Robotizing housing

Frans J.M. van Gasssel

Autumn 2010
Outline

- Problem potential workforce
- Modeling performing workforce activities
- Mechanization and robotizing actions
- Realizing solutions by:
  - Analyzing activities
  - Collaborative design
Workforce & Aging Society

Youth (<15) & Potential Workforce (15-65) & Retired (>65) for Europe (27) over 1950-2060


Department of Architecture, Building & Planning / PEBE group
Workforce at the construction site
Daily activities aging society

- In the house -
Daily activities aging society

- Round the house -
Modeling performing activities

To perform activities

Based on the method SADT (Structured Analysis and Design Techniques)

(http://en.wikipedia.org/wiki/Structured_Analysis_and_Design_Technique)

Department of Architecture, Building & Planning / PEBE group
<table>
<thead>
<tr>
<th>Actions</th>
<th>People</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide strength and energy</td>
<td>Movement system:</td>
<td>Power tools:</td>
</tr>
<tr>
<td>WALKING</td>
<td>* muscles</td>
<td>* energy sources</td>
</tr>
<tr>
<td></td>
<td>* lungs</td>
<td>* transmissions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WHEELCHAIR</td>
</tr>
<tr>
<td>Receive and issue Information</td>
<td>Senses:</td>
<td>Telecommunications tools:</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>* eyes</td>
<td>* scanner</td>
</tr>
<tr>
<td></td>
<td>* ears</td>
<td>* microphone</td>
</tr>
<tr>
<td></td>
<td>* voice</td>
<td>* monitor</td>
</tr>
<tr>
<td></td>
<td>* hands</td>
<td>* keyboard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HEARING AID</td>
</tr>
<tr>
<td>Make decisions</td>
<td>Thought system:</td>
<td>Computer equipment:</td>
</tr>
<tr>
<td>TAKING MEDICINES</td>
<td>* brain</td>
<td>* computer</td>
</tr>
<tr>
<td></td>
<td>* memory</td>
<td>* software</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* artificial intelligence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EQUIPMENT WITH ALARM</td>
</tr>
</tbody>
</table>
Mechanizing and robotizing actions

Initial stage

Human actions

Equipment actions

Mechanization
Robotizing

Human actions

Equipment actions

Final stage
## Mechanizing and robotizing actions in construction

<table>
<thead>
<tr>
<th>Initial stage</th>
<th>Final stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixing sand and cement by a spade</td>
<td>Sand and cement are already mixed in the factory</td>
</tr>
<tr>
<td>Finishing a concrete floor</td>
<td></td>
</tr>
<tr>
<td>Assembling a wall panel</td>
<td></td>
</tr>
<tr>
<td>Initial stage</td>
<td>Final stage</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Vacuum the house</td>
<td>Robot</td>
</tr>
<tr>
<td>Playing with a puppet</td>
<td>Robot which reacts on voice</td>
</tr>
<tr>
<td>Stepping stairs</td>
<td>Chair lift</td>
</tr>
</tbody>
</table>

Mechanization and robotizing actions in housekeeping
The WABOT-HOUSE laboratory in Japan is a symbiotic society where robots and human beings share the same sphere of living embraced by the natural environment. The detail shows a floor adaptable system.
House as a robot

Clemson University US

Department of Architecture, Building & Planning / PEBE group
How to generate solutions

- Analyzing activities and actions
- Collaborative design
Analyzing ADL

Existing activity

Tools
Methods

- Structuring actions by SADT
- Interviews
- Photos & videos
- Multi moment measurements
- NIOSH lift index
- Human Physical load (NPR 2739)

Description activity

Human actions

Equipment actions

Department of Architecture, Building & Planning / PEBE group
Description analyzed activities

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Activity</th>
<th>Equipment used for the activity and describing its sub-activity.</th>
<th>Describing the sub-activities by people</th>
</tr>
</thead>
</table>
| 1        | Making the workplace ready   | Chair: sitting  
Newspaper: peelings storage                                                     | Choosing a comfortable working place                                 |
| 2        | Filling pan with water       | Pan: to store peeled potatoes  
Tap: water supply                                                               | Handling tap and holding pan.  
Controlling the water flow.                                                  |
| 3        | Peeling                      | Knife: peeling the potato                                                       | Controlling peeling process  
Putting the peel on the newspaper                                             |

End stage

Department of Architecture, Building & Planning / PEBE group
Scenario collaborative design

1. Describing the problem
2. (Re)formulating the design question

Creating ideas

Evaluating ideas

Engineering a solution

Working methods

Department of Architecture, Building & Planning / PEBE group
Creating ideas by working methods
Questions?