MIS 3504
Digital Design and Innovation

Process Flow

Stephen Salvia

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

planning and presentation are strongly interwoven. 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 people conceive of the assembly process and to characterize the properties of well-designed instructions. Based on the results of these experiments and post-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.

A system interrelating these design principles: Our assembly instruction design system consists of two parts: a planner and a presenter. The planner receives the parts of the assembly, the sequence, and the assembler’s competence level as inputs, and produces an assembly instruction as output. The presenter 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 in assembly sequence.

2 Design Principles for Assembly Instructions

Before we can develop automated tools for designing assembly instructions, we must understand how people think about and communicate the process of assembling an object. Cognitive psychologists have identified 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 how people mentally represent ideas and concepts. We performed human subject experiments based on these techniques to determine how people mentally represent ideas and concepts. The results of these experiments are described in a separate paper.

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 describe 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 textual, instructional, and visual instructions were equally effective. Yet another group of participants used instructions ranked in the second experiment to assemble the TV stand, while instructions engaged a task completion time and error rate. We found that generally, the highly rated instructions were easier to understand and follow. Participants spent less time assembling the TV stand and made fewer errors. Based on these experiments, as well as earlier cognitive research, we identify 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 pre-conceived pieces instead of by common discontinuities; 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 legs of a chair or the drawers of a desk) [Tversky and Hoffman 1984]. When possible, people prefer that parts within a group are added to the assembly at the same time, or in sequence one after another. The part groups are usually considered as hierarchical structures, which parallel the subassembly structure of the object.

Conclusion: 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.
Core Requirement Components

- Business Rules
  - 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
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>An 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="image" alt="Punched Tape" /></td>
<td>An old computer punched tape input.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Connector" /></td>
<td>A jump from one point to another.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Off-Page Connector" /></td>
<td>Continuation onto another page.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Transfer" /></td>
<td>Transfer of materials.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Or" /></td>
<td>Logical OR.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Summing Junction" /></td>
<td>Logical AND.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Collate" /></td>
<td>Organizing data into a standard format or arrangement.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Sort" /></td>
<td>Sorting of data into some pre-defined order.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Merge (Storage)" /></td>
<td>Merge multiple processes into one. Also used to show raw material storage.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Extract (Measurement)" /></td>
<td>Extract (split processes) or more commonly - a measurement or finished goods.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Extract (Finished Goods)" /></td>
<td>Extract (finished goods).</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Stored Data" /></td>
<td>A general data storage flowchart symbol.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Magnetic Disk (Database)" /></td>
<td>A database.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Direct Access Storage" /></td>
<td>Storage on a hard drive.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Internal Storage" /></td>
<td>Data stored in memory.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Sequential Access Storage (Magnetic Tape)" /></td>
<td>An old reel of tape.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Callout" /></td>
<td>One of many callout symbols used to add comments to a flowchart.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="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

Employee Review Dates

Career Manager

For Each Employee, Examine Review Date

If Review Date Within 1 Month

Yes

Send Self-Analysis Forms to Employee

No

If Project Completion Date Within 1 Month

No

Send Project Review Form to Project Manager

Yes

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:
Think:

Actors [who]

Actions [what]

Decisions [when]

Space [where]

SEQUENCE

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 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
Swim Lane Process Mapping

Draw a lane next to each person.
What is the next step?
Swim Lane Process Mapping

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

- **Receiving Clerk**
  - Check Materials

- **Forklift Driver**
  - Where?

- **Warehouse Foreman**
  - WMS

- **Data Processing**

Show decisions as diamonds, note business rules elsewhere

Show databases as cylinders
Swim Lane Process Mapping

1. Unload Trucks
2. Check Materials
3. Put Away
4. Where?
5. WMS

Steps:
- Materials
- Keep going

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

Receiving Dock
- Materials
- Unload Trucks
- Check Materials
- Where?
- Record Location

Receiving Clerk

Forklift Driver
- Put Away

Warehouse Foreman
- WMS

Data Processing
- 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, September 29, 2015
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.