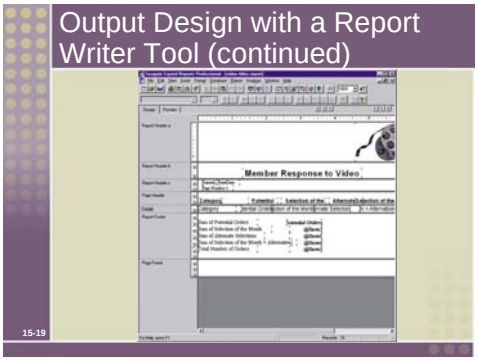
Teaching Notes
As shown here with System Architect, many CASE tools include facilities for report and screen layout
Another approach used today is to develop working prototypes with PC-database applications. Tools such as Visio or even spreadsheets can be used to quickly develop non-working output prototypes.

Slide 18



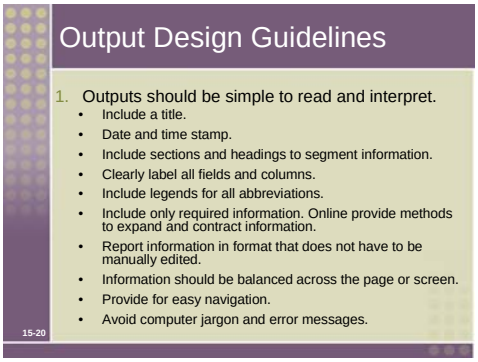
Teaching Notes
A final way to design output with a GUI report writer tool, such as Seagate Crystal Reports (shown here). Tools such as this create the actual "code" to be integrated in the operational information system.

Slide 19



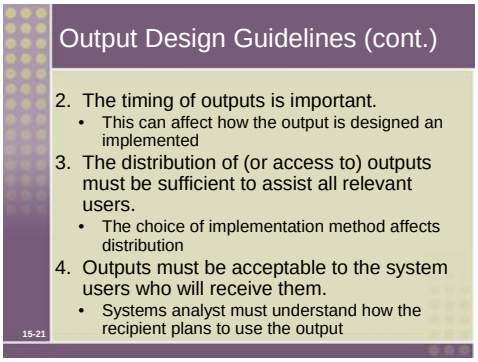
No additional notes:

Slide 20



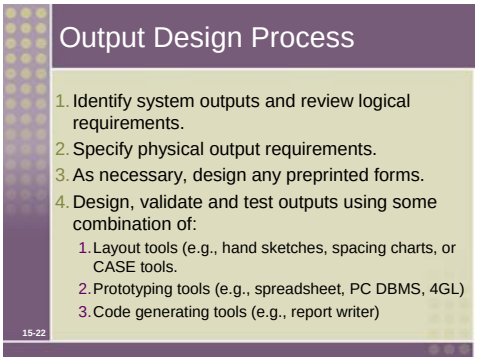
Teaching Notes
If the designer does not understand the purpose of the report or the information in it well enough to do all of these things, then he or she is not yet ready to design the report!
Design guidelines are continued on the next slide.

Slide 21



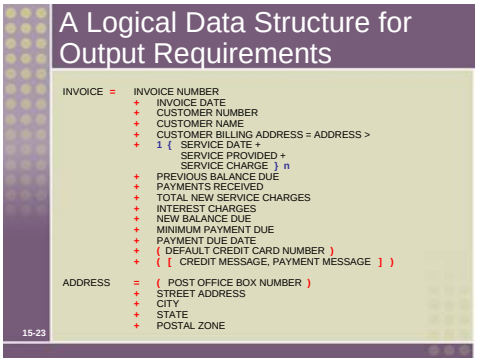
No additional notes:

Slide 22



Teaching Notes
The next slide shows a logical data structure for output requirements (related to step 1).
Following slides present other output design principles.

Slide 23



Teaching Notes
It may be useful to walk through this technique for specifying “logical” output requirements.
The red and blue symbols are relational operators, that is, they specify the relationship between attributes to be included on the output in terms of

Sequence	+
Selection	[data attributes]
Iteration	min { data attributes } max
Optionality	(data attributes)

Many CASE tools support this logical notation

Slide 24

Tabular Report Design Principles

Design Issue	Design Guideline	Examples
Page Size	Today the page sizes of choice are standard (8½" x 11") and legal (8½" x 14").	Not applicable
Page Orientation	Portrait orientation is often preferred because it is oriented the way we orient most books and reports; however, landscape is often necessitated for tabular reports because more columns can be printed.	portrait landscape
Page Headings	At a minimum, page headers should include a recognizable report title, date and time, and page numbers.	JAN 4, 2004 Page 4 of 8 Oversubscriptions By Course
Report Legends	A legend is an explanation of abbreviations, colors, or codes used in a report. In a printed report, a legend can be printed on only the first or last page. On a display screen, a legend can be made available as a pop-up dialogue box.	REPORT LEGEND SEATS – Number of seats in classroom LIM – Course Enrollment Limit

Teaching Notes
Refer to Figure 15-9 in the text for a more readable version.

Slide 25

Tabular Report Design Principles (cont.)

Design Issue	Design Guideline	Examples
Column Headings	Column headings should be short and descriptive. Avoid abbreviations or include a Report Legend	Self-explanatory
Heading Alignments	Alignment should be tested with users for preferences with a special emphasis on the risk of misinterpretation of the information.	NAME STATUS AMOUNT XXXXXXX XXX X $X.XX
Column Spacing	If columns are too close, users may not properly differentiate between the columns. If they are too far apart, the user may have difficulty following a single row. Rule of thumb is to use 3-5 spaces between each.	Self explanatory
Row Headings	The first one or two columns should identify data that differentiates each row. Rows should be sequenced in a fashion that supports their use. Frequently rows are sorted on a numerical key or alphabetically.	STUDENT ID STUDENT NAME 999-38-8476 Mary Ellen Kukow 999-39-5857 Robert Flynn

No additional notes.

Slide 26

Tabular Report Design Principles (concluded)

Design Issue	Design Guideline	Examples
Formatting	Data is often stored without formatting characters to save storage space. Outputs should reformat data to match the users' norms.	As stored: As output: 307877262 307-87-7262 8004445454 (800) 444-5454 02272004 Feb 27, 2004
Control Breaks	Groups of rows should be logically grouped in the report. The transition from one group to the next is called a control break and is frequently followed by subtotals for the group.	RANK NAME SALARY CPT JANEWAY, K 175,000 CPT KIRK, J 225,000 CPT PICARD, J 200,000 CPT SISKO, B 165,000 CAPTAINS TOTAL 765,000 LTC CHAKOTAY 110,000 OTC DATA 125,000 LTC RICKER, W 140,000 LTC SPOCK, S 155,000 EXEC OFFCR TOTAL 530,000
End of Report	The end of a report should be clearly indicated to ensure that users have the entire report.	*** END OF REPORT ***

No additional notes.

Slide 27

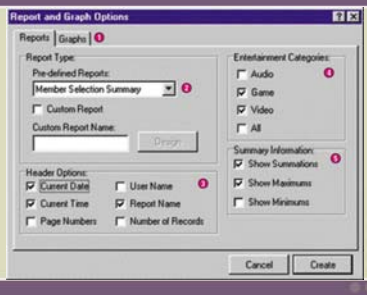
Screen Output Design Principles

Screen Design Consideration	Design Guidelines
Size	The designer should consider the "lowest common denominator." The default window size should be less than or equal to the worst resolution display in the user community.
Scrolling	On-line outputs have the advantage of not being limited by the physical page. This can also be a disadvantage if important information such as column headings scrolls off the screen. If possible, freeze important headings at the top of a screen.
Navigation	Users should always have a sense of where they are in a network of on-line screens. Users also require the ability to navigate between screens.
Partitioning	In Windows, zones are forms within forms. On the Internet, frames are pages within pages.
Information Hiding	On-line applications offer capabilities to hide information until it is either needed or becomes important. Techniques include drill-down and pop-up dialogue boxes.
Highlighting	Highlighting can call users' attention to erroneous data, exception data, or specific problems. Highlighting can also be a distraction if misused.
Printing	Always provide users the option to print a permanent copy of the report.

Teaching Notes
Refer to Figure 15-10 in the text for a more readable version.

Slide 28

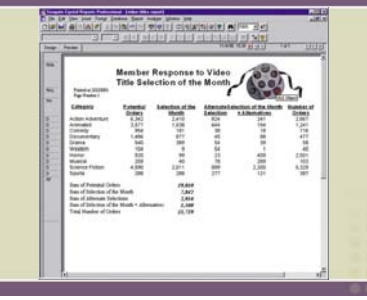
Report Customization



Teaching Notes
Adding a user dialogue to a report is a powerful way to give users the ability to customize a report for various kinds of detail, exceptions, and summarization (see Slide 4).
These screens must be prototyped and approved by users as well as the reports.
Ask students what types of things would be asked of users as they review this output customization dialogue prototype.

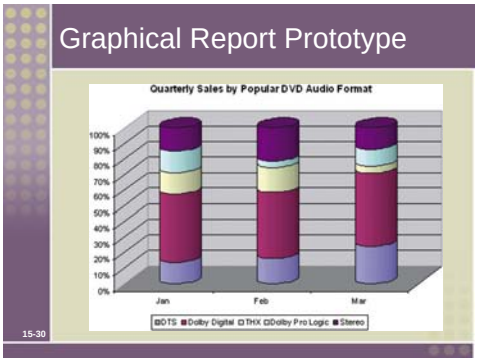
Slide 29

Tabular Report Prototype



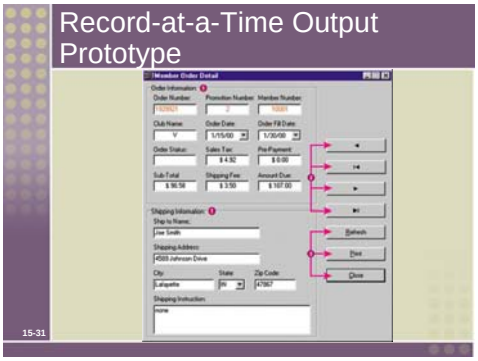
Teaching Notes
Ask students what types of things would be asked of users as they review this output prototype.

Slide 30



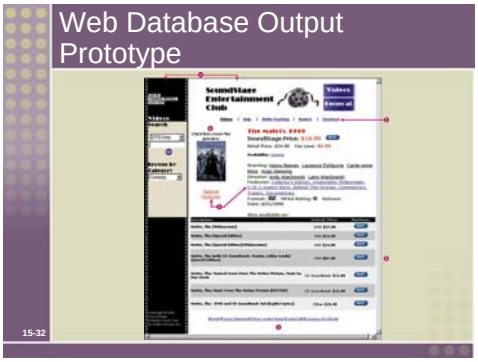
No additional notes.

Slide 31



Teaching Notes
This kind of output is useful for on-screen browsing and can eliminate a lot of printing costs

Slide 32



Teaching Notes
Ask students how they would verify this prototype. Who would they ask? What would they ask them?
How are web outputs different than other outputs?

Slide 33

No additional notes

Answers to End of Chapter Questions and Exercises

Review Questions

1. Prototypes are not fully functional; rather, they are simple mock-ups of the information systems. These prototypes contain dummy data from databases such as Microsoft Access. In additional to that, they do not have any security features or optimized data access, which is always required in the final version of the information systems.

2. Outputs can be classified based on two characteristics:

   a. The outputs' distribution and audience, which is about how the outputs are distributed—inside or outside of the organization and the people who read and use them
   b. Implementation methods

3. The summary report is used to aggregate data and to filter out information that may not be of interest of managers. It is often used to indicate trends or potential problems based on the data.

   The exception report also filters out information before the report reaches the manager. However, the exception report only includes exceptions to some condition or standard. For example, it may be used to identify customers who have overdue payments, which can be understood as a condition.

4. Invoices, account statements, paychecks, course schedules, airline tickets, boarding pass, travel itineraries, telephone bills, purchase orders, and mailing labels.

   All of the reports will leave the organization.

5. Tabular output is the most common format for printed output. It is an output that presents information as columns of text and numbers.

   Zoned output is an output that places text and numbers into designated areas of boxes of a form.

6. It is because screen outputs only provide information temporarily. If a user leaves the screen, the information cannot be retrieved again easily. This is also why many e-commerce websites will ask the user to print out the order confirmation shown on the screen. Perhaps most important, many users are more comfortable with printed reports than they are with screen reports.

7. • Line chart
   • Area chart
   • Bar chart
   • Column chart
   • Pie chart
   • Donut chart
   • Radar chart
   • Scatter chart

8. Graphic output can present data relationships, associations, and trends in a manner that tabular reports can not

9. • Computer outputs should be clear, easy to read and to interpret
   • Output should be timely.
   • Distribution of reports must reach the system users who need and use the information. Computer outputs must meet the expectations and needs of their audience.

   The guidelines' main focus is on the system users who will ultimately be using the reports. Thus, it is very important for the system analysts to find out what exactly the users need and/or want in the reports.

10. • Identify system outputs and review logical requirements
    • Specify physical output requirements
    • Design preprinted external forms as necessary
    • Design, validate, and test outputs

11. Type and purpose of the output: this is an important criterion because reports are used to convey information for the users. Therefore, analysts must know what the reports are for and what kind of format the users want. If analysts fail to understand the type and the purpose of the reports, the reports will contain only useless data. Operational, technical, and economic feasibility: feasibility is always important because analysts must ensure that the users' requirements can be met within an organization's technical and economic ability. .

12. • Implementation method: what method is best for a particular type of output
    • Frequency of the output being generated
    • Pages of output generated for a single copy of a printed output
    • Number of copies for each output
    • Distribution control of the output

13. Preprinted forms are helpful if there are external or turnaround documents because some or most of the information they contain is constant and less likely to change. What are some of the design issues for screen output design?

    Size
    Scrolling
    Navigation
    Partitioning
    Information hiding
    Highlighting
    Printing

14. Frames are pages within pages; therefore, users can scroll independently within pages. Frames can also be used for a legend, table of contents, or summary information.

Problems and Exercises

1. One hundred years ago, the only delivery method (other than a verbal presentation) was to print the report, and the only medium was paper. Fifty years ago, there were still only two options: paper and microfilm. Today there are at least seven delivery methods: printed, microfilm, screen, POS, multimedia, e-mail, and hyperlinks. Arguably, the biggest change in reports has been the speed in which the report can be generated and disseminated.

2. One approach would be to show a summary report of the number of cases by age for each child protection worker in tabular format. A simplified logical data structure for this report might be as follows:

```
REPORT = REPORT TITLE
         + REPORT DATE
         + 1 (CPS WORKER LNAME + CPS WORKER FI +
              CPS WORKER CASES OPEN 1-30 DAYS +
              CPS WORKER CASES OPEN 31-60 DAYS +
              CPS WORKER CASES OPEN OVER 60 DAYS +
              CPS WORKER TOTAL OPEN CASES) N
         +  TOTAL CASES OPEN 1-30 DAYS
         + TOTAL CASES OPEN 31-60 DAYS
         + TOTAL CASES OPEN OVER 60 DAYS +
         + GRAND TOTAL OPEN CASES
```

3. Shown below is an example of a basic version of the report:

Run Date: 05/01/2005 Page 1 of 1

Department of Social Services
Child Protection Agency
Summary Report of Caseload by Age and CPS Worker
April 2005

CPS Worker	Cases Open 1 – 30 Days	Cases Open 31 – 60 Days	Cases Open Over 60 Days	Total Open Cases
Anderson, J	12	6	0	18
Jenkins, T	14	8	1	23
La Rosa, S	17	1	1	19
Hannigan, A	21	10	8	39
Shelby, S	14	3	0	17
Tsai, B	29	1	0	30
…	…	…	…	…
…	…	…	…	…
…	…	…	…	…
Miller, G	11	2	1	14
Total	118	31	11	160

4. Based upon the examples shown in the book, line and area charts would be inappropriate because they show changes in data over a period of time, whereas this report is a “snapshot” of caseload as of a specific date. A radar chart would also be inappropriate because it compares different elements of multiple categories or series of data.

   Appropriate chart types include bar, column, pie, and donut charts. The bar and column charts can be used to compare series or categories of data. The pie and donut chart depict the parts in a single series or category of data, and the relationship of these parts to their whole.

The most appropriate or best one to use would depend upon what the customer want to see in this report. For example, if the director wants to compare CPS worker caseloads, the most appropriate chart to use would be a bar or column chart. If the director wants to look at open cases over 60 days compared to total caseload for an individual CPS worker, then a pie or donut chart would be the most appropriate one to use.

5. This is a summary report. Depending on what the sales manager needs to know, each row could show total sales for the previous week and year to date by vehicle category (new, used, commercial etc.), salesperson, make and model of vehicle, etc. But you need to ask the sales manager specifically what is needed, preferably before designing the report!

6. The sales manager needs an exception report. Data elements would include sales period, salesperson name, sales category (used cars, new cars, commercial vehicles, etc.), and number of vehicles sold for previous week and for year to date. You could group the report in several ways, e.g., depending upon customer preference by sales category, by number of vehicles sold starting with the least (since this is an exception report), or by sales category and then subgroup to number of vehicles sold.

7. A10, B11, C12, D9, E6, F1, G8, H2, I7, J4, K5, L, M3,

8. Bar charts are a highly effective graphic tool for comparing a data series over a period of time, such as annual sales by quarter. Pie charts are not! Pie charts are not intended to show discrete data, but the relationship of the parts to the whole for a single series of data.

9. A detail report showing open cases by CPS worker needs to be designed. Data elements should include CPS worker name, the identifying name and/or case number for each open case, the age of each case or date opened, a line for the CPS worker to enter the case status, and a line to enter the estimated date of completion. Since the intent of this report is to help CPS workers manage and prioritize their caseloads, case should be listed in order by age (oldest first) rather than in alphabetical order. A simple prototype design might look like the following:

Report Date: 05/01/2005 Page 1 of 1

DEPARTMENT OF SOCIAL SERVICES
CHILD PROTECTION AGENCY
DETAIL REPORT OF OPEN CASES BY CPS WORKER
IN CASE AGE ORDER
APRIL 2005

CPS Worker: Hannigan, A

Date Opened	Case Number	Status of Case	Estimated Date of Completion
01/03/2005	A54321		
01/12/2005	F01512		
...			
...			
...			
04/29/2005	B35723		

Please return the completed copy of this report to the director no later than _____

10. 1. The purpose of outputs is to present information to system users. Because they are the most visible part of an information system, system users and owners often base the value of an information system on the outputs.
    2. In designing outputs, a good place to begin is with the physical data flow diagrams, because they identify both the net outputs and the implementation method.
    3. Outputs can be categorized by two characteristics: 1) by their distribution and audience and 2) by their implementation method.
    4. In a report, subtotals often occur at control breaks, which are used to transition from one group of data to the next one.
    5. In a tabular report, readability is influenced by column spacing, which generally should be 3-5 spaces.

11. Based upon the brief information you have been given, you already know the type of report output is to be shown in a summary report for internal use, as well as the report frequency and the information to be included in the report. The remaining design issues need to address the implementation methods, specifically:
    1) What implementation method should you use for this report? Since this

report is for an executive, you should consider designing both screen and printed output, so the report can be viewed regardless of whether the Vice President has access to the company network.

2) For screen output, what are the limitations of the users' screen displays? Since this report is being created for the executive level, screen output can be designed based upon higher-end displays.
3) For printed output, what size should the report be? In general, most executives today prefer the 8 ½ by 11 size report. What about page orientation? Portrait is generally preferred by executives, but landscape is better suited to tabular reports.

12. If CASE tools or other dedicated report writing tools are not available, Microsoft Access makes an excellent, widely used and commonly available tool for prototyping.

    Critical design principles include:
    - Design the output to be simple to read and to understand; avoid jargon, cryptic prompts, and labels that are not clear.
    - Include only required information in the report.
    - Navigation to, from and within the report should be intuitive.
    - Report availability should match the frequency of the report (i.e., a daily report for executives should be ready first thing every morning.)
    - Perhaps most important, know how the executives plan to use the report in order to make sure it meets their needs.

13. As with all elements of systems design, screen design for websites should focus on the needs of the target users. In addition to general design principles, screen design considerations should include the following:
    - Avoid colors that are low-contrast and which make text difficult to read.
    - Special attention should be paid to designing navigation buttons and tools that are easy to read and to understand.
    - Pages should have ample white space and not be cluttered.
    - Font styles and sizes should be chosen for their readability.
    - On-line help messages should be clear and not cryptic.
    - Avoid any gimmickry, such as blinking or reverse video.
    - Screen resolution should be based upon the "lowest common denominator" principle, and should not be designed for high-resolution monitors.
    - Minimize the amount of scrolling needed, which may be difficult for many senior citizens with arthritis or limited hand mobility.
    - Shading separating ach detail line should be used to improve readability.
    - Avoid multimedia players which may require an extension or plug-in to be downloaded.

Projects and Research

1. The student should find numerous articles on this subject, and not have any problems finding different viewpoints, which should be reflected in their responses. Perhaps the most common viewpoint among industry writers and experts is that while the paperless office is not likely to occur in the near future, company intranets and other technological advancements make the "less-paper" office a viable option.

2. The purpose of this question is to have the student appreciate the human interface engineering issues involved in designing a form or interface. Responses regarding what is "good," as well as the student's redesign of a "bad" form, should be consistent with the guidelines discussed in this chapter. The last two questions are open-ended, but the response should indicate a thoughtful consideration of these issues.

3. Other than paper and microfilm, the timeline should show that all other output methods were not developed and/or not commercially available more than 10 – 25 years ago. Student responses should recognize that turnaround documents have probably existed in some form or another since the invention of paper or papyrus, and that microfilm, which become commercially available in the first half of the 20th century, had a major impact upon the storage of archival records. Responses should also be able to describe the enormous changes in organizational business processes and cultures wrought by the PC, of which the ability to view reports and information on screen was a significant part. Further, responses should link PC monitors as a necessary predecessor to e-mail. As for the output method that has had the most significant impact, responses should indicate that it is paper of course.

4. These questions are very open-ended as to responses. Their purpose is to get the student thinking dynamically about what the future may hold in terms of technological changes, the impact it may have upon what they do and how they do it, and how or if they should try to prepare for these changes.

5. The purpose of these questions is to help students understand the unique capabilities – both from a theoretical and practical standpoint – of intranets in terms of their screen interfaces, and how their unique differences from internet website interfaces may impact design guidelines and decisions. As such, responses are open-ended, but should indicate that the student understands the unique and essential characteristics of intranets.

6. Like several of the preceding questions, the purpose of these questions is to help the student understand and appreciate the tremendous impact that technological changes have had upon the flow of information. Responses can be open-ended, but should indicate that the student understands the gravity of the changes at organizational and individual levels.

Minicases

1. Please refer to page 584 for a discussion on each type of report.

2. I suggest they either use Formmail.cgi or PHP code. The coding for this is minimal, but does require server-side scripting.

   e.g. with Formmail:

```
<form method=POST action="/cgi-bin/formmail/formmail.cgi" target="_top">
<INPUT TYPE="HIDDEN" NAME="recipient" VALUE="yourname @wherever ">
<INPUT TYPE="HIDDEN" NAME="subject"  VALUE="WebSite Contact">
<INPUT TYPE="HIDDEN" NAME="redirect" VALUE=" thanks.htm">
 <INPUT TYPE="HIDDEN" NAME="required" VALUE="email,your_name">
<input type=hidden name="sort" value="title, interest, your_name, com-
pany_name, street_address, city_name, state_name, zipcode, phone, com-
pany_name, email, comments">

<input type="submit" value="Submit Info" onmouse-
over="this.className='buttonon'" onmouseout="this.className='button'"
class="button"> <input type=reset value="Clear Form" onmouse-
over="this.className='buttonon'" onmouseout="this.className='button'"
class="button"><br>

</FORM>
```

3. Data should be entered one time only. Otherwise, there is more of an opportunity for errors and there will be a much higher (unnecessarily so) labor cost associated with the data. Examples of data problems are formatting data types such as: Date. Should it be 1/2/05, January 2, 2005, or something else?

4. There is no set answer to this. Students should be graded in most part on their ability to understand the positive aspects of one design, and use that to improve a poor design.

Team and Individual Exercises

There are no answers to this section.