Working method to enhance end-user value for aging-in-place

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Johanna E.M.H. van Bronswijk
Outline

Problem
  Workforce & the Aging Society

Modeling activities from the perspective of robotization

Solutions
  Lessons from the construction industry

Working methods to enhance end-user values
  Analysis activities
  Design solutions
Workforce & Aging Society

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

Daily activities in the house
Daily activities round the house
Modeling activities by SADT (Structured Analysis and Design Technique)

Activity aspects:

• Physical actions

• Mental actions

• Social actions
# People & Equipment

<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>Make decisions</td>
<td>Thought system:</td>
<td>HEARING AID</td>
</tr>
<tr>
<td>TAKING MEDICINES</td>
<td>*brain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*memory</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Computer equipment:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*computer</td>
</tr>
<tr>
<td></td>
<td></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>
Mechanization & robotization concept

Initial stage

Human actions | Equipment actions

Mechanization & robotization

Final stage

Human actions | Equipment actions
Lessons from the construction industry
<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>
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
How to generate end-user values

- Analyzing activities and actions
- Collaborative design
Analyzing ADL

Existing activity

Description activity

Tools
Methods

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

Human actions

Equipment actions
Analyzing peeling potatoes
Peeling potatoes
# Analyzing 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>
<tbody>
<tr>
<td>1</td>
<td>Making the workplace ready</td>
<td>Chair: sitting</td>
<td>Choosing a comfortable working place</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Newspaper: peelings storage</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Filling pan with water</td>
<td>Pan: to store peeled potatoes</td>
<td>Handling tap and holding pan.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tap: water supply</td>
<td>Controlling the water flow.</td>
</tr>
<tr>
<td>3</td>
<td>Peeling</td>
<td>Knife: peeling the potato</td>
<td>Controlling peeling process</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Putting the peel on the newspaper</td>
</tr>
</tbody>
</table>

## End stage
Collaborative design

- Scenario
- Control
- Aim
- Result
- Designers
- Working methods
Scenario collaborative design

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

Creating ideas

Evaluating ideas

Engineering a solution

Working methods
Ruimte maken met behulp van werkvormen
**Initial stage**

- Old chimney on the roof
- New chimney on the ground
- Pre-fab chimney

**Requirements**

1. Working method suitable for about 100 chimneys in one street
2. Maximum renovation time: four hour per chimney
3. Safe working place on the roof

**Wishes**

1. Minimal costs
2. Minimal time

---

**End stage**

- New chimney on the roof
- Demolished chimney in rubble container

**Characteristics**

- New chimney on the roof
- Demolished chimney in rubble container
<table>
<thead>
<tr>
<th>Werkwijze I</th>
<th>Werkwijze II</th>
<th>Werkwijze III</th>
<th>Werkwijze IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1 WERKPLEK BEREIKBAAR MAKEN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F2 SCHOORSTEEN PIP</td>
<td>PROP</td>
<td>LUCHT BAL</td>
<td>EMMER</td>
</tr>
<tr>
<td>SCHOON HOUDEN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F3 OUDEN SCHOORSTEEN SLOPEN</td>
<td>BOORHAMER SLOPEN</td>
<td>KRAANKLEM</td>
<td>OMDUWEN</td>
</tr>
<tr>
<td>F4 OUDEN SCHOORSTEEN AFWEREN</td>
<td>LIFT BAK</td>
<td>KRAAN BAK</td>
<td>STARTKOEER BAK</td>
</tr>
<tr>
<td>F5 NIEUWE SCHOORSTEEN AANVOEREN</td>
<td>KRAAN</td>
<td>VERREIKER</td>
<td>TRANSPORTEUR</td>
</tr>
<tr>
<td>F6 NIEUWE SCHOORSTEEN PLAATSEN</td>
<td>STEELLOPSES</td>
<td>VERREIKER</td>
<td></td>
</tr>
<tr>
<td>F7 VERPLAATSEN WERKPLEK</td>
<td>AFBREKEN OP BOUWEN</td>
<td>VERPLAATSEN</td>
<td></td>
</tr>
</tbody>
</table>

Diagrammen: A en B
Solution in practice
Conclusion
Select the suitable working methods to enhance end-user values

Questions?
A humanoid robot named Chrome-kid picks up a tee-shirt from a laundry basket to fold it during the housekeeping robot contest in Kawasaki in Kanagawa prefecture, suburban Tokyo on August 17, 2008. 15 hand-made robots participated the preliminary competition and will be vying for the total prize of money 1 million yen in the final next month.
Architectural robots

http://www.youtube.com/watch?v=MjunOm0oLuA
http://www.youtube.com/watch?v=s1E3AtnlS5g
http://www.youtube.com/watch?v=-k2j2WKaMws
http://www.metacafe.com/watch/2395592/interactive_toilet_itoi_demonstration_video/
# Form to report activities

**Washing hands**

## Initial stage

**Dirty hands, tablet of soap, water**

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<thead>
<tr>
<th>Sequence</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moisten the hands</td>
<td><strong>Tap</strong>: delivering water</td>
<td>Turning on and off the tap</td>
</tr>
<tr>
<td>2</td>
<td>Soaping the hands</td>
<td><strong>Tablet of soap</strong>: delivering soap</td>
<td>Rubbing the soap</td>
</tr>
<tr>
<td>3a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## End stage

**Clean hands, dirty water**
Activities of Daily Living (ADL)

The current model seeks to define 'what living means' (Roper et al, 2000, p15) and it breaks it down into the following categories:

- Maintaining a safe environment
- Breathing
- Eating and drinking
- Communication
- Elimination
- Washing and dressing
- Controlling temperature
- Mobilization
- Working and playing
- Expressing sexuality
- Sleeping
- Death and dying


[http://books.google.co.uk/books?id=RJ21IkAZQQ4C](http://books.google.co.uk/books?id=RJ21IkAZQQ4C).

De baas denkt een flink eind vooruit, vrees ik.
VIDEO’s

http://world.honda.com/ASIMO/

http://www.youtube.com/watch?v=gfVZnGiG-rw

http://www.robotics.usc.edu/?l=Robots:Movies

http://www.twarobotics.nl/
ASIBOT is portable assistive robot for elderly and disease people bringing more freedom in daily tasks as eating, drinking, shaving, make up, tooth cleaning, etc. The robot is under experimentation in the National Hospital of Paraplegics in Toledo.