ISG*ISARC2012

Testing a working method for designers to solve problems with activities of daily living

Frans J.M. van Gassel

TU/e Technische Universiteit Eindhoven University of Technology

Where innovation starts

Outline

Problem

- Workforce & the Aging Society

Modeling activities from the perspective of robotization

Solutions

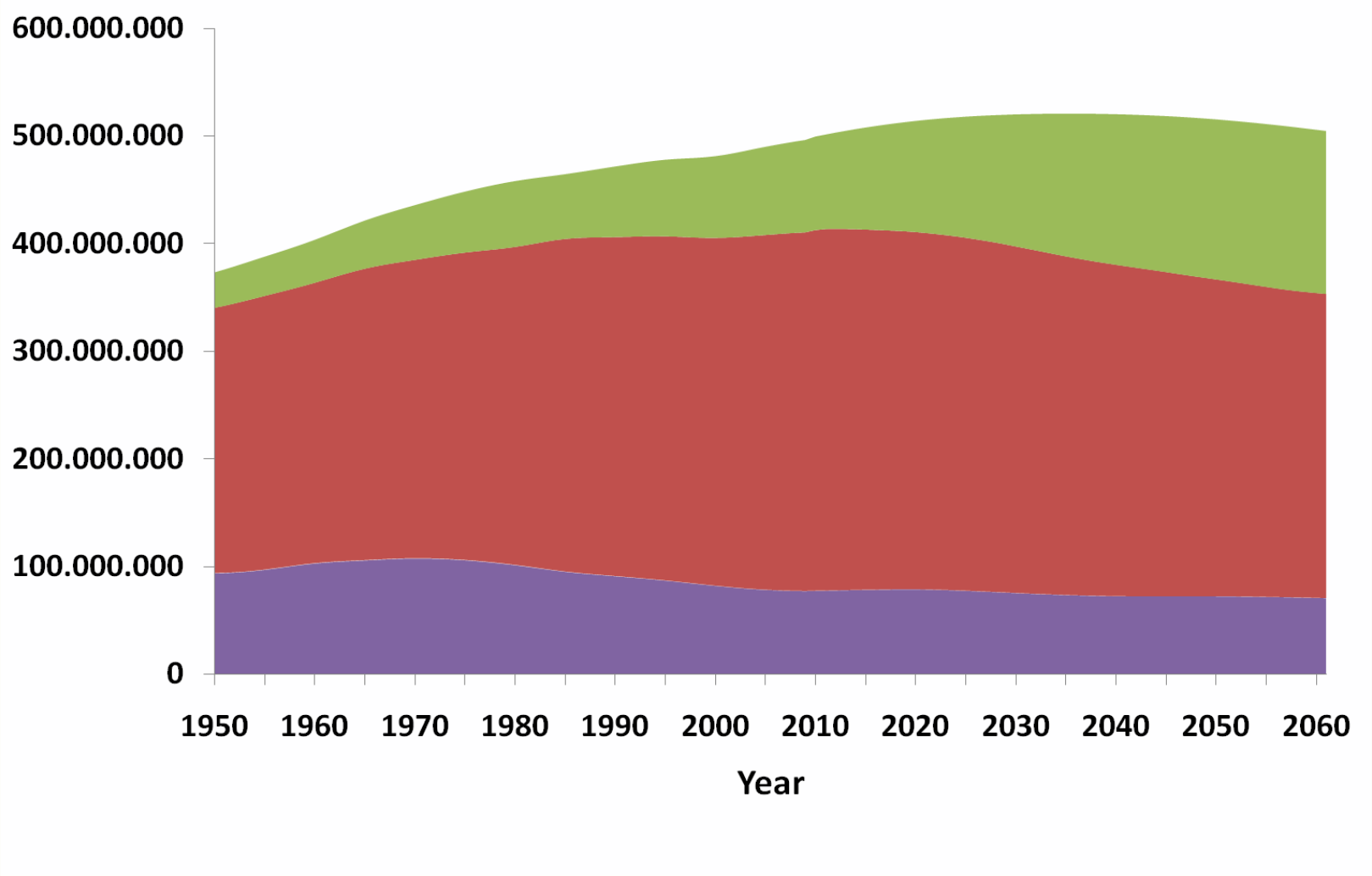
- Lessons from the construction industry

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

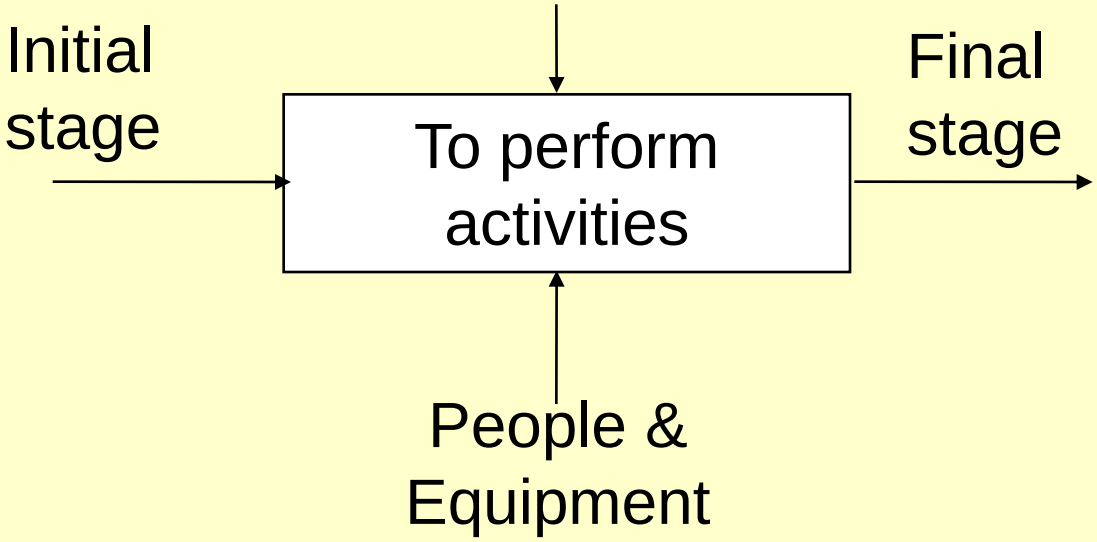


United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2008 Revision, CD-ROM edition; 2009; http://unstats.un.org/unsd/demographic/products/socind/population.htm; retrieved February 2010

Daily activities in the house

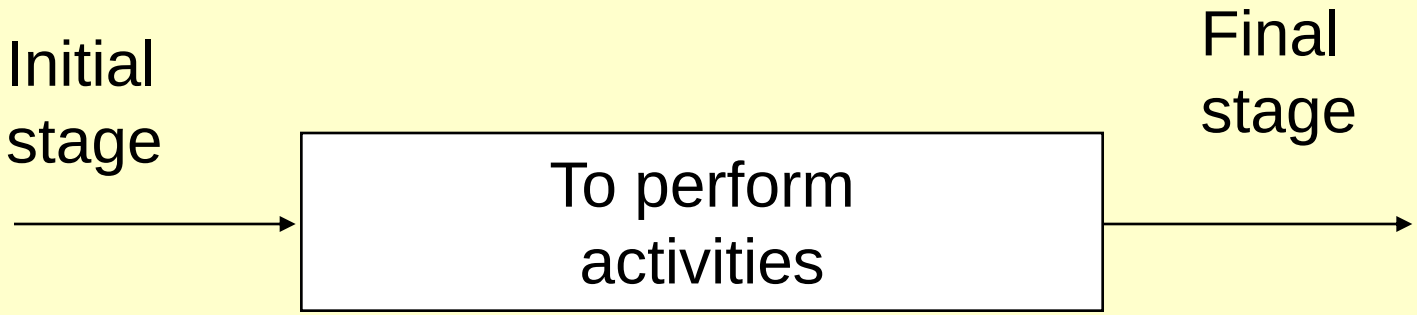
Daily activities round the house

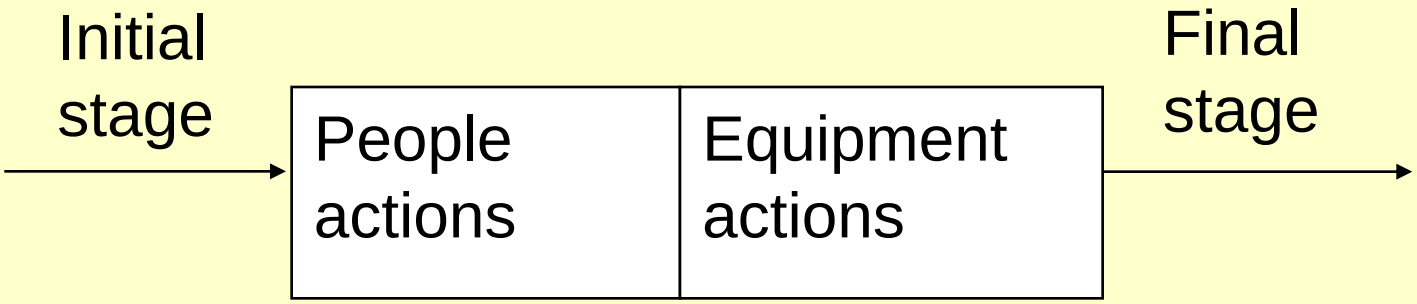
Modeling activities by SADT (Structured Analysis and Design Technique)



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

People and equipment actions





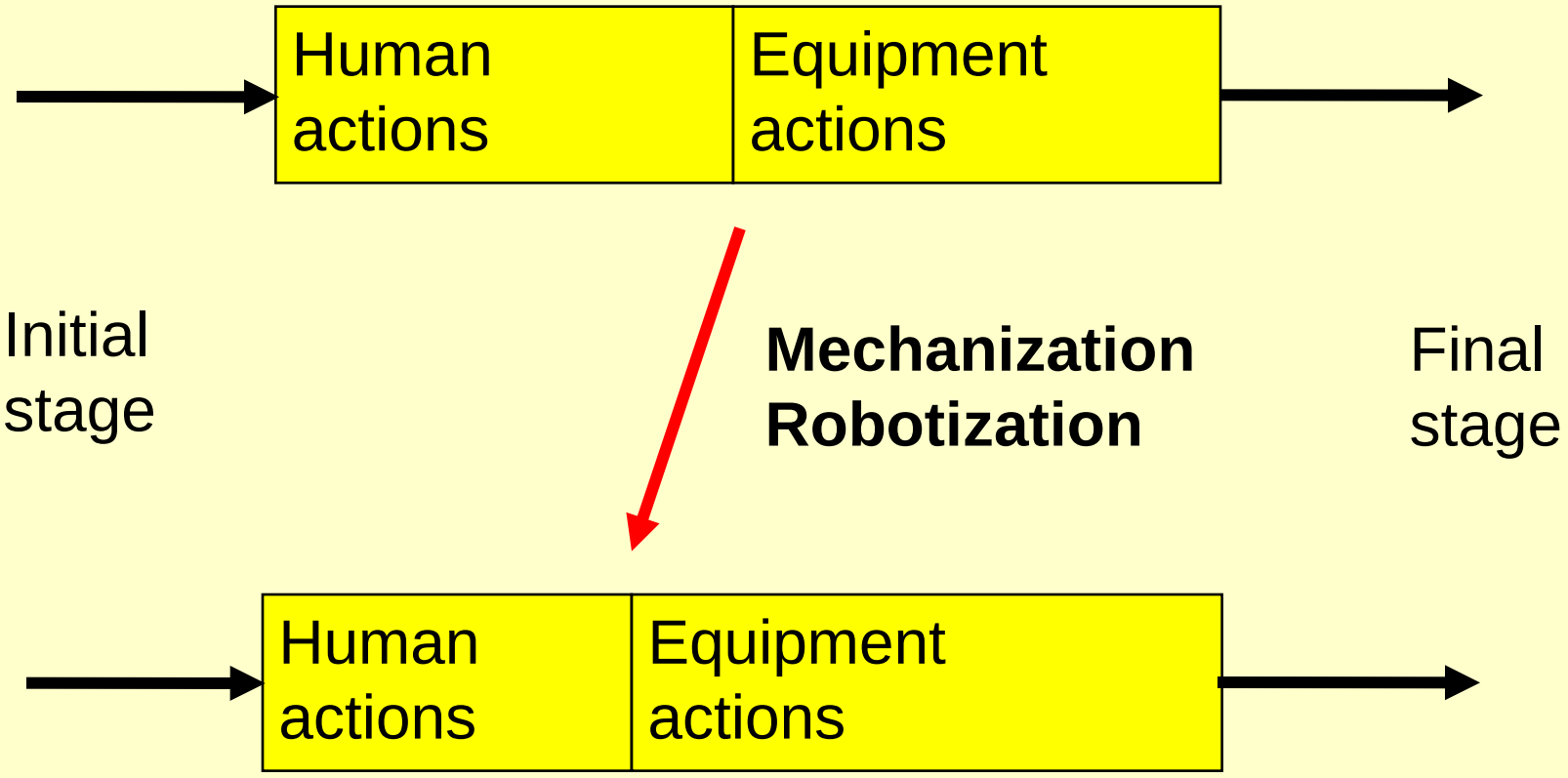
Activity aspects:

- Physical actions
- Mental actions
- Social actions

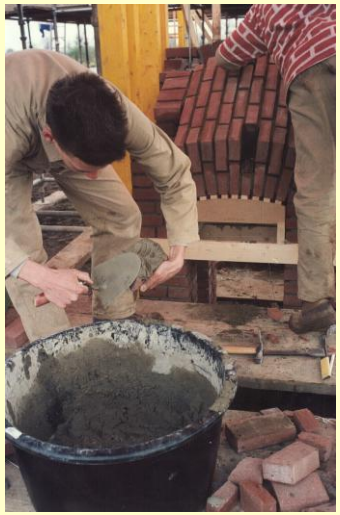
People & Equipment

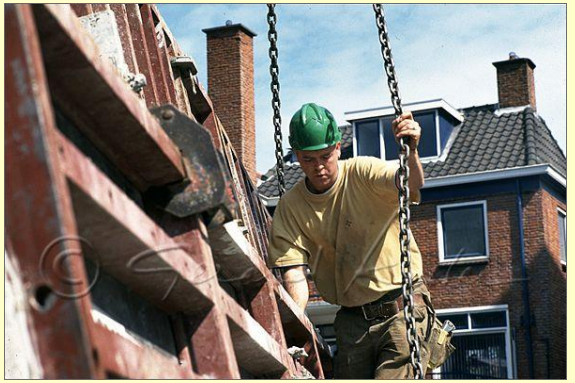
Actions	People	Equipment
Provide strength and energy WALKING	Movement system: *muscles *lungs	Power tools: *energy sources *Transmissions WHEELCHAIR
Receive and issue Information DISCUSSION	Senses: *eyes *ears *voice *hands	Telecommunications tools: *scanner *microphone *monitor *keyboard HEARING AID
Make decisions TAKING MEDICINES	Thought system: *brain *memory	Computer equipment: *computer *software *artificial intelligence EQUIPMENT WITH ALARM

Mechanization & robotization concept



Lessons from the construction industry





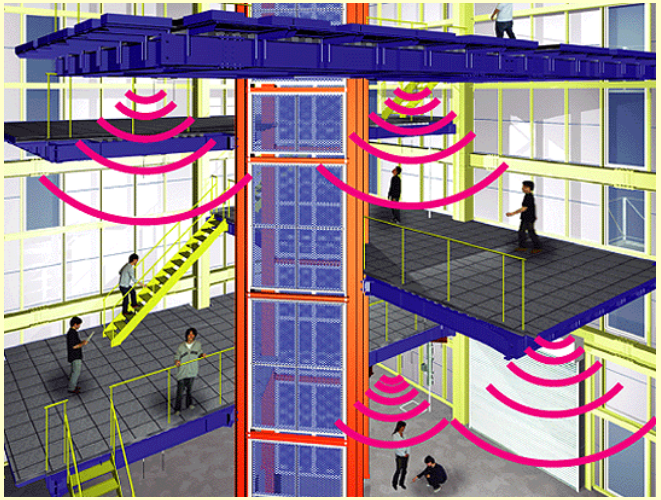
Mechanization & robotization concepts in construction

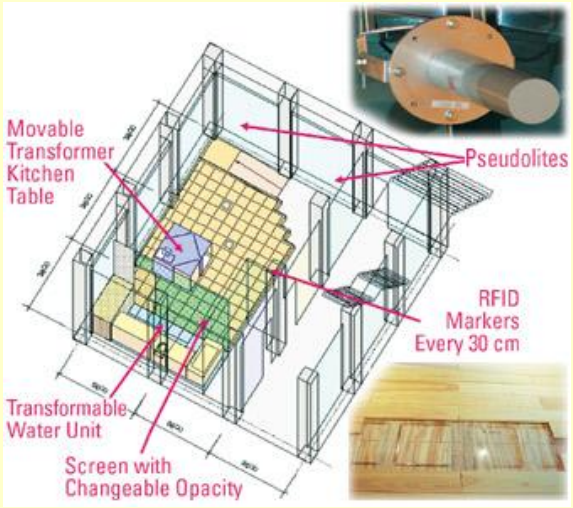
Initial stage		Final stage	
	Mixing sand and cement by a spade		Sand and cement are already mixed in the factory
	Finishing a concrete floor		
	Assembling a wall panel		

Mechanization & robotization concepts in housekeeping

Initial stage		Final stage	
	Vacuum the house		Robot
	Playing with a puppet		Robot which reacts on voice
	Stepping stairs		Chair lift

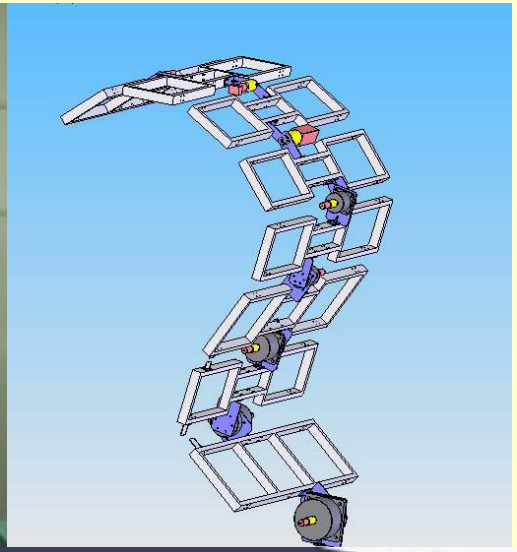
House as a robot





*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.*

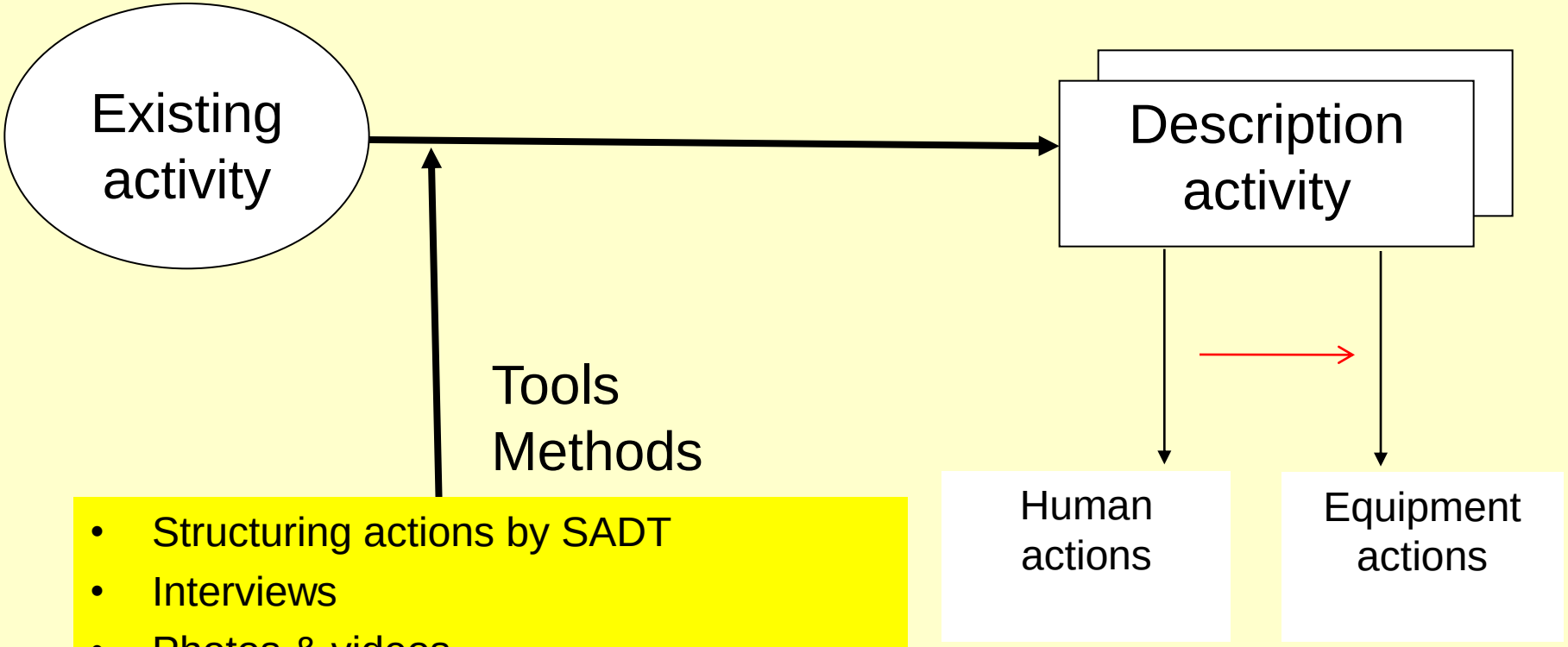
House as a robot



How to generate end-user values

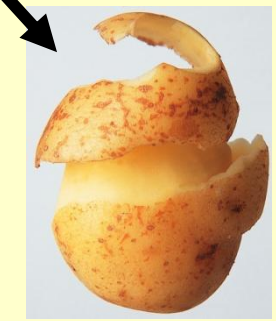
- Analyzing activities and actions
- Collaborative design

Analyzing ADL



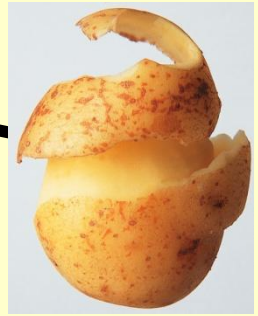
- Structuring actions by SADT
- Interviews
- Photos & videos
- Multi moment measurements
- NIOSH lift index
- Human Physical load (NPR 2739)

Analyzing peeling potatoes



Exercise analyzing Activity Daily Living

Peeling potatoes



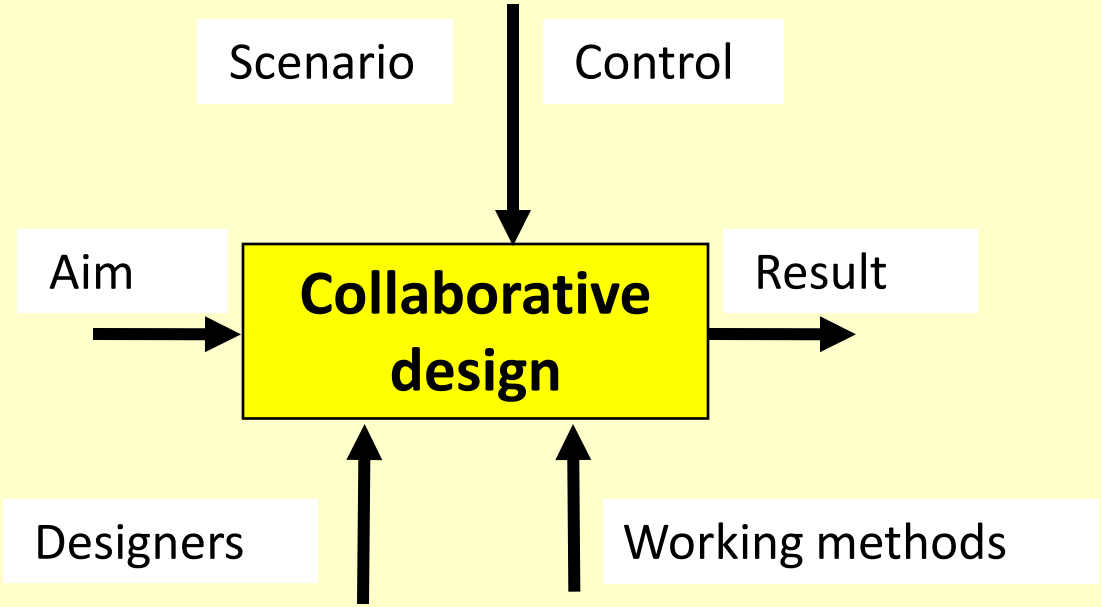
Analyzing activities

Initial stage

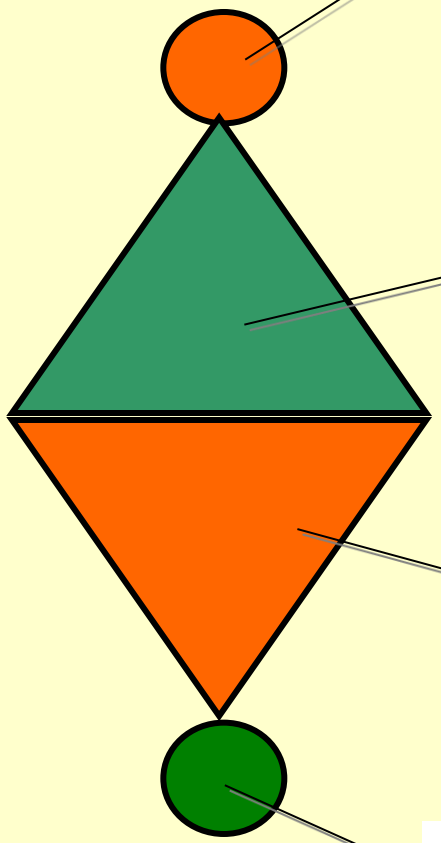
Sequence	Activity	Equipment used for the activity and describing its sub-activity.	Describing the sub-activities by people
1	Making the workplace ready	Chair: sitting Newspaper: peelings storage	Choosing a comfortable working place
2	Filling pan with water	Pan: to store peeled potatoes Tap: water supply	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

Collaborative design



Scenario collaborative design



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

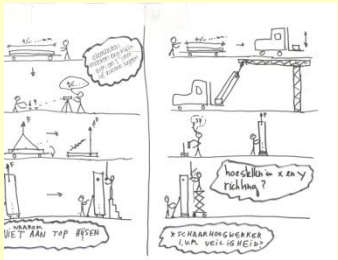
Creating ideas

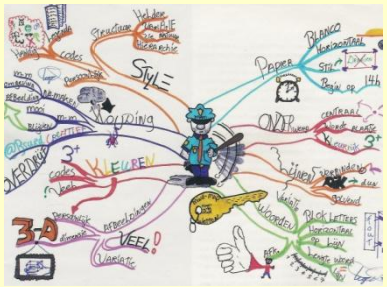
Evaluating ideas

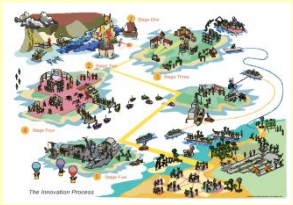
Engineering a solution

Working methods

Ruimte maken met behulp van werkvormen

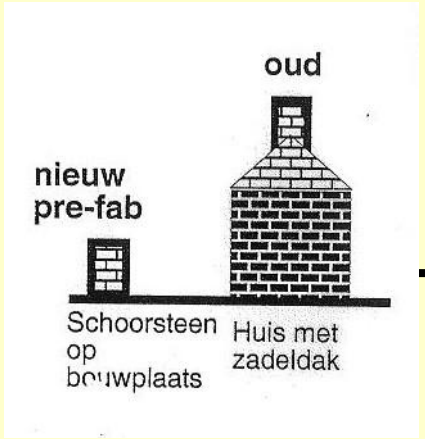






Designing an improved activity

Initial stage



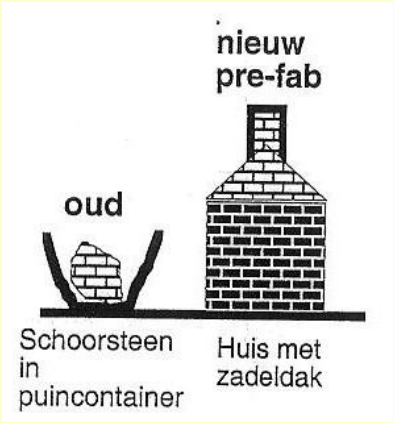
Replacing chimneys

Action 1

Action 2a

Action 2b

End stage



Characteristics initial stage

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

Requirements

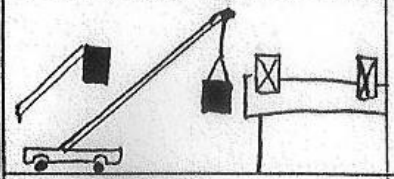
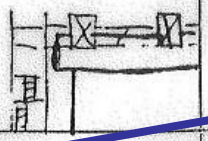
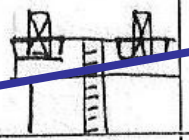
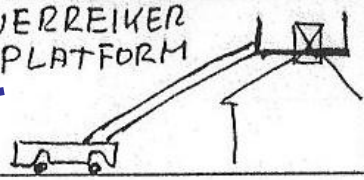
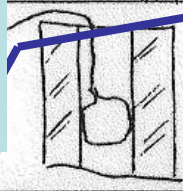
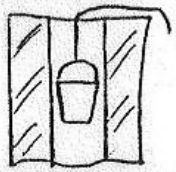
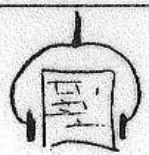
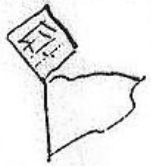
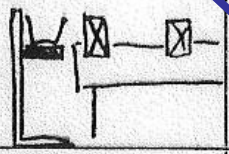
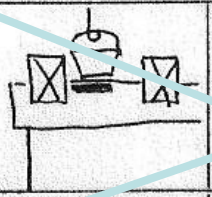
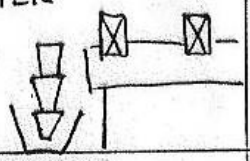
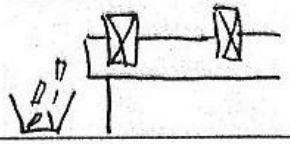
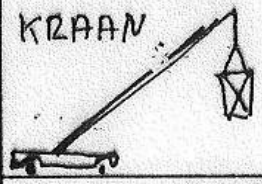
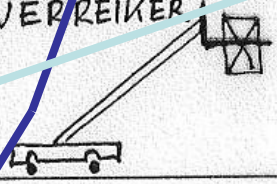
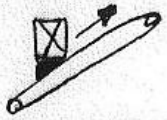
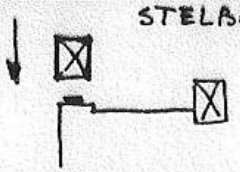
1. Working method suitable for about 100 chimneys in one street
2. Maximum renovation time: four hour per chimney
3. Safe working place on the roof

Wishes

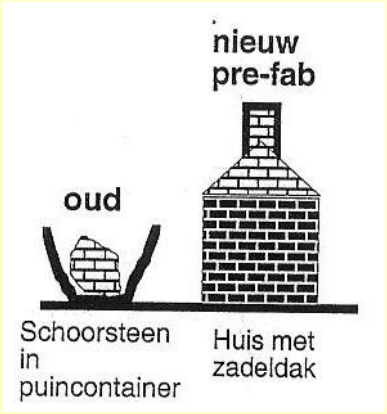
1. Minimal costs
2. Minimal time

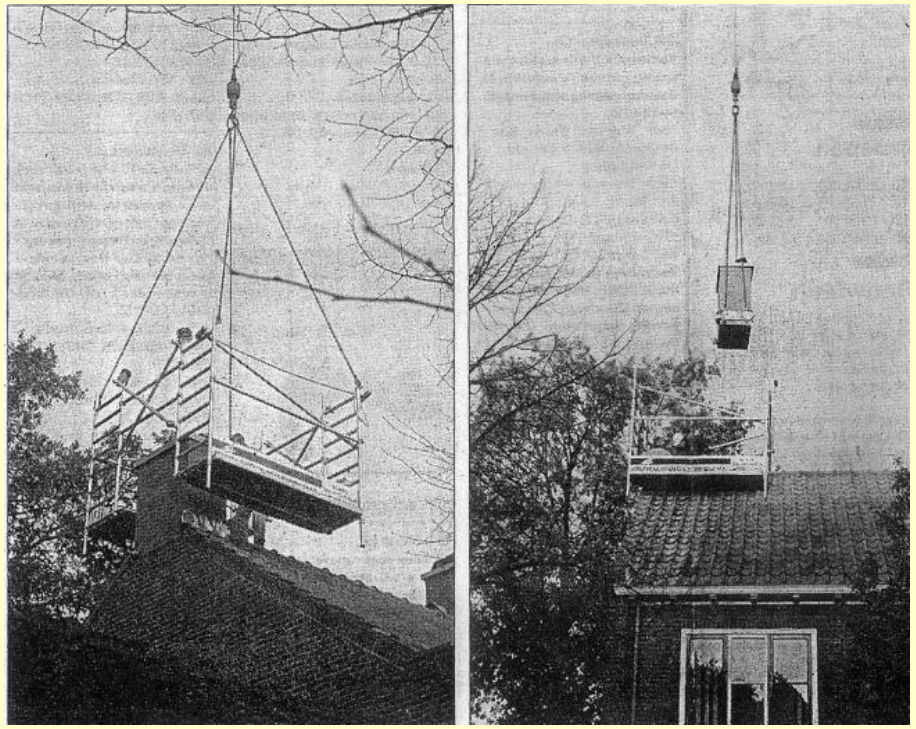
Characteristics end stage

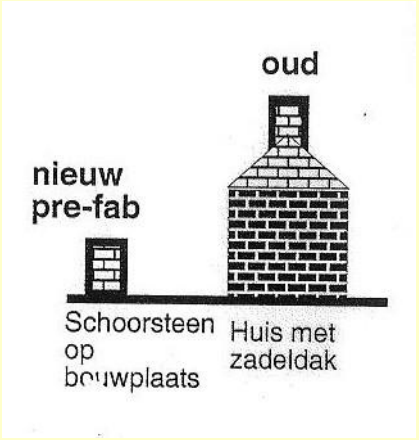
- New chimney on the roof
- Demolished chimney in rubble container

	Werkwijze I	Werkwijze II	Werkwijze III	Werkwijze IV
F1 WERKPLEK BEREIKBAAR MAKEN		STEIGER 	PLATFORM LADDER 	VERREIKER PLATFORM 
F2 SCHOORSTEEN PIJP SCHOON HOUDEN	 PROP	 LUCHT BAL	 EMMER	
F3 OUDE SCHOORSTEEN SLOPEN	BOORHAMER SLOPEN	KRAAN KLEM 	OMDUWEN 	
F4 OUDE SCHOORSTEEN AFVOEREN	LIFT BAK 	KRAAN BAK 	STORTKOKER BAK 	GOOIEN 
F5 NIEUWE SCHOORSTEEN AANVOEREN	KRAAN  B	VERREIKER 	TRANSPORTEUR 	
F6 NIEUWE SCHOORSTEEN PLAATSEN	STELBLOKJES 			
F7 VERPLAATSEN WERKPLEK	AFBREKEN OPBOUWEN	VERPLAATSEN A		

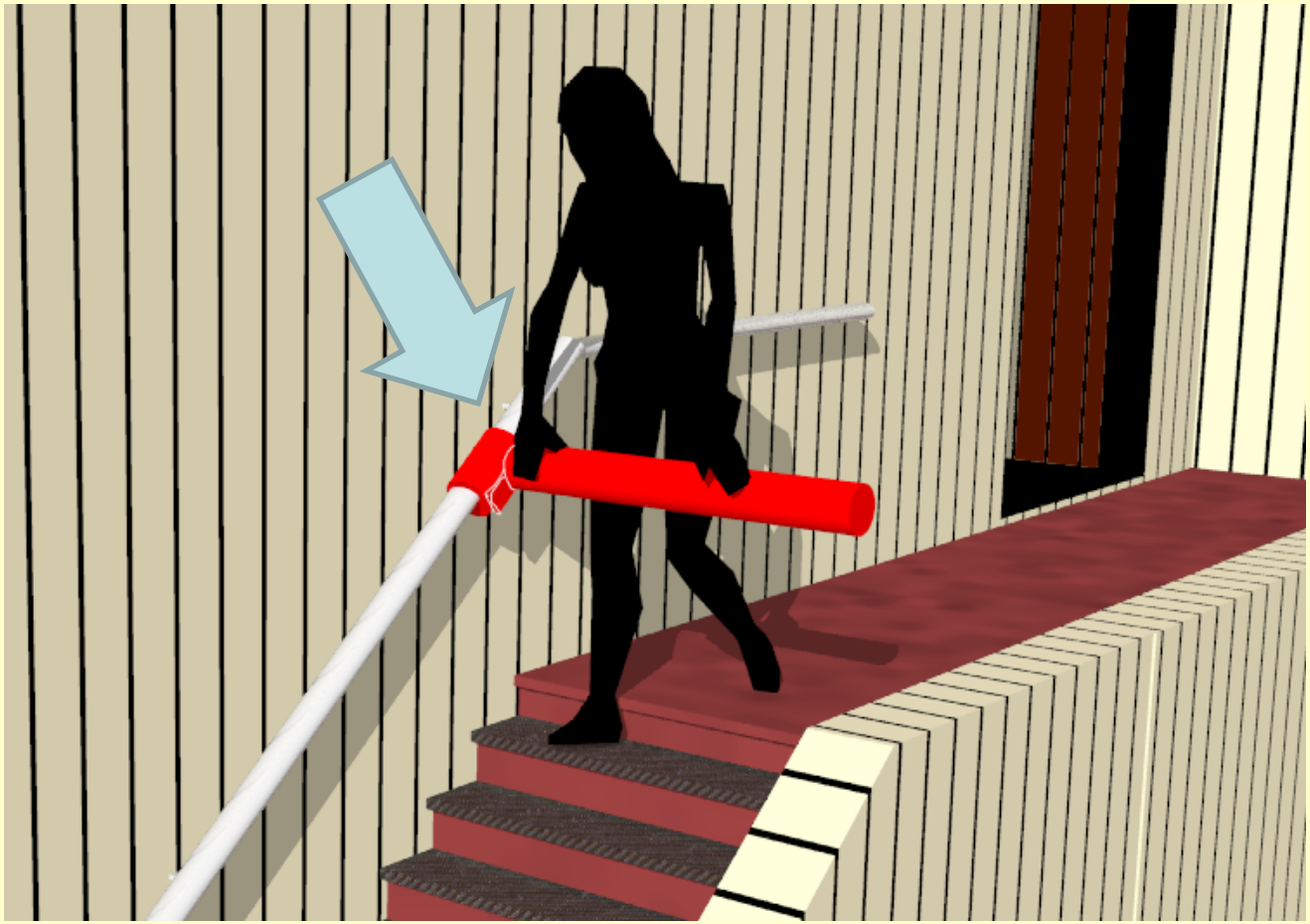
Solution in practice







Scenario



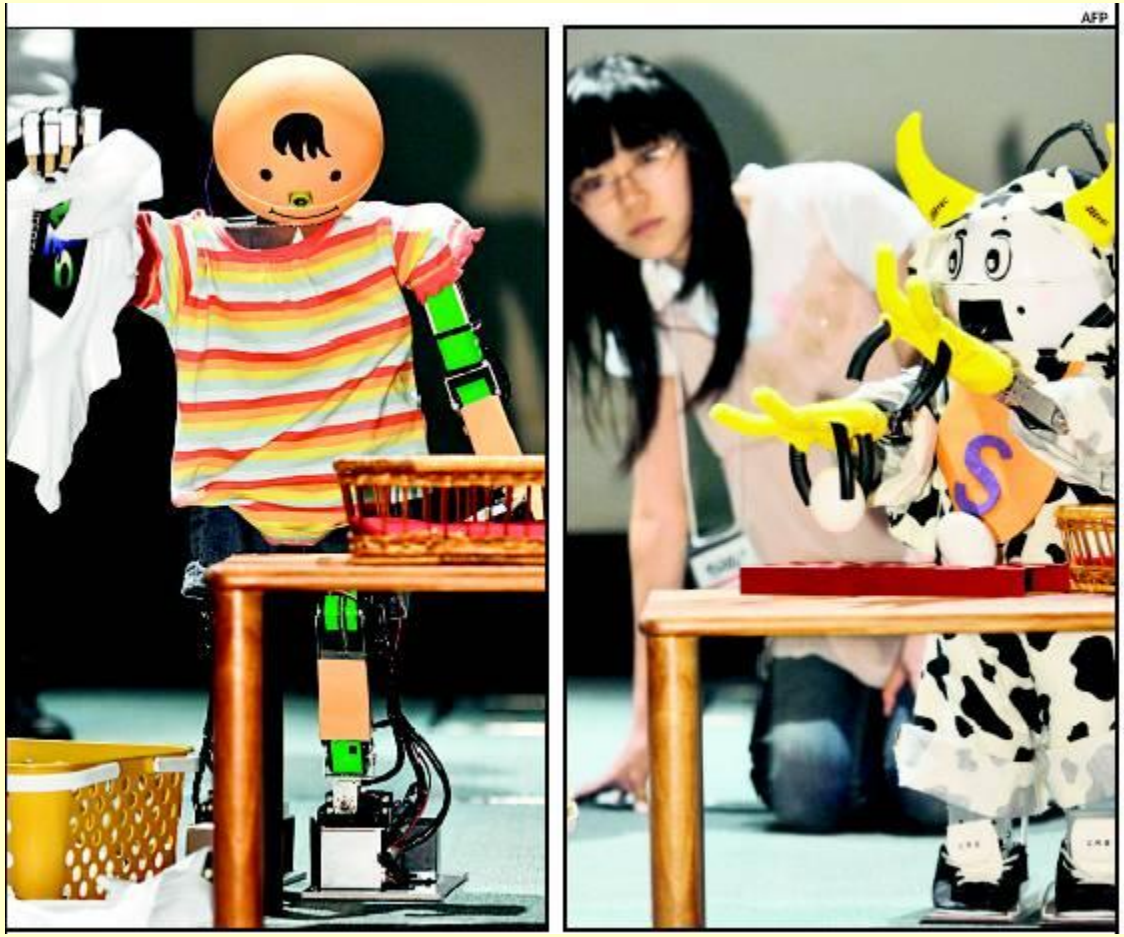
Conclusion

Select the suitable working methods to enhance end-user values

Questions?

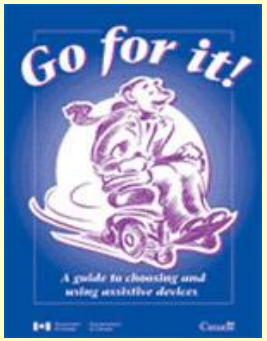
Cleaning windows

Connecting to water	Tap water	Bucket with water	Through hose	Reservoir	Water-butt	All-in-one unit
Adding detergent	All-in-one unit	Empty a bottle in bucket	Disolving tablet	Spraying glassex on window	In windows integrated detergent nozzle (like a car)	
Cleaning windows with sponge	Sponge with detergent	Sponge on a stick	Sponge on a water hose	Magnetic sponge system for cleaning windows inside and outside at the same time	Robotic sponge	Dirt repellant windows
Swiping windows	Wipers	Rail with wipers	Wiper on a stick	Magnetic wipe system for wiping windows inside and outside at the same time	Robotic wiper	Self drying windows
Drying windows with chamois	Chamois on stick	Magnetic chamois for drying windows inside and outside at the same time	Robotic chamois	Chamois on a rail	Self drying windows	
Reaching high places	Robotic system	Magnetic system	Using a long stick	Rail	Elevator	Platform
Reaching lower places	Parapet of 1m	Magnetic system	Using a stick	Rail	Robotic system	Tilted window
Drying difficult corners	Tilted window	Robotic system	Chamois wich forms around corner	Rail	Self drying windows	Blowing hot air alongside the corners



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**

Sequence	**Activity**	**Equipment used for the activity and describing its sub-activity.**	**Describing the sub-activities by people**
1	Moisten the hands	**Tap:** delivering water	Turning on and off the tap
2	Soaping the hands	**Tablet of soap**: delivering soap	Rubbing the soap
3a			
3b			

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

Roper N., Logan W.W. & Tierney A.J. (2000). *The Roper-Logan-Tierney Model of Nursing: Based on Activities of Living*. Edinburgh: Elsevier Health Sciences. ISBN 0443063737. http://books.google.co.uk/books?id=RJ21IkAZQQ4C.


DE BAAS DENKT EEN FLINK EIND VOORUIT, VREES IK
WIEGEL

VIDEO's

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

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

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

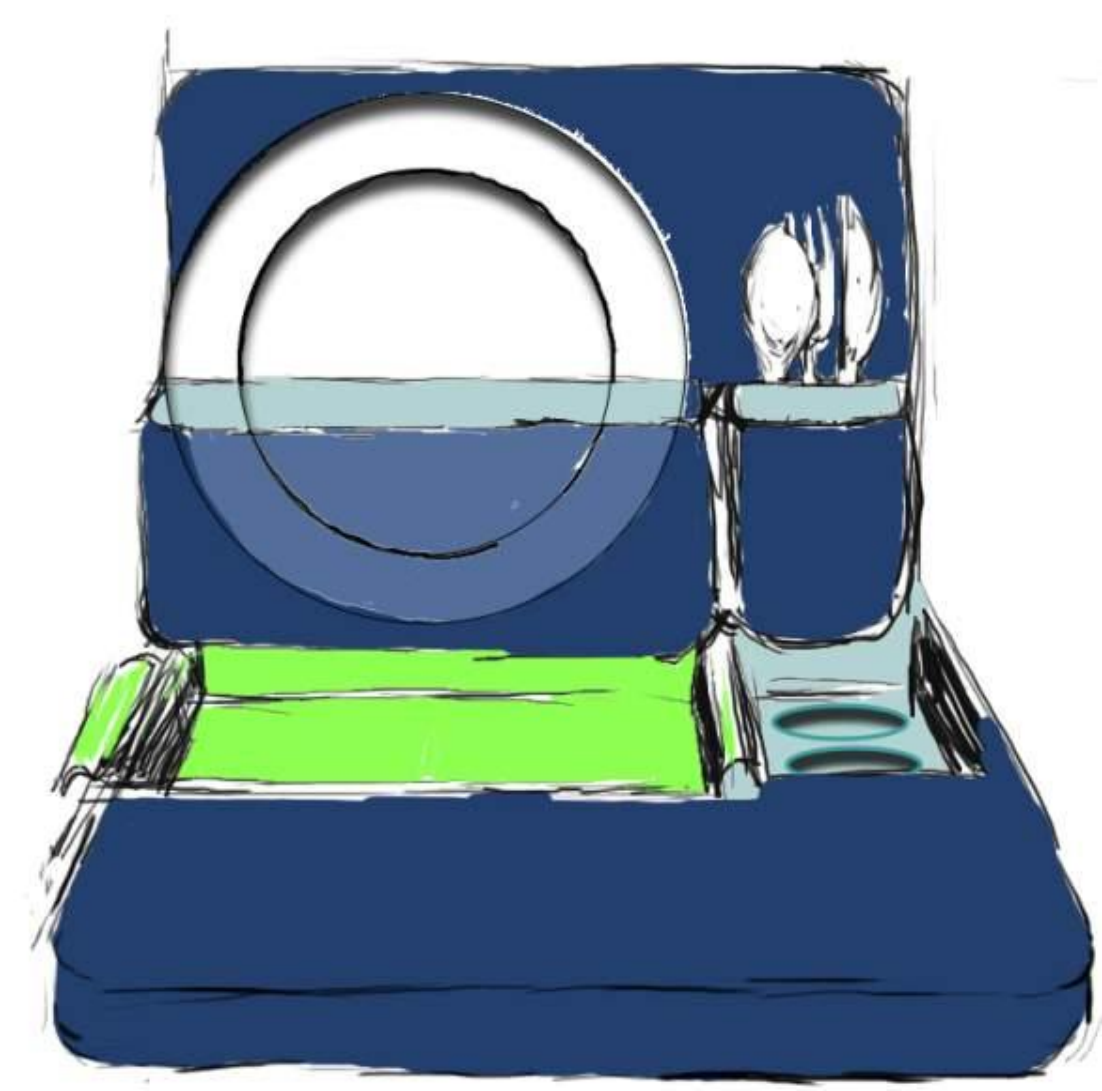
http://www.twarobotics.nl/

Mechanization & robotization ADL

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.

Paro

Result rollator

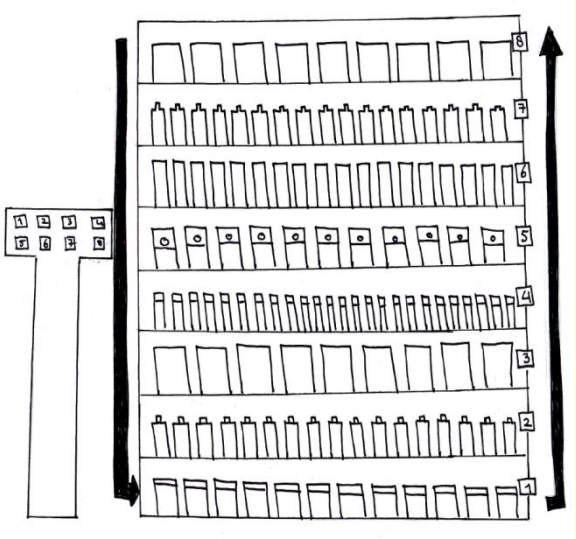


Rollator:

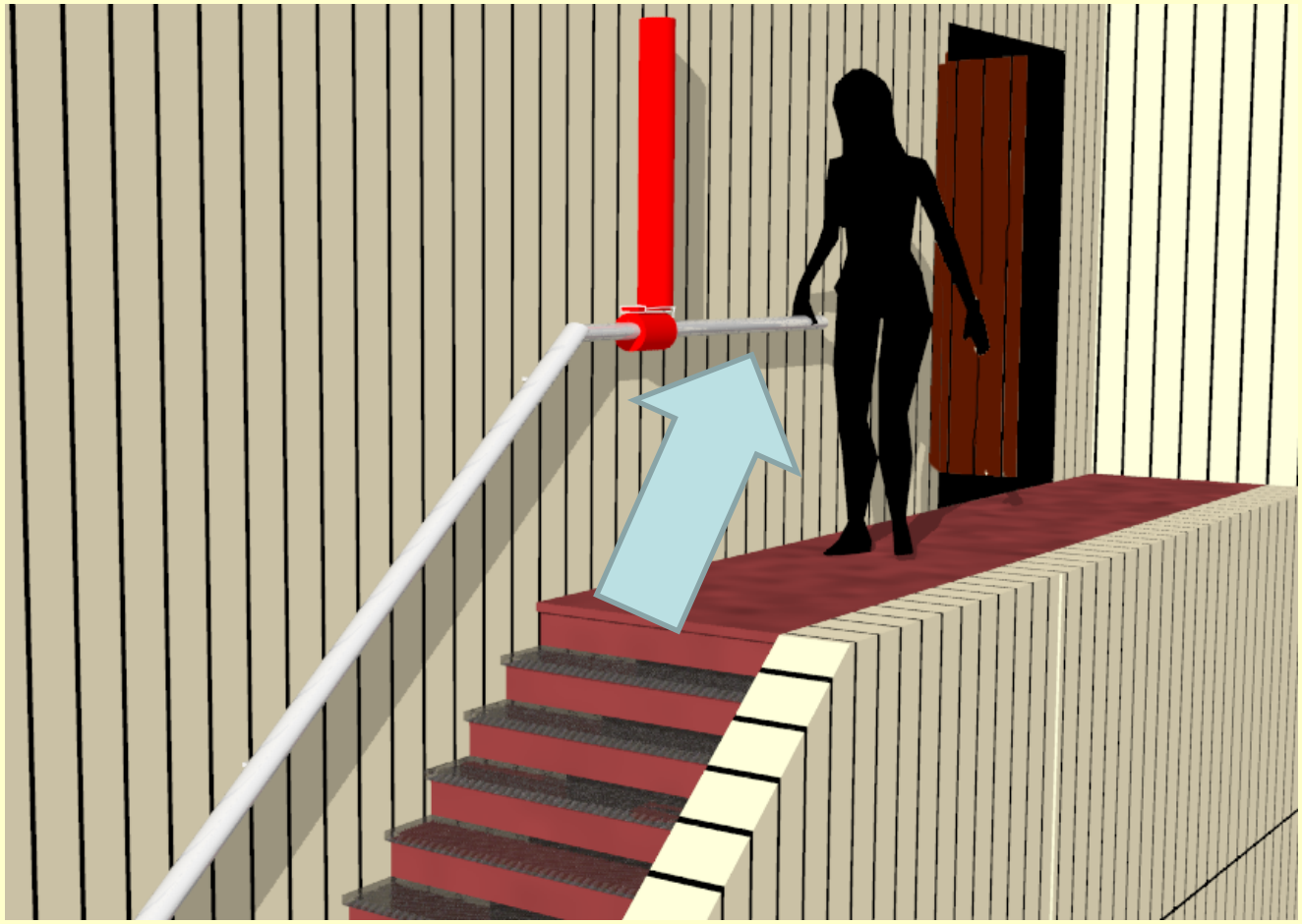
- Unfoldable tray
- Feedforward by means of physical shapes
- Elastic bands to fixate, like a picnic basket

Final solution

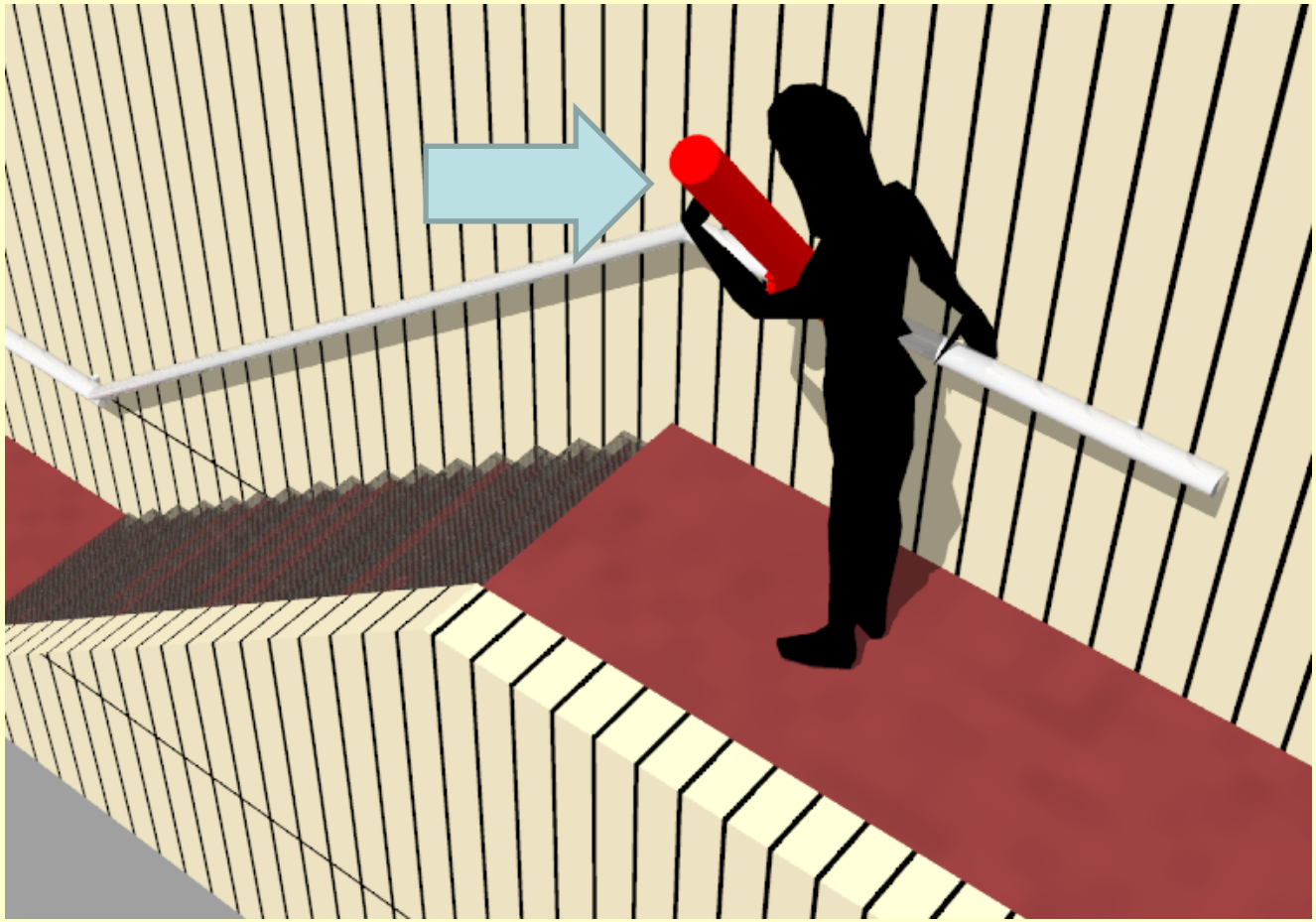
Initial stage	Morphological method	End stage
Standing in front of the shelf, without peanut butter	Type in the number of the desired shelf and the shelves rotates so the desired product is a reaching height. Take the product and put it in the shopping cart	Peanut butter in the shopping cart.



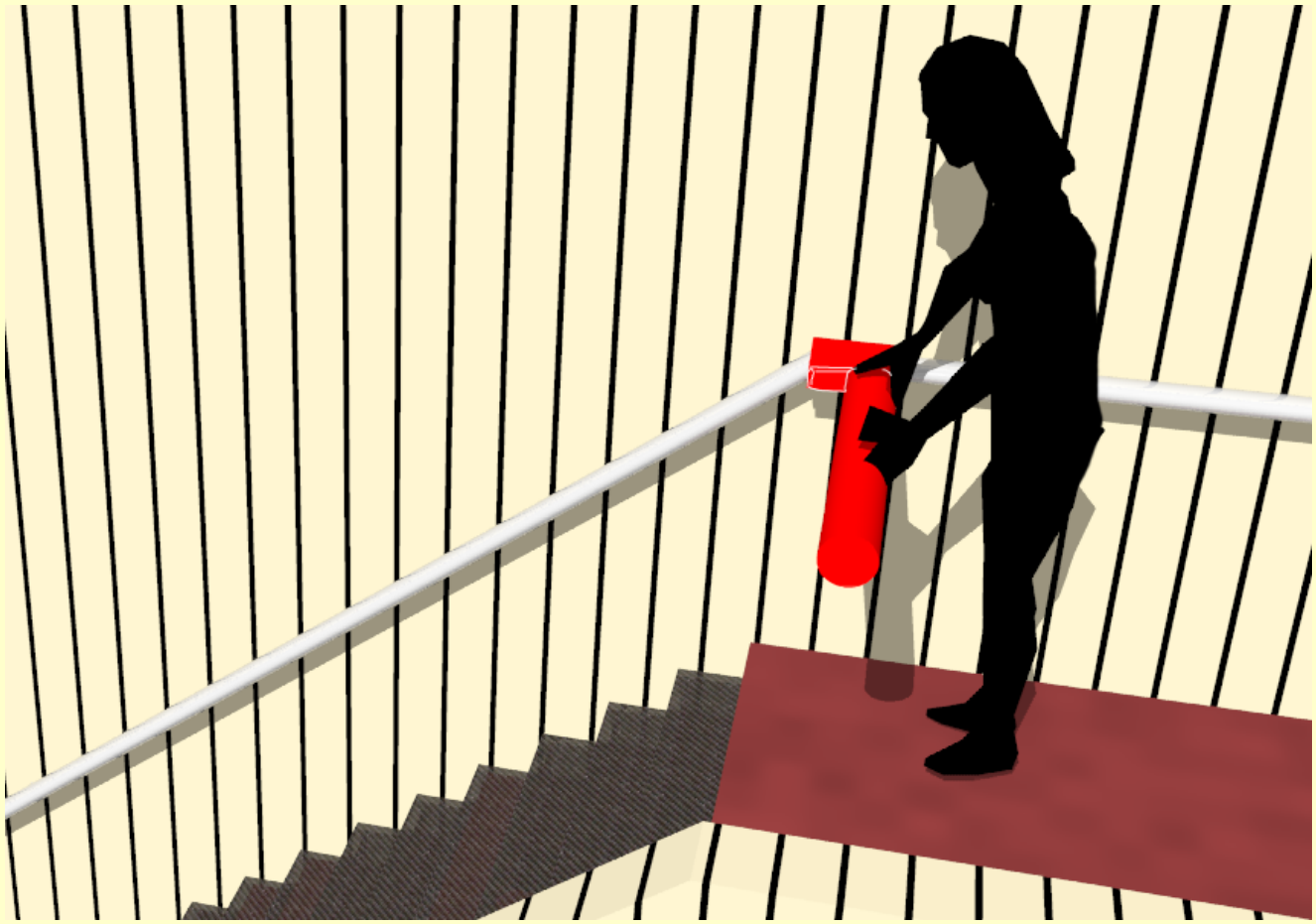
Scenario



Scenario

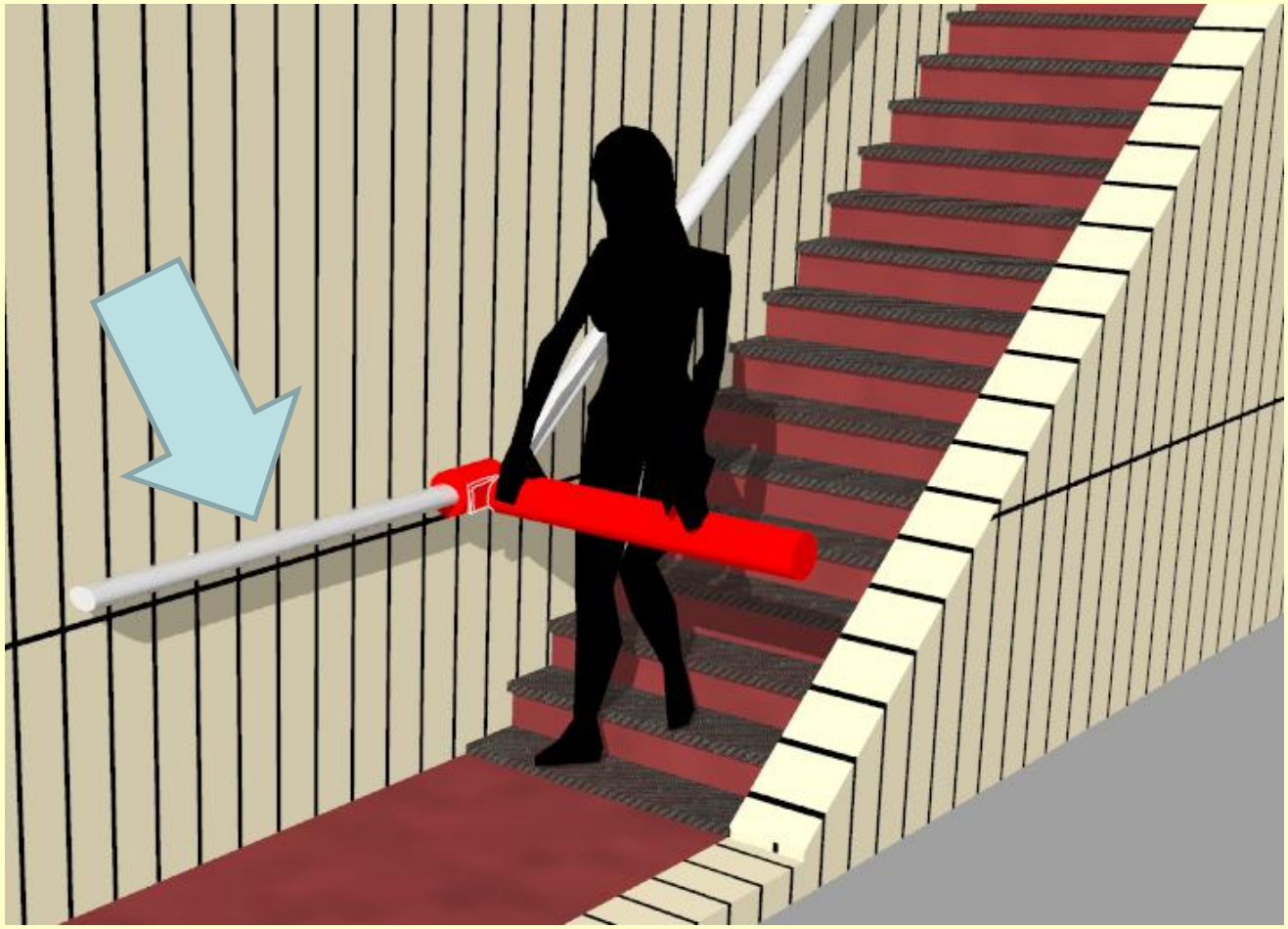


Scenario



Scenario

Scenario



Scenario

Scenario