

# Research Methods in Human Factors and Applied Cognition

## Task Analysis and Cognitive Task Analysis - Week 5

PSYC 645 Spring 2001  
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## Week 5 Activities

- ◆ Assignment Discussion
- ◆ Visiting Lecture - Link Analysis
- ◆ Reading Discussion
- ◆ Lecture Notes - Link Analysis
- ◆ Reading and Assignment for Week 6

## Assignment

Carry out HTA of setting up to record and run a thirty minute program on the VCR of your choice.

## Visiting Lecture

Debbie Bruce: Link Analysis

## Reading

- ◆ Kirwan & Ainsworth:
  - Link Analysis (pp. 118-125);
  - Timeline Analysis (pp. 135-145)

## Introduction to Task Analysis and Cognitive Task Analysis

Week 5

Link Analysis

## Link Analysis

Used to identify the relationships (links) between an individual(s) and some part of a system

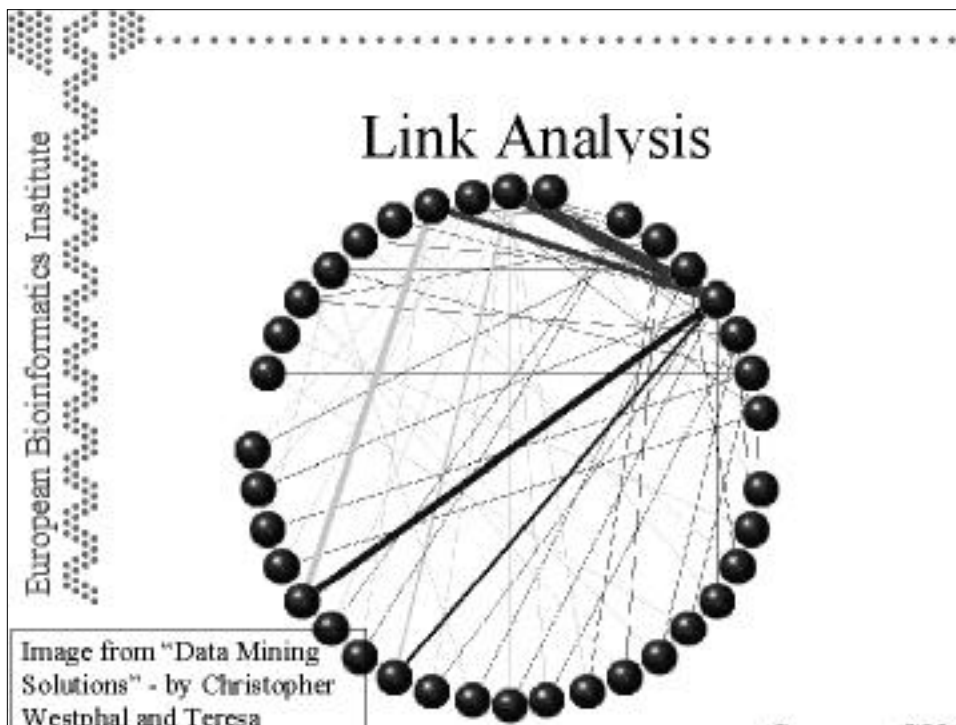
(Chapanis, 1959)

## Overview

- ◆ A representational technique to systematically record and represent the nature, frequency and/or importance of:
  - Movements
  - Communication
  - Interactions
- ◆ Self-contained and simple to use
- ◆ Much more versatile and much more wide spread than you would suspect from reading K&A!

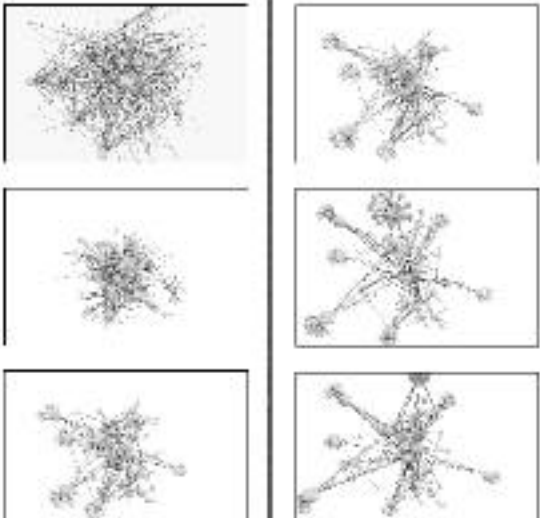
## Applications

- ◆ Communications links between individuals in mobile time critical tasks
- ◆ Hardware-oriented between task and equipment
- ◆ Layout of equipment for offices and control rooms
- ◆ Control and display systems
- ◆ Web sites
  - <http://searchenginewatch.com/searchday/01/sd1219-links.html>
- ◆ Eye tracking

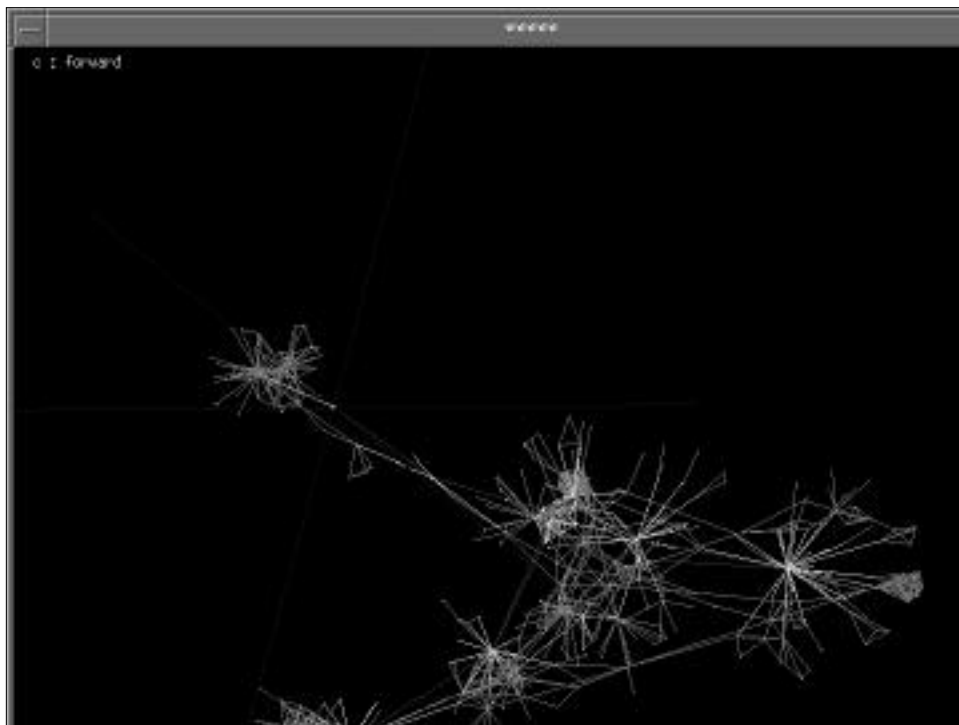


European Bioinformatics Institute

# Information Visualisation



The figure displays six small network graphs arranged in a 3x2 grid. The left column shows three different views of a single, dense, star-like network structure. The right column shows three different views of a more complex, multi-lobed network structure with several distinct clusters and connecting paths. The graphs are rendered in grayscale with nodes as small dots and edges as thin lines.



## Description

### General Method

- ◆ Collect background data on equipment items
- ◆ Data by observation or from procedures
- ◆ Displays may be difficult to collect data from
  - But this is what eye trackers are for!!
- ◆ Develop comprehensive list of links
- ◆ Links are sequential between two items
- ◆ Draw in links as lines on diagram

## Definition of Links

- ◆ Type
  - Only control movements
  - Eye movements
  - Voice
- ◆ Granularity
  - Equipment
  - Control Panels
  - Workstations
  - User visits to web pages

## Information Collection

- ◆ Record Sequential Links
  - Observation - walkthrough
  - Written procedures
- ◆ Count number of times each link is made
- ◆ Produce table of link associations
- ◆ Conditional links can be recorded

## Representation

For complex analyses, or where temporal information is important use graphical representation:

1. Schematic Link Diagrams
2. Spatial Link Diagrams

## Schematic Link Diagrams

- ◆ Each part represented by a circle or square but not to real position
- ◆ Use line patterns to represent different types of link
- ◆ Will quickly establish most frequent links
- ◆ Can clarify overlaps and multi-persons

## Spatial Link Diagrams

- ◆ Topographical representation
- ◆ Accurate spatial view - e.g. floor plan
- ◆ Use line patterns to represent different types of link
- ◆ Will quickly establish most frequent links
- ◆ Possible lack of clarity
- ◆ Global as opposed to OSD individual steps view

## Practical Advice

- ◆ Use representative samples
  - More than one user
  - More than one task
- ◆ Position most frequently used items in center with others around for clarity
- ◆ Ensure system design is stable
- ◆ Does not need expertise to gather information (except for judgement on importance)

## Resources

- ◆ Observational based link analyses are still basically paper and pencil based
- ◆ But computerized help exists
  - for Palm Pilots!!

## Links to Other Methods

- ◆ Complementary to OSD Spatial Analysis
- ◆ If procedural information is not available the Walkthrough can be used
- ◆ For accurate timing data is needed then Event Logging can be used
- ◆ For undefined tasks then Observational Technique should be used

## Advantages

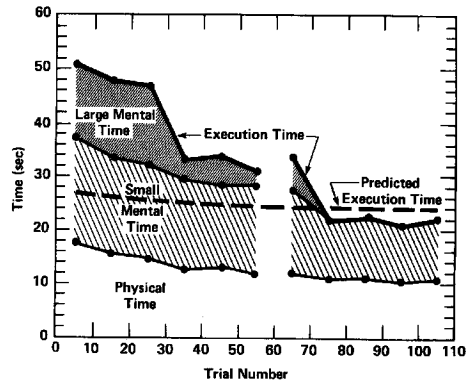
- ◆ May not require active participation by users
- ◆ Uses observable and measurable data - objective
- ◆ Straightforward - little formal training
- ◆ No expensive facilities needed
- ◆ Good for multi-person systems and communications

## Disadvantages

- ◆ Needs preliminary data collection by other means, which may need to be extensive
- ◆ Only considers basic physical relationships for performance optimization other relationships will need to be considered
  - This is not necessarily true. Can do a link analysis of who talks to whom in an organization or command center (e.g.,)
- ◆ Only fairly simple systems can be considered
  - Far from true!!
- ◆ Link frequency equates to importance and this may be an erroneous assumption
- ◆ Only shows frequency not amount of time available to make them

## Timeline Analysis

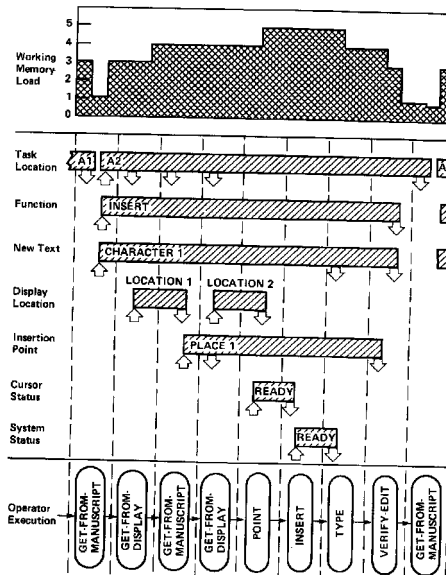
- ◆ A very general technique
- ◆ Basic concept is incorporated in many, many other techniques such as
  - OSD
  - GOMS
  - Network modeling or PERT chart techniques such as CPM-GOMS

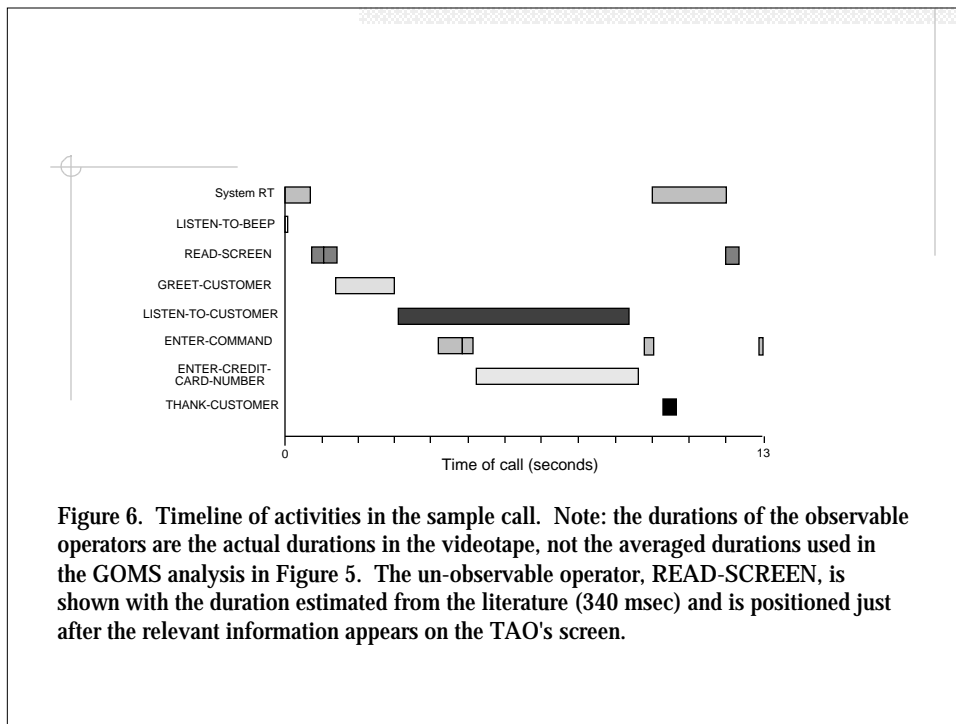


**Figure 11.10. User's execution time in the clause-switching task in Experiment 11A.**

The times are averaged in 10-trial blocks. The top solid line shows the user's actual execution times; and the dashed line shows the predicted time to execute the user's best method, as calculated with the Keystroke-Level Model. The user's time is decomposed into three components: the physical time (the unshaded area on the bottom), the small mental time (the lightly shaded area in the middle), and the large mental time (the darkly shaded area on the top). See the text for how these time components are defined and interpreted.

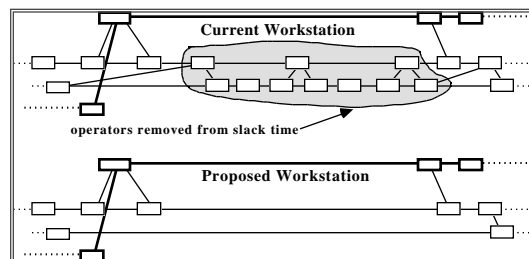
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## Implications for Design (1)

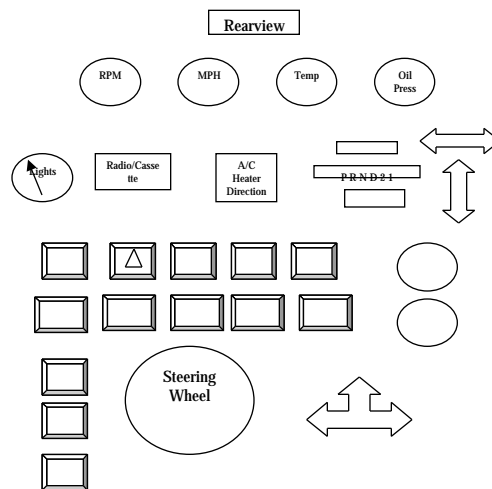
### 1 Models as explanation.



## Assignment: Due next week -- Car Dashboard Design

- ◆ Using items below sketch out a first pass design layout which achieves an efficient and safe operation of the car.
- ◆ Look at some basic maneuvers and criteria such as moving off, changing lanes on a freeway, coming up to lights, long journey.
- ◆ Consider them for both day and night.
- ◆ Remember assumptions, allocation of functions.
- ◆ Do not worry about actual distances at this stage, nor location relative to driver's height – they are later worries!

## Car Dashboard Design



# Assignment and Reading

## For Week 06

1. Shepherd, Ch. 6: Analysis of tasks -- some illustrations
2. Carry out Link Analysis on car dashboard to show most important relationships