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

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

The 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 process and to characterize the properties of well-designed instructions. Based on the results of these experiments and prior cognitive psychology research, we identified design principles for effective assembly instructions. These principles connect people’s concepted models of the assembly task to the visual representation of the task.

A system interactively designs the assembly sequence:
Our assembly instruction design system consists of two parts: a planner and a presenter. The planner searches the space of feasible assembly sequences to find one that best matches the cognitive design principles. To do this the planner must also consider many aspects of the instructions. The presenter then encodes a diagram for each step of the assembly sequence generated by the planner. The presenter also uses the design principles to determine where to place parts, guidelines and errors. In particular, the presenter can generate action diagrams which use the conventions of exploded views to clearly depict parts and operation required inside assembly steps.

Design Principles for Assembly Instructions

Before we can develop automatic tools for designing assembly instructions, we must understand how people think about and communicate the process of assembling an object. Cognitive psychologists have invented a variety of techniques to investigate how people mentally represent ideas and concepts. We recently performed human subject experiments based on these techniques to determine the mental representations underlying assembly (Haines and Tversky 2002). We briefly describe our experimental setup.

In the first experiment, we asked participants to assemble a toy stand, given only a photograph of the completed stand as a guide. After they assembled the toy stand, we asked them to create a set of instructions that would show another person how 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 highly ranked instructions were more effective. Yet another group of participants used instructions ranked in the second experiment to assemble the toy stand; while experienced assemblers used task completion time and error rates. We found that general the highly ranked instructions were easier to understand and follow. Participants spent less time assembling the toy stand and made fewer errors.

Based on these experiments, as well as earlier cognitive research, we have identified a set of design principles for creating assembly instructions that are easy to understand and follow.

Hierarchy and grouping of parts:
People think of assemblies as a hierarchy of parts. At the base level, parts are segmented by perceived coherence instead of by content consistency; that is, parts that are disjoint are more likely to be segmented. Typically, the disjoint parts are also grouped by dimension functions (e.g., the group of a chair or the drawers of a desk) [Tversky and Hershson 1986]. When possible, people prefer that part within a group are added to the assembly at the same time, or in sequence once another.

The part groups are usually considered in hierarchical structures, which parallel the subassembly structure of the object.

What tells a better Story

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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.

September income was six thousand three hundred and the expenses were six thousand dollars generating a profit of three hundred and thirty 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.
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
Workflow Diagrams

• 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><img src="image1.png" alt="Symbol" /></td>
<td>Punched Tape - An old computer punched tape input.</td>
<td></td>
</tr>
<tr>
<td><img src="image2.png" alt="Symbol" /></td>
<td>Connector - A jump from one point to another.</td>
<td></td>
</tr>
<tr>
<td><img src="image3.png" alt="Symbol" /></td>
<td>Off-Page Connector - Continuation onto another page.</td>
<td></td>
</tr>
<tr>
<td><img src="image4.png" alt="Symbol" /></td>
<td>Transfer - Transfer of materials.</td>
<td></td>
</tr>
<tr>
<td><img src="image5.png" alt="Symbol" /></td>
<td>Or - Logical OR.</td>
<td></td>
</tr>
<tr>
<td><img src="image6.png" alt="Symbol" /></td>
<td>Summing Junction - Logical AND.</td>
<td></td>
</tr>
<tr>
<td><img src="image7.png" alt="Symbol" /></td>
<td>Collate - Organizing data into a standard format or arrangement.</td>
<td></td>
</tr>
<tr>
<td><img src="image8.png" alt="Symbol" /></td>
<td>Sort - Sorting of data into some pre-defined order.</td>
<td></td>
</tr>
<tr>
<td><img src="image9.png" alt="Symbol" /></td>
<td>Merge (Storage) - Merge multiple processes into one. Also used to show raw material storage.</td>
<td></td>
</tr>
<tr>
<td><img src="image10.png" alt="Symbol" /></td>
<td>Extract (Measurement) (Finished Goods) - Extract (split processes) or more commonly - a measurement or finished goods.</td>
<td></td>
</tr>
<tr>
<td><img src="image11.png" alt="Symbol" /></td>
<td>Stored Data - A general data storage flowchart symbol.</td>
<td></td>
</tr>
<tr>
<td><img src="image12.png" alt="Symbol" /></td>
<td>Magnetic Disk (Database) - A database.</td>
<td></td>
</tr>
<tr>
<td><img src="image13.png" alt="Symbol" /></td>
<td>Direct Access Storage - Storage on a hard drive.</td>
<td></td>
</tr>
<tr>
<td><img src="image14.png" alt="Symbol" /></td>
<td>Internal Storage - Data stored in memory.</td>
<td></td>
</tr>
<tr>
<td><img src="image15.png" alt="Symbol" /></td>
<td>Sequential Access Storage (Magnetic Tape) - An old reel of tape.</td>
<td></td>
</tr>
<tr>
<td><img src="image16.png" alt="Symbol" /></td>
<td>Callout - One of many callout symbols used to add comments to a flowchart.</td>
<td></td>
</tr>
<tr>
<td><img src="image17.png" alt="Symbol" /></td>
<td>Flow Line - Indicates the direction of flow for materials and/or information.</td>
<td></td>
</tr>
</tbody>
</table>

**Flow Chart Symbols**
Flow Chart Example
UML Activity Diagram

Samples links:

Online Shopping

[search] Search Items [found] View Item [made decision]
[not found] 
[browse] Browse Items

Add to Shopping Cart

Shopping cart can be checked at any time
Check Shopping Cart

Proceed to Checkout

Checkout

Update Shopping Cart

[update needed] [done with shopping]
[more shopping]

[view cart]

View Shopping Cart

[proceed]
SIPOC (supplier-input-process-output-customer)

Samples links:
Use Case Diagram

Samples links:
Swim Lane Diagram

Samples links:
Think:

Actors [who]

Actions [what]

Decisions [when]

Space [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?
Swim Lane Process Mapping

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 paper work describing delivered materials and creates new entries of the materials in the Warehouse Management System
• Receiving Clerk send memo via hardcopy to the Warehouse Foreman indicating the new materials have arrived on the loading doc 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 store in each bin and the material has expiration dates that require first in first out usage during manufacturing
• The Warehouse Foreman make 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 steps a warehouse goes through 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
Swim Lane Process Mapping

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

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

**What is the first step?**

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

- **Materials** ➔ **Unload Trucks**
Swim Lane Process Mapping

What is the next step?
Swim Lane Process Mapping

- Receiving Dock: Unload Trucks
- Receiving Clerk: Check Materials
- Forklift Driver: Where?
- Warehouse Foreman: Show databases as cylinders
- Data Processing: Show decisions as diamonds, note business rules elsewhere
Swim Lane Process Mapping

- **Receiving Dock**
  - Materials
  - Unload Trucks

- **Receiving Clerk**
  - Check Materials

- **Forklift Driver**
  - Where?
  - Put Away
  - Keep going

- **Warehouse Foreman**
  - WMS

- **Data Processing**
Swim Lane Process Mapping

Unloading

Trucks

Check
Materials

Put Away

WMS

Where?

Record
Location

Materials

Receiving Dock

Receiving Clerk

Forklift Driver

Warehouse Foreman

Data Processing

WMS
Swim Lane Process Mapping

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

Receiving Clerk

Forklift Driver

Warehouse Foreman

Data Processing

Finish
- Record Location
- Material Away
- WMS
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, October 3, 2017
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.