Semiotic Analysis of Assembly and Disassembly Instructions

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Presentation overview

- A qualitative study to investigate how people perceive and react to the signs in the given work instruction

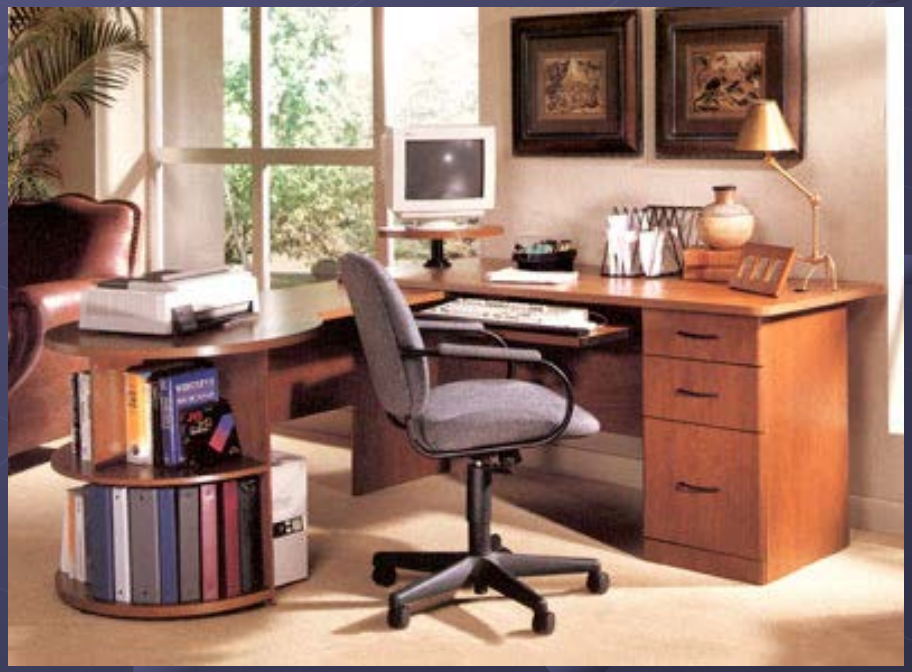
- Significance
  - Practice of outsourcing and customer involvement
  - Trend of longer product lifespan and mass customization
  - Assembly/disassembly as one of the most important activities in the lifecycle of a product

Work instruction

- Work instruction
  - Product of process planning or instructional design
  - Communication between the task designer and the operator
- Forms of work instruction
  - To-Do list
  - User manual
  - Step-by-step illustration
  - Multimedia instruction
- Example
  - “Some Assembly Required”
  - Assembly instruction of Sauder furniture

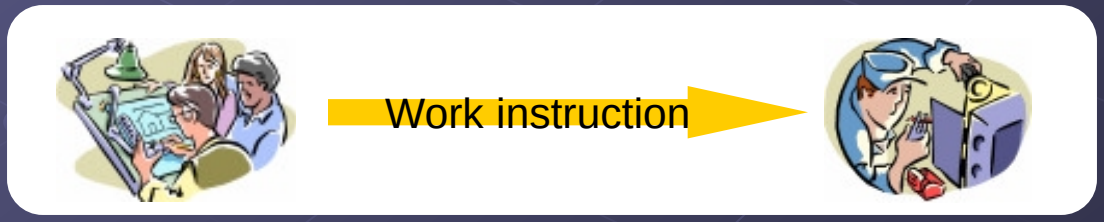
Designing a task

- Task designer (process planner)
  - Task objectives
  - Resource available
  - Sequence and details of the tasks

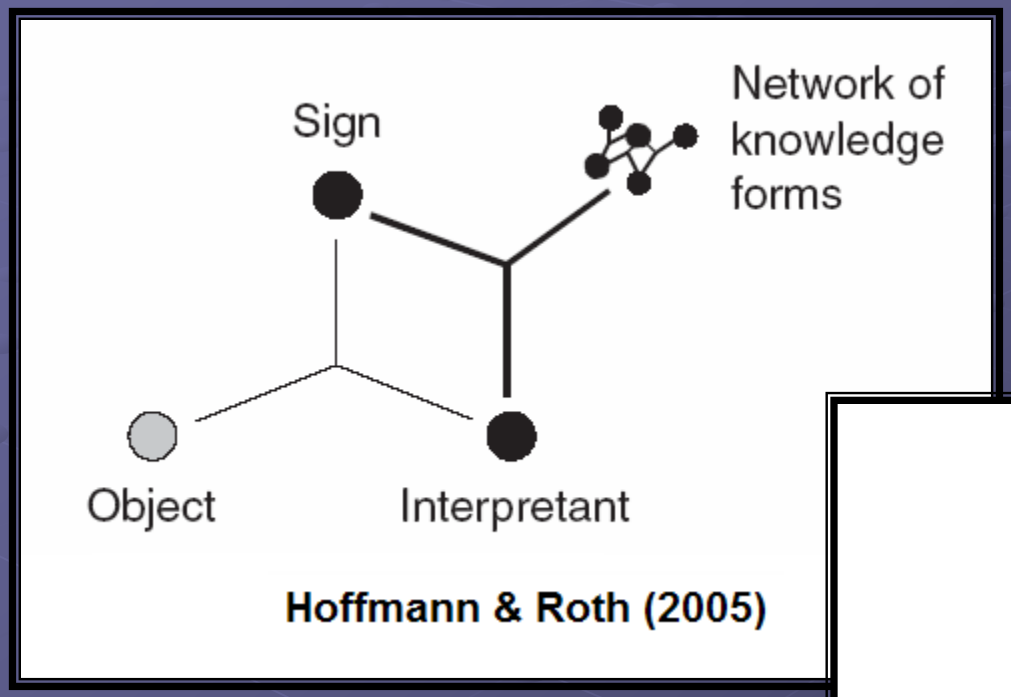


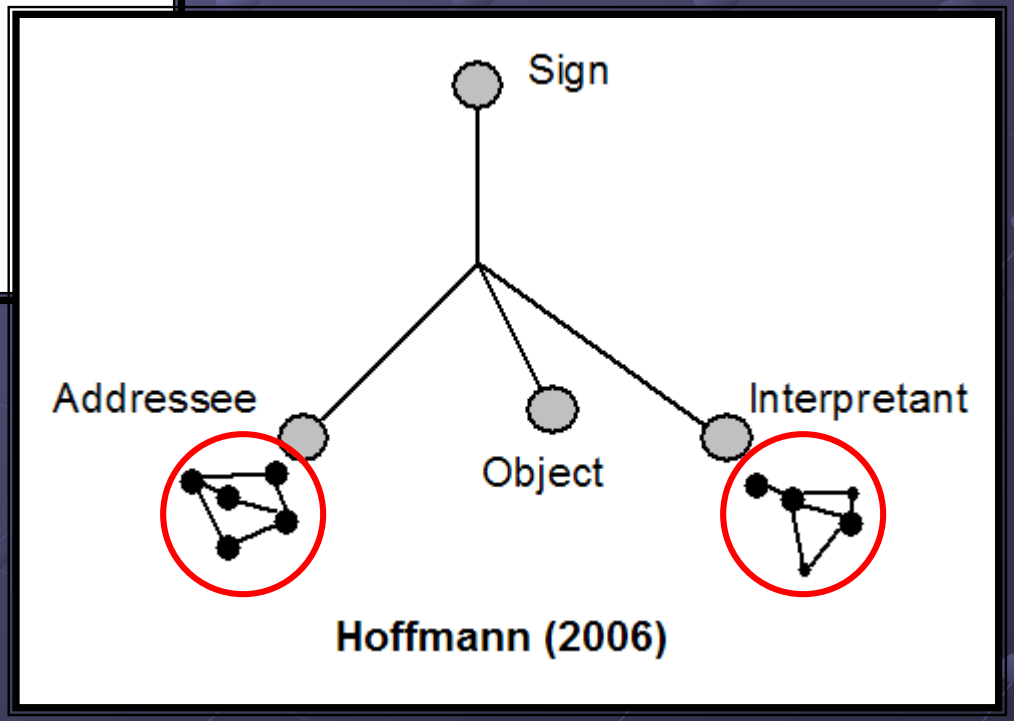
Executing a task

- Task execution (field engineer or end user)
  - What am I asked to do?
  - Have I done something similar before?
  - How will I proceed?
- The problems
  - One way communication with assumption
  - Utilization of work instruction



Sign relation





Experiment

- Qualitative study of assembling and disassembling a Brigg & Stratton 3.5hp engine
  - Four senior level engineering & technology students w/ internship experiences
  - Step-by-step work instruction from DEPCO
  - Think-aloud during the course of exercise
  - Video and audio tape recording
  - Pre- and post-test knowledge measurement
  - Transcription and semiotic analysis

Example instruction

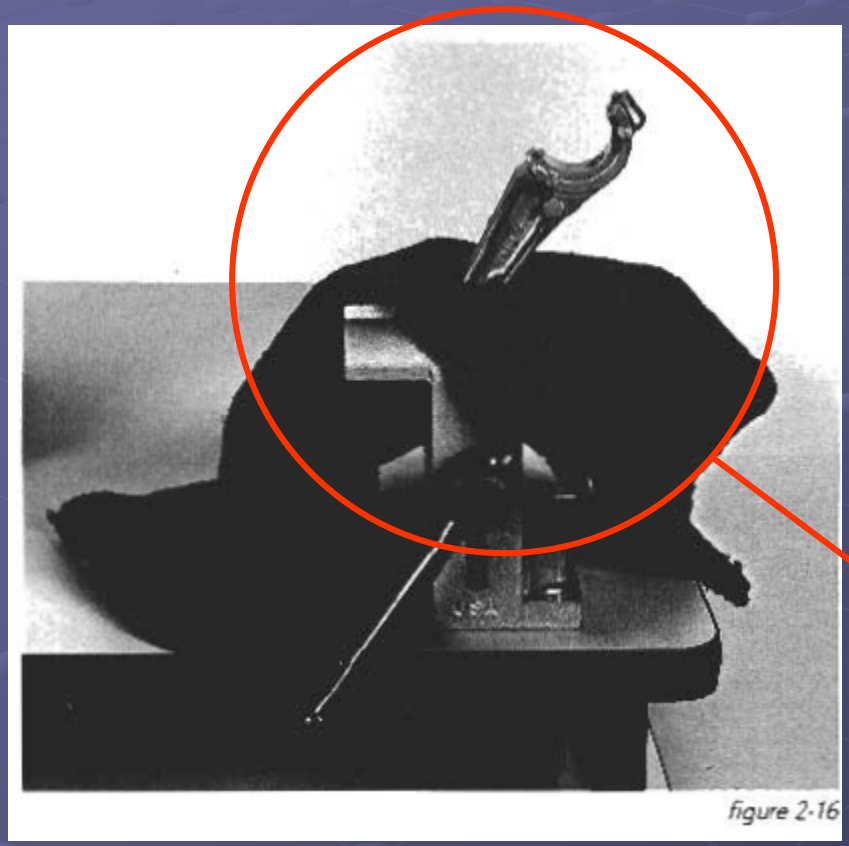


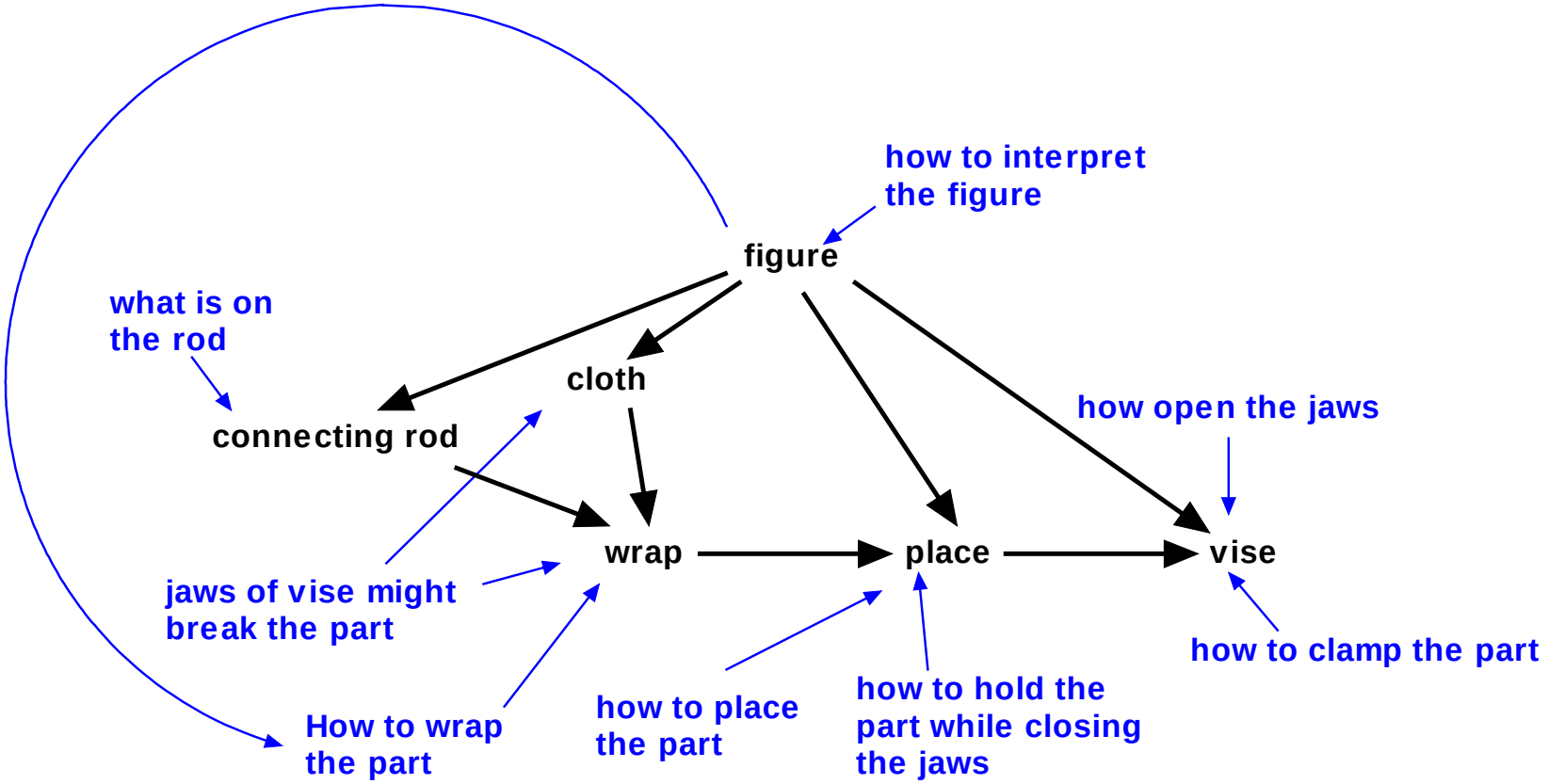
figure 2-16

- Wrap the connecting rod in a piece of cloth to protect it from the jaws of the vice.
- Place the connecting rod in the vise as in figure 2-16.
- Spatial relationship
  - Location
  - Orientation

Example transcription

- **(Video) Think-aloud (44 sec.)**
- (Reading the instruction)
- First thing…use the rod and the vise
- (Rotate twice the handle of the vise, picking up the rod)
- That is easy just according to the picture
- (Refer to the picture to see how to wrap the rod)
- (Position and compare the wrapped rod to the jaws of the vise)
- (Open further the vise to make sure that the part fits)
- (Try to put it in…)
- (Use both hands to feel the shape of the rod)
- (Check again the instruction, text then picture)
- Here…I refer to the picture… that I suppose to vise it with the thickest edge (point to the end of the rod)
- I have to watch out that (check the picture one more time and point to the end of rod again) …there is a notch on top of it
- (Put the rod in and slowly close the jaws of the vise and ensure that it is positioned upward properly) Be careful not to break the notch…by the end of vise

Semiotic scheme



User model of assembly

- User analysis in the instructional design model
- User-centered work instruction considering their current knowledge, skills, and learning styles
- To-Do list
  - Identify the nodes and corresponding knowledge and skills
  - Consider the impact of learning styles on instructional design
  - Task analysis to build the hierarchical network
  - Classification of behaviors
  - Implementation of HCI models such as GOMS or ACT-R

Future applications

- On the job training
  - Training sessions customized for individual learners considering their current knowledge, skill, and learning styles
    - Happier employee: Improved learning motivation
    - Happier employer: Cost effective due to time saving
  - Can also be applied to distance learning or CBT
- In the field
  - Assuming the *generic* work instruction is ready
  - Work instructions customized for individual operators considering their current knowledge, skills, and learning styles
    - Bandwidth sensitive content: Reduced package size as only necessary information will be packed.
    - Improved situation awareness: More suitable content presentation with the consideration of the individual's learning style