

Decision Support Systems in Organizations

Radhika Santhanam

Price Chair


MIS Division Director

Price College of Business

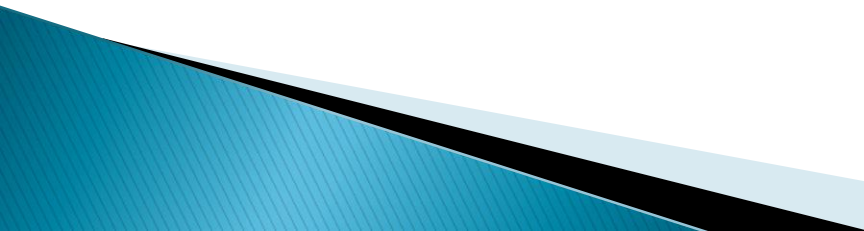
University of Oklahoma



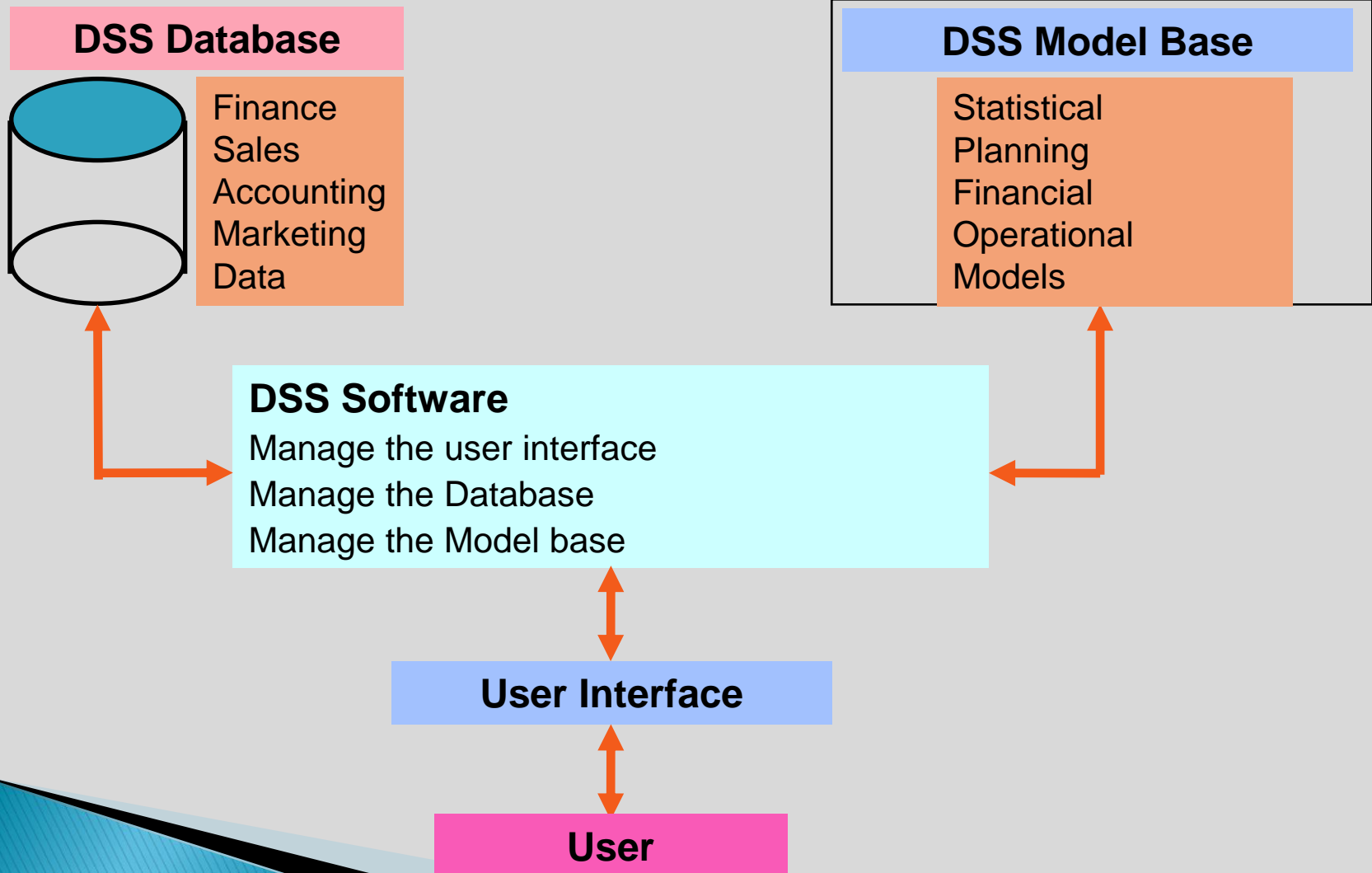
DSS among the many Information Systems (IS) in Organizations

- ▶ Basic Information Systems – Transaction Processing Systems
 - ▶ Managerial Decision Making and Management Support Systems
 - MIS – Management Information Systems
 - **DSS – Decision Support Systems**
 - Executive Information Systems
 - GDSS – Group Decision Support Systems
 - ▶ Other Emergent Systems – Business Intelligence
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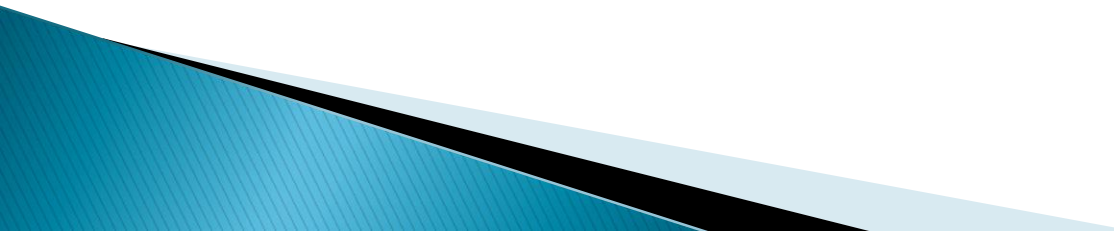
Decision Support Systems

- ▶ **General Conceptualization:** A *DSS* combines models, data and user friendly software to support **semi-structured** decisions of managers and is under user control.
 - ▶ Decision-maker is an active player involved in “what-if” scenarios. Supports the intuition and judgement of the user
 - ▶ Flexible and attempts to incorporate decision-making styles of user
 - ▶ User makes the decision, not the system
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Decision Support Systems – Model



Decision Support Systems - Examples

- ▶ A Simple Spreadsheet for Retirement Planning
 - ▶ Logistics Planning and Vehicle Routing Systems
 - ▶ Sales, Financial Planning, and Pricing Decisions
 - ▶ Plant Maintenance
 - ▶ Sustainability, Energy Conservation
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Research on DSS

What displays are suitable?

When should feedback be provided?

Decision Making Process

Tools and Applications

Should it be rapid prototyping or waterfall method?

What are ideal software characteristics?

Heuristics and Models

What optimization method is suitable?

Can heuristics be developed?



Could Guidance to Choose Appropriate Display Formats Improve Decision Making Performance in Crisis Situations?

Shen, Santhanam and Carswell

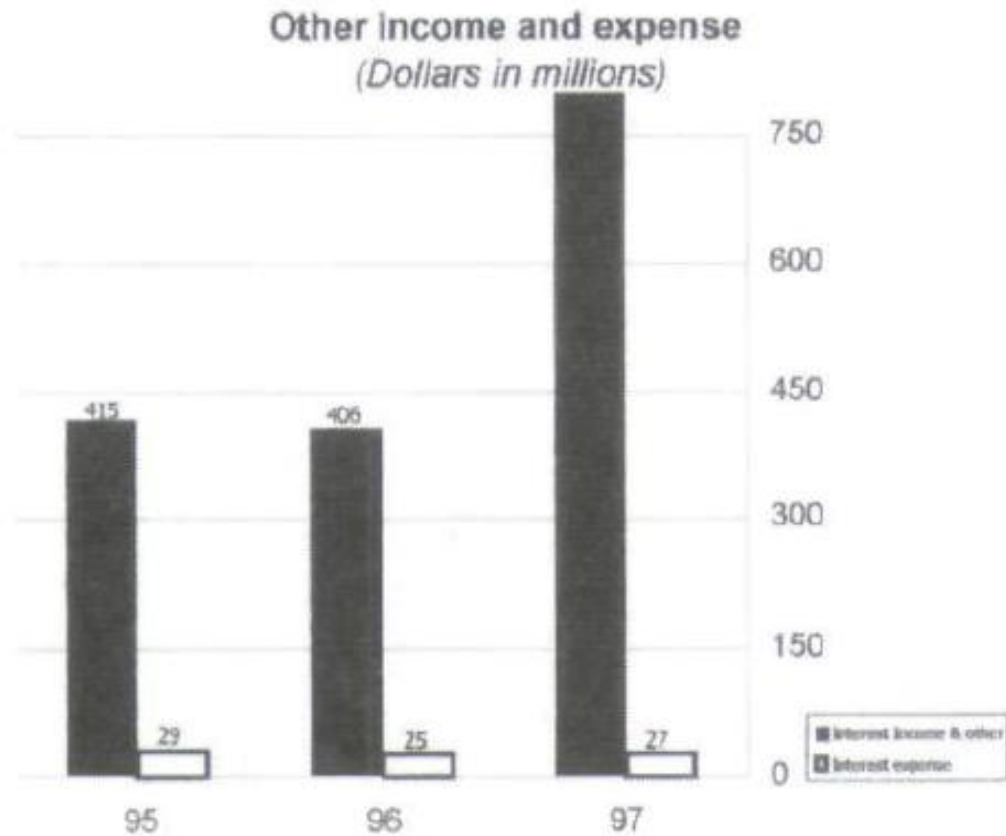


Visual Displays used in Corporate Reporting

- ▶ Presentation graphics are increasingly used in the corporate annual reports of large companies and in DSS (Beattie & Jones 2001, Beattie & Jones 2002)
 - Many communication advantages of Visual Display formats that can interest, enliven the presentation and processing of information
 - Overuse of Visual Displays – Tufte’s Principles
 - Misuse in the corporate world

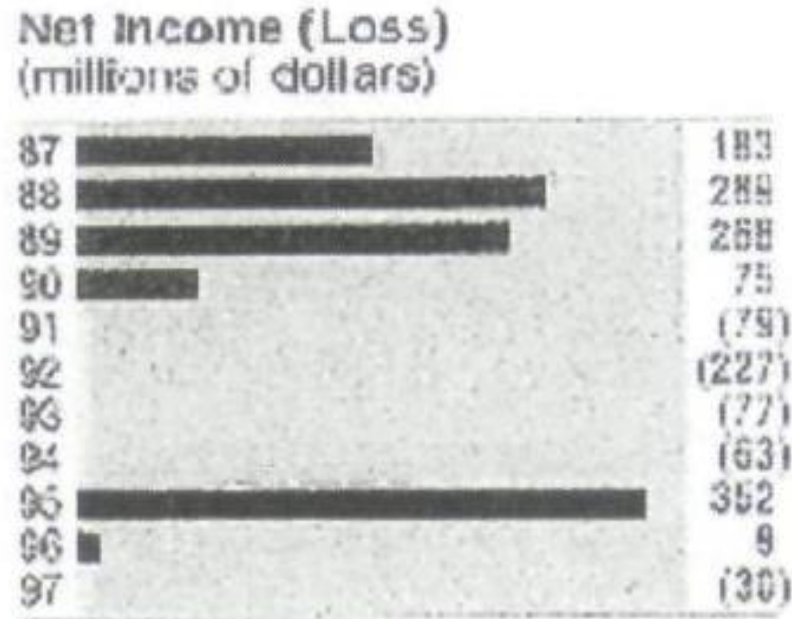
Misuse of Graphs in Corporate Reporting – Masking

(Intel, 1997 Annual Report, p. 22)



Misuse of Graphs in Corporate Reporting

- Negative values not graphed



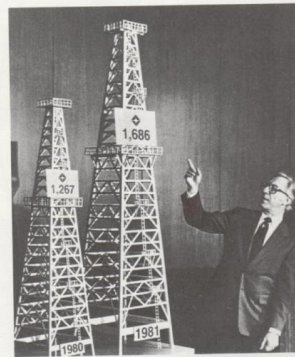
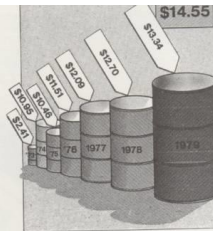
(Boise Cascade Corporation, 1997
Annual Report, p.1)

Dimensionality in Visual Displays

graphic do not reliably produce appropriately proportional changes in perceived areas. The problem is all the worse when the areas are tricked up into three dimensions:

By surface area, the Lie Factor for this graphic is 9.4. But, if one takes the barrel metaphor seriously and assumes that the *volume* of the barrels represents the price change, then the volume from 1973 to 1979 increases 27,000 percent compared to a data increase of 454 percent, for a Lie Factor of 59.4, which is a record.

Similarly, a three-dimensional representation puffing up one-dimensional data:



New York Times, January 27, 1981,
p. D-1.

Conclusion: The use of two (or three) varying dimensions to show one-dimensional data is a weak and inefficient technique, capable of handling only very small data sets, often with error in design and ambiguity in perception. These designs cause so many problems that they should be avoided:

The number of information-carrying (variable) dimensions depicted should not exceed the number of dimensions in the data.

3D graphs in Corporate Reporting

**Sales by Location
(\$Millions)**

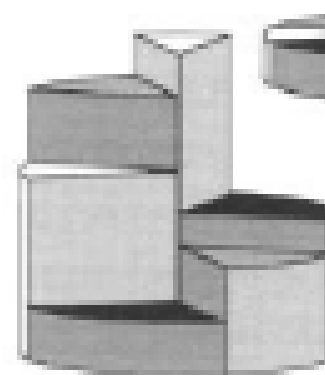
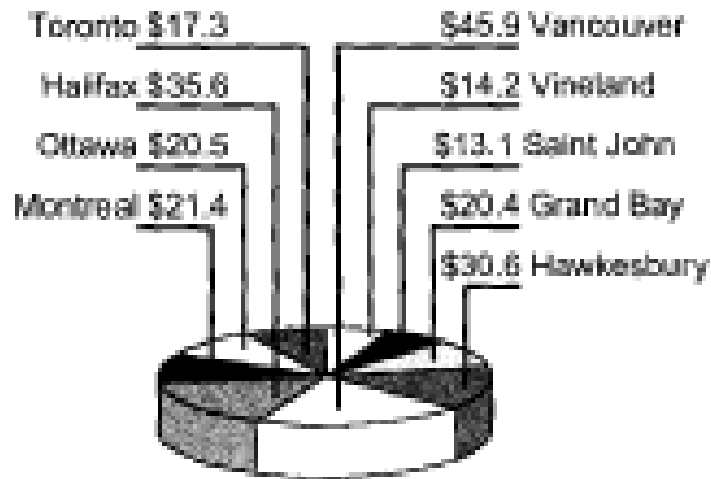


Fig. 2A



Fig. 2B

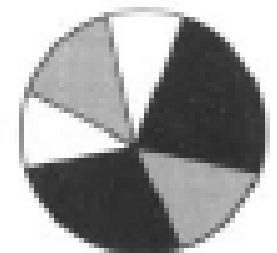
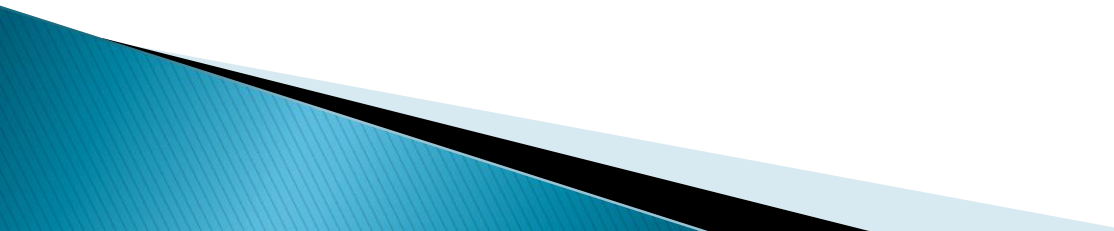


Fig. 2C

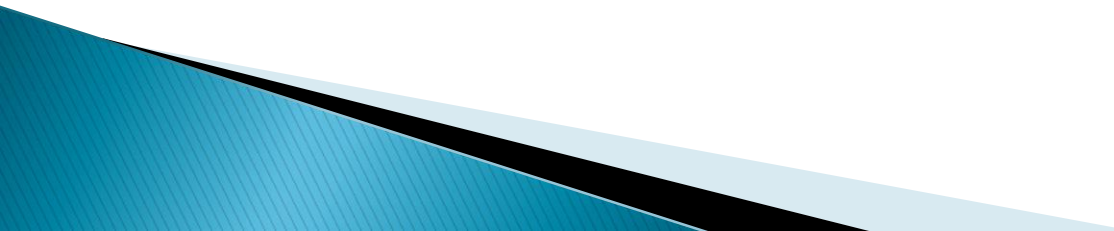
Incorrect Visual Displays

- Improper visual displays can alter financial decisions made by stock-brokers and investment managers, especially in stressful situation (Arunachalam, Pei, and Steinbart 2002)
 - Can decision makers develop knowledge to choose appropriate displays and choose the the correct display to the appropriate task?
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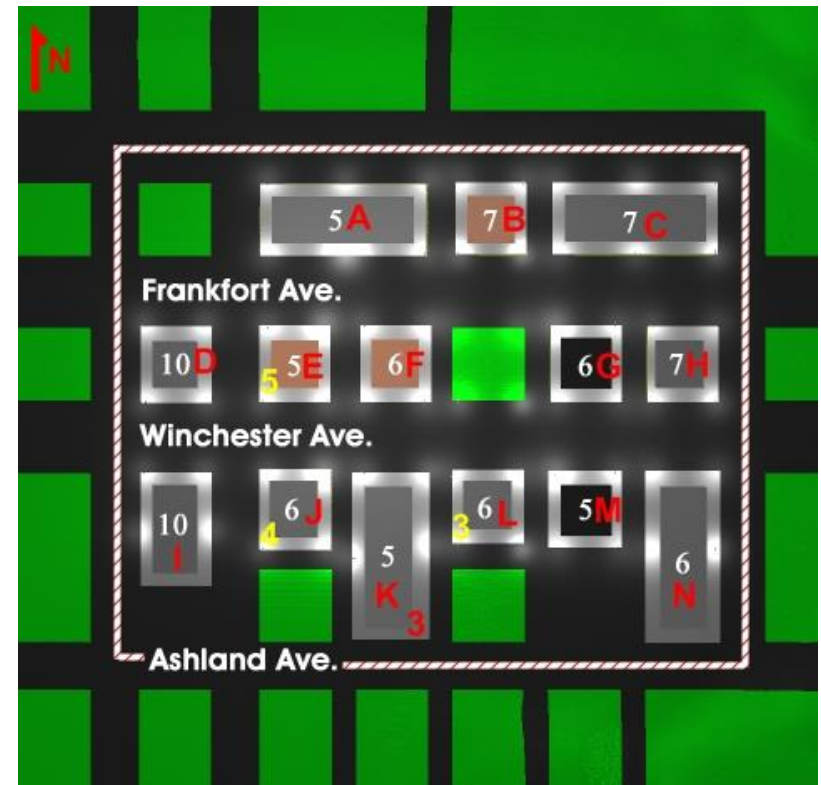
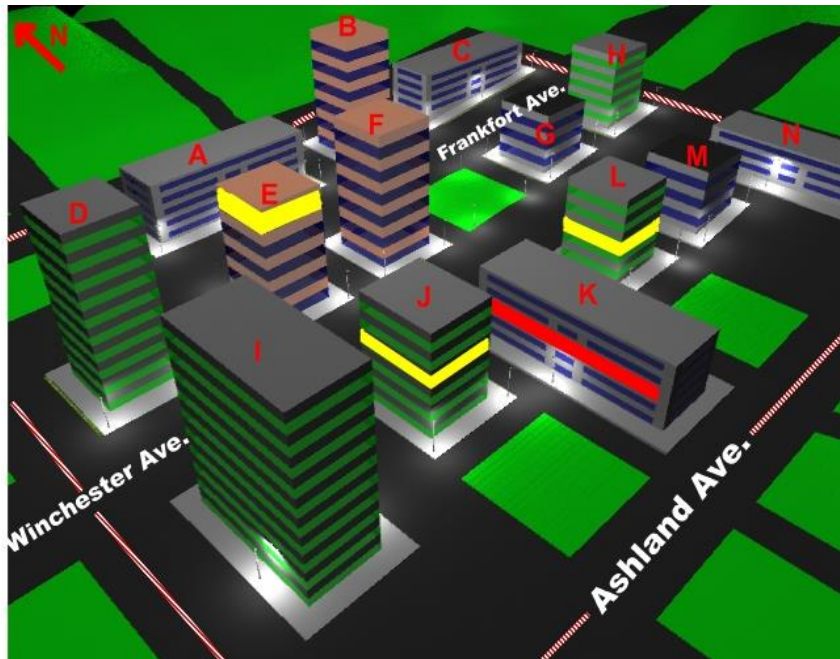
Cognitive Fit and Decisional Guidance

- ▶ Cognitive Fit Theory – Vessey 1991
- ▶ Problem representation should match problem solving task to help the decision maker develop a good mental representation
- ▶ Decisional guidance – (Silver 1991) Systems can provide at appropriate time points and help the decision maker choose functions and displays

An Experiment in Crisis Situation

- ▶ Simulate Incident managers dealing with Civil Emergency situations
 - ▶ One group provided guidance in choosing 2d vs 3d displays and the other a control script describing incident managers job responsibilities
 - ▶ Psychology students recruited as subjects.
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Decision Making in Stressful Situations



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1. A security officer has to cover all the buildings on a single street, starting with the one that has the fewest buildings on both sides. 2-D 3-D
- Which display will be suited to this decision task?**
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1. If an incident commander wants to determine appropriate helicopter landings spots on top of a building **which of the two visual displays is better suited to his decision task?** 2-D 3-D
-

1. The incident commander thinks that the distance from to **Frankfort Ave** to **Winchester Ave** is shorter than the distance from **Winchester Ave.** to **Ashland Ave.** **Which display will be suited to determine if he is right?** 2-D 3-D
-

1. Are any of the **biohazards** in different buildings level with one another? **Which display is best suited to answer this question?** 2-D 3-D
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Results

▶ Decisional Guidance

- Matching 3D tasks to 3D displays – Participants with decisional guidance are significantly better ($p=0.011$)
- Matching 2D tasks to 2D displays – No significant difference ($p=0.876$)

Results

▶ Time

- Participants with Decisional Guidance spent marginally shorter time to finish the task than those without ($p=0.097$).
- No significant difference in confidence between participants with Decisional Guidance and those without ($p=0.658$)

Implications

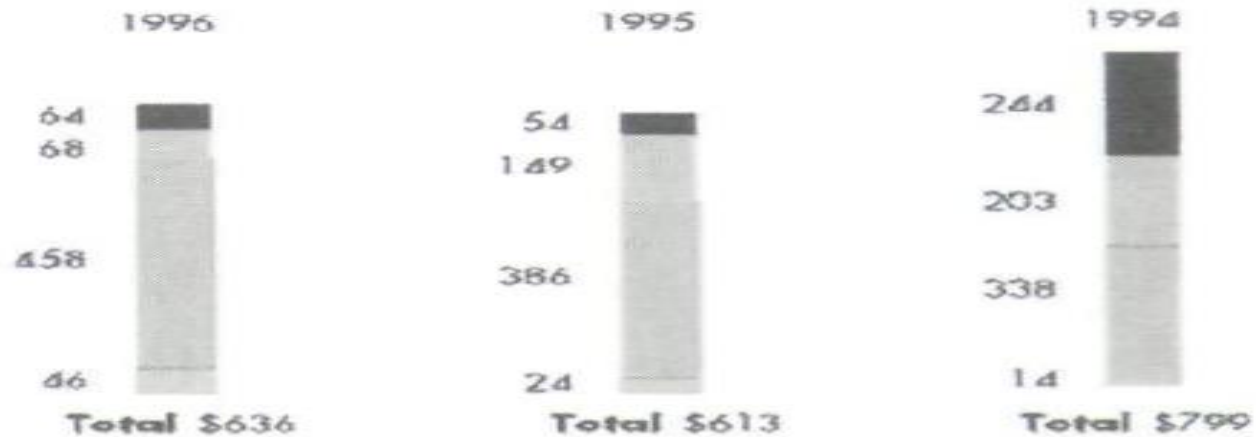
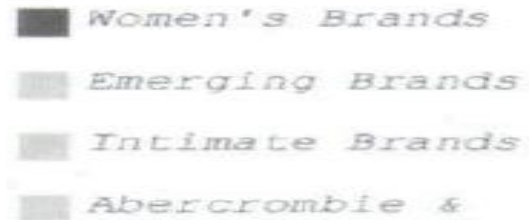
- ▶ Partial evidence that guidance can improve decision makers choice of display such that display can have a “cognitive fit” to the task.
- ▶ Validation of tasks and more testing
- ▶ Tasks that are more Financial and Quantitative will be used.
- ▶

Year Reversal

Operating Income

(\$ in millions)

FITC:



(The Limited, Inc., 1996 Annual Report, p. 4)

Procedures

- ▶ Background – Demographics, Graph Preference, Mental Rotation
 - ▶ Decisional Guidance or Control Script
 - ▶ Information on the projected Displays
 - ▶ Manipulation checks
 - ▶ 20 Experimental Tasks given and Both Displays Projected on the big screen
 - ▶ Accuracy, decision confidence, mental workload
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