MIS 3504
Digital Design and Innovation

Process Flow

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Process DIAGRAMMING
Understanding HOW people do their work
Think VISUALLY
What tells a better Story

**TEXT Description**

Planning and presentation are strongly interwoven. Therefore both issues must be considered simultaneously.

**Contributions of our work include:**

- Cognitive design principles for effective assembly instructions
- We performed cognitive psychology experiments to identify how mental constructs of the assembly processes and to characterize the properties of well-designed instructions. Based on the results of these experiments and prior cognitive psychology research, we identify design-principles for effective assembly instructions. These principles connect people's conceptual model of the assembly task to the visual representation of the task.

**Visual Diagram**

**2. Design Principles for Assembly Instructions**

Before we can develop automatic tools for designing assembly instructions, we must understand how people think, act, and communicate the process of assembling an object. Cognitive psychologists have investigated this domain to develop ways of understanding and interpreting the mental representations underlying assembly [Moser and Ten- sky 2002]. We briefly describe our experimental setup.

In the first experiment, we asked participants to assemble a TV stand, given a photograph of the completed stand as a guide. After they assembled the TV stand, we asked them to create a set of instructions that would allow another person to assemble it. Examples of the diagrams they drew are shown in Figure 2. In the second experiment, we asked a new group of participants to rank the effectiveness of a subset of the instructions produced in the first experiment. Finally, the third experiment tested whether the rated instructions were more effective. Yet another group of participants tested instructions ranked in the second experiment to create a PCB (printed circuit board) and then to assemble a TV stand, with photographs used as a guide. Participants spent less time assembling the TV stand and made fewer errors.

**Hierarchy of grouping of parts:** People think of assemblies as a hierarchy of parts. At the base level, parts are segmented by pretense (e.g., a chair or a desk as a whole). At the next level, parts are segmented by function (e.g., a leg or a chair). Parts are then segmented by context (e.g., a leg or a chair). The second level is a level of abstraction, and we think of it as a two-level hierarchy. [Palmer et al. 1981; Bil ALTER 1999].

**Structural diagrams and action diagrams:** Based on analysis of the hand-drawn instructions we collected in the first experiment, we define two types of assembly diagrams: structural diagrams and action diagrams (see Figure 2). Structural diagrams present the parts of the assembly in a two-level hierarchical structure. Visual comparison of two consecutive diagrams is often used to enhance the understanding of the instructions. Action diagrams present the parts of the assembly in a two-level hierarchical structure. Visual comparison of two consecutive diagrams is often used to enhance the understanding of the instructions. Action diagrams are used to guide the assembly process. The combination of structural and action diagrams is useful for understanding the assembly process. A better approach is to use different tools to enhance the understanding of the instructions. A better approach is to use different tools to enhance the understanding of the instructions. A better approach is to use different tools to enhance the understanding of the instructions. A better approach is to use different tools to enhance the understanding of the instructions.
assembly process: IKEA
What tells a better Story

If you need to explain to your team members how Steve’s consultants firm is financially performing in terms of

- Income vs Expense over twelve months
- Profitability over twelve months

Which approach would you prefer?

- Textual
- Graphical
Steve’s Consulting Company Profitability

January income was four thousand dollars and the expenses were three thousand nine hundred dollars generating a profit of one hundred dollars.

February income was four thousand two hundred and thirty dollars and the expenses were four thousand one hundred dollars generating a profit of one hundred and thirty dollars.

March income was five thousand dollars and the expenses were four thousand nine hundred dollars generating a profit of one hundred dollars.

April income was six thousand two hundred dollars and the expenses were six thousand dollars generating a profit of two hundred and thirty dollars.

May income was six thousand dollars and the expenses were five thousand nine hundred dollars generating a profit of one hundred dollars.

June income was five thousand nine hundred and the expenses were five thousand eight hundred dollars generating a profit of one hundred dollars.

July income was six thousand one hundred and forty dollars and the expenses were six thousand dollars generating a profit of one hundred and forty dollars.

August income was six thousand four hundred and thirty dollars and the expenses were six thousand one hundred and fifty dollars generating a profit of two hundred and fifty dollars.

October income was six thousand four hundred and fifty dollars and the expenses were six thousand and sixty dollars generating a profit of three hundred and ninety dollars.

November income was seven thousand dollars and the expenses were six thousand six hundred dollars generating a profit of four hundred and thirty dollars.

December income was six thousand eight hundred dollars and the expenses were six thousand three hundred and fifty dollars generating a profit of four hundred and fifty dollars.
Core Requirement Components

- Data (Attributes, Entities)
- Processes (or Use Cases)
- External Agents (or Actors)
Workflow Diagrams

• How would you describe a process you routinely use to a friend who wanted to do the same thing?
• Is it easier to use words or draw a picture of the steps you take?
• What would some uses of this approach be?
ASK THEM QUESTIONS:

• Capturing a routine process and explaining it to someone else is difficult, especially for more complex processes. Understanding how something works is critical to improving it. Therefore, getting a good understand of what happens when, how its done, how the steps relate and who decides what questions with what information along the way is a key skill for the BA.

• Word descriptions can be ambiguous. Drawing out the steps is usually seen as a better way to communicate the information of how a process works.
  - Mapping a work process for general understanding
  - process improvement
  - documenting computer logic to be written
  - writing emergency procedures, etc.

• This is a key technique for BA, systems development, process improvement, startups, etc.
**Workflow Diagrams**

- One of a Business Analyst’s key tools, especially for analyzing the as-is situation
- Great way to begin to understand process you are dealing with at high level
- Different levels of workflow can be used to explain the process to different audiences
- Can document Standard Operating Procedures (SOP’s)
- Revising the flow to facilitate improvements is standard design technique
What Does a Workflow Diagram Reveal:

• The steps in a process
• A sequence of actions and responses/decisions
• Problems in a process and revisions to improve it
• How work is accomplished
• How tasks interrelate
• What information flows through the process
• What decisions are made
• How individual workers are involved with the process
What would we want to include in a workflow diagram?

There are many different types of workflow diagrams, we will focus on one.

- Swim Lane Flowcharting
- ANSI Flowcharting
- UML Activity Diagrams
- SIPOC (supplier-input-process-output-customer)
- Use Case Diagram
<table>
<thead>
<tr>
<th>Flowchart Symbol</th>
<th>Name (Alternates)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Process</td>
<td>An operation or action step.</td>
</tr>
<tr>
<td></td>
<td>Terminator</td>
<td>A start or stop point in a process.</td>
</tr>
<tr>
<td></td>
<td>Decision</td>
<td>A question or branch in the process.</td>
</tr>
<tr>
<td></td>
<td>Delay</td>
<td>A waiting period.</td>
</tr>
<tr>
<td></td>
<td>Predefined Process</td>
<td>A formally defined sub-process.</td>
</tr>
<tr>
<td></td>
<td>Alternate Process</td>
<td>An alternate to the normal process step.</td>
</tr>
<tr>
<td></td>
<td>Data (I/O)</td>
<td>Indicates data inputs and outputs to and from a process.</td>
</tr>
<tr>
<td></td>
<td>Document</td>
<td>A document or report.</td>
</tr>
<tr>
<td></td>
<td>Multi-Document</td>
<td>Same as Document, except, well, multiple documents.</td>
</tr>
<tr>
<td></td>
<td>Preparation</td>
<td>A preparation or set-up process step.</td>
</tr>
<tr>
<td></td>
<td>Display</td>
<td>A machine display.</td>
</tr>
<tr>
<td></td>
<td>Manual Input</td>
<td>Manually input into a system.</td>
</tr>
<tr>
<td></td>
<td>Manual Operation</td>
<td>A process step that isn't automated.</td>
</tr>
<tr>
<td></td>
<td>Card</td>
<td>A old computer punch card.</td>
</tr>
<tr>
<td>Symbol</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Punch Tape</td>
<td>An old computer punched tape input.</td>
<td></td>
</tr>
<tr>
<td>Connector</td>
<td>A jump from one point to another.</td>
<td></td>
</tr>
<tr>
<td>Off-Page Connector</td>
<td>Continuation onto another page.</td>
<td></td>
</tr>
<tr>
<td>Transfer</td>
<td>Transfer of materials.</td>
<td></td>
</tr>
<tr>
<td>Or</td>
<td>Logical OR.</td>
<td></td>
</tr>
<tr>
<td>Summing Junction</td>
<td>Logical AND.</td>
<td></td>
</tr>
<tr>
<td>Collate</td>
<td>Organizing data into a standard format or arrangement.</td>
<td></td>
</tr>
<tr>
<td>Sort</td>
<td>Sorting of data into some pre-defined order.</td>
<td></td>
</tr>
<tr>
<td>Merge (Storage)</td>
<td>Merge multiple processes into one.</td>
<td></td>
</tr>
<tr>
<td>Extract (Measurement)</td>
<td>Extract (split processes) or more commonly - a measurement or finished goods.</td>
<td></td>
</tr>
<tr>
<td>Stored Data</td>
<td>A general data storage flowchart symbol.</td>
<td></td>
</tr>
<tr>
<td>Magnetic Disk (Database)</td>
<td>A database.</td>
<td></td>
</tr>
<tr>
<td>Direct Access Storage</td>
<td>Storage on a hard drive.</td>
<td></td>
</tr>
<tr>
<td>Internal Storage</td>
<td>Data stored in memory.</td>
<td></td>
</tr>
<tr>
<td>Sequential Access Storage (Magnetic Tape)</td>
<td>An old reel of tape.</td>
<td></td>
</tr>
<tr>
<td>Callout</td>
<td>One of many callout symbols used to add comments to a flowchart.</td>
<td></td>
</tr>
<tr>
<td>Flow Line</td>
<td>Indicates the direction of flow for materials and/or information</td>
<td></td>
</tr>
</tbody>
</table>
Flowchart

Samples links:
Flow Chart Example

ANSI STANDARD FLOWCHART SAMPLE FOR MONITORING REVIEW DATES

Start

Produce Schedule of Review Dates

For Each Employee, Examine Review Date

If Project Completion Date Within 1 Month

No

Yes

Send Project Review Form to Project Manager

If Review Date Within 1 Month

No

Yes

Send Self-Analysis Forms to Employee

Send Project Review Form to Project Manager

Assemble Past Project Reviews & Career Development Plan

Send Review Package to Career Manager

Stop

Legend:

A. Approve Employee Review Step
B. Complete Self Analysis Step
C. Complete Project Review Step
D. Update Career Development Step
UML Activity Diagram

Samples links:
SIPOC (supplier-input-process-output-customer)

Samples links:
Use Case Diagram

Samples links:
Swim Lane Diagram

Samples links:
Swim Lane Diagram

Ergo Chair Value Chain Order Fulfillment Process

Customer

Sales

Order Entry

Inventory

Production

Delivery

Supplier

Process Orders

approved orders

Perform Setup

Assemble Chairs

Ship Parts

Deliver Chairs
Think:  

Actors  [who]  

Actions  [what]  

Decisions  [when]  

Sequence  [where]  

RELATIONSHIPS
Swim Lane Process Mapping

1. Name the process - subject+verb+object

1. What’s the business event that initiates the process?

1. What’s the outcome of the process?
1. Name the process - subject+verb+object

Warehouse Receives Materials

1. What’s the business event that initiates the process?

Receive Materials

1. What’s the outcome of the process?

Materials are Stored
ABC Assembly Company
Material Delivery Process

• Manufacture delivers and unloads materials at the ABC Assembly Company Loading Dock

• Receiving Clerk receives invoice paperwork describing delivered materials and creates new entries of the materials in the Warehouse Management System

• Receiving Clerk sends memo via hardcopy to the Warehouse Foreman indicating the new materials have arrived on the loading dock and are ready to be stored in the proper material bin locations which will later be used in the assemble process by the production teams.

• The Warehouse Foreman performs a visual scan of the location bins to determine where to store the arriving materials. The location for storage is critical as there are physical weight limitations on the quantity of material stored in each bin and the material has expiration dates that require first in first out usage during manufacturing.

• The Warehouse Foreman makes the material location determinations and then will verbally tell the Forklift Driver where to place the newly arrived materials.

• When the Forklift Driver has completed storing all the new materials in the verbally assigned bin location(s), they will then verbally communicate to the Warehouse Foreman the storage locations.

• The Warehouse Foreman will log into the Warehouse Management System to update the new entries that the Receiving Clerk initially entered into the system with the storage locations.

• The Receiving Clerk will periodically check the Warehouse Management System confirm the bin locations have been updated by the Warehouse Foreman.

• The Material Delivery Process is completed.
Swim Lane Workflow Exercise

• With your teammates,
• Take 15 minutes to imagine the steps of the warehouse when it receives material from its suppliers
• Sketch it out if you can
• Be ready to share your ideas
Swim Lane Process Mapping

List all people and departments that may be involved in the process

- Receiving Dock
- Receiving Clerk
- Forklift Driver
- Warehouse Foreman
- Data Processing
<table>
<thead>
<tr>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving Dock</td>
</tr>
<tr>
<td>Receiving Clerk</td>
</tr>
<tr>
<td>Forklift Driver</td>
</tr>
<tr>
<td>Warehouse Foreman</td>
</tr>
<tr>
<td>Data Processing</td>
</tr>
</tbody>
</table>

Draw a lane next to each person.
Swim Lane Process Mapping

What is the first step?

Materials → Unload Trucks

- Receiving Dock
- Receiving Clerk
- Forklift Driver
- Warehouse Foreman
- Data Processing
Swim Lane Process Mapping

What is the next step?

- Unload Trucks
- Check Materials

Roles:
- Receiving Dock
- Receiving Clerk
- Forklift Driver
- Warehouse Foreman
- Data Processing
Swim Lane Process Mapping

1. Unload Trucks
2. Check Materials
3. Where?

- Receiving Dock
- Receiving Clerk
- Forklift Driver
- Warehouse Foreman
- Data Processing

Show databases as cylinders
Show decisions as diamonds, note business rules elsewhere
Swim Lane Process Mapping

1. Receiving Dock
   - Unload Trucks
2. Receiving Clerk
   - Check Materials
3. Forklift Driver
   - Where?
4. Warehouse Foreman
   - WMS
5. Data Processing
   - Put Away

Flow:
- Materials → Unload Trucks → Check Materials → Where? → WMS → Put Away → Keep going
Swim Lane Process Mapping

1. Unload Trucks
2. Check Materials
3. Put Away
4. Record Location

- **Receiving Dock**: Materials, Unload Trucks, Check Materials, Where?, WMS
- **Receiving Clerk**: Put Away
- **Forklift Driver**: Where?, WMS
- **Warehouse Foreman**: Materials, Unload Trucks, Check Materials, Where?, WMS, Put Away, Record Location
- **Data Processing**: Where?, WMS
Swim Lane Process Mapping

Receiving Dock
- Materials
  - Unload Trucks
  - Check Materials
    - Where?
      - WMS

Receiving Clerk
- Put Away
  - WMS
  - Record Location
    - Material Away

Forklift Driver

Warehouse Foreman

Data Processing

Finish
Individual Case Assignment:
Sales Order Case
Develop Swim lane Process flow

Links to documents on the MIS 3504 Blog site
Case background (Discount Auto Parts - Sales Order)
Swim Lane Excel Template
Swim Lane PPT Template

Due class 6, February 16, 2016
Exercise: draw the sales process described in the sales order case

- **Actors** – Who are all of the people/departments involved?
- **Actions** – What are the steps they perform in the process?
- **Sequence** – Map the process in sequence using the swim lane method.