

Human Factors

**Ambient Design**

**for**

**Aging Society**

Chair for Building

Realization and Robotics

Thomas Bock, Technische

Universität München (TUM)



# Existing Situation in German Care Facilities







Flüssigkeitszufuhr weniger als 1.000 ml pro Tag  
Flüssigkeitszufuhr weniger als 700 ml pro Tag  
Bei demenzieller Erkrankung: Zwischen- und Spätmahlzeit(en) werden verabreicht bzw. angeboten  
Keine Maßnahmen erforderlich (Hdz.)  
Maßnahmen / Prophylaxen siehe Pflegeplanung zu ATL 4 (Hdz.) *Stu. Du Bc*

Name: *Rapp Maere*  
Jahr: *2010* Nr. *25*

### Körperpflege

Dat.	Nr.	a) Probleme	b) Ressourcen	Ziele	über- prüfen Am	Hdz.	Kenn- zeichnung Maßnahmen	Maßnahmen	Hdz.	Dat.	Ergebnis	Hdz.
	11.5	alt u. komplizierte Wunde						(i) (ii) Ganzkörperwäsche am Waschbecken (1/1-1-1)				
	11.6	Alte Person hat sich nicht Hilfsbedarf hat sich ver- mindert, aber ohne Hilfe geht es nicht						(iii) (iv) Teilwäsche unter- körper am Waschbecken (1-1/1-1)				
	11.7	hat intakte Haut, kann sich selbst und Hände selbst waschen						(v) Hfg am Waschbecken (1-1/1-1)				
	11.8	hat Zahnteilprothesen sieht sie selber ein, eigene Zähne putzt sie selber						(vi) Duschen & wöchentlich u. Pfau				
	11.9	Wäsche wird in Wappelle gesammelt und von Tochter zu Hause gewaschen						(vii) Kämmen (2/2/1-1)				
	11.10							(i) (ii) Zahnpflege (1/1/1-1) - Prothesen reinigen - Mund spülen				
	11.11							(viii) Rasieren n. Bedarf				

Planungsblatt 3134  
Behandlungspflege 5514

















# Transfer Systems Ceiling





# Homemaking and Entertainment Robots (Home Service Robots)

- **Edutainment robots** are designed to amuse, communicate, perform simple tasks in the household – they can also be used as a control interface (for example Wakamura)
- **Homemaking Robots** are robots which take over simple tasks as cleaning, transporting of objects or informing about intruders or the pets' well-being

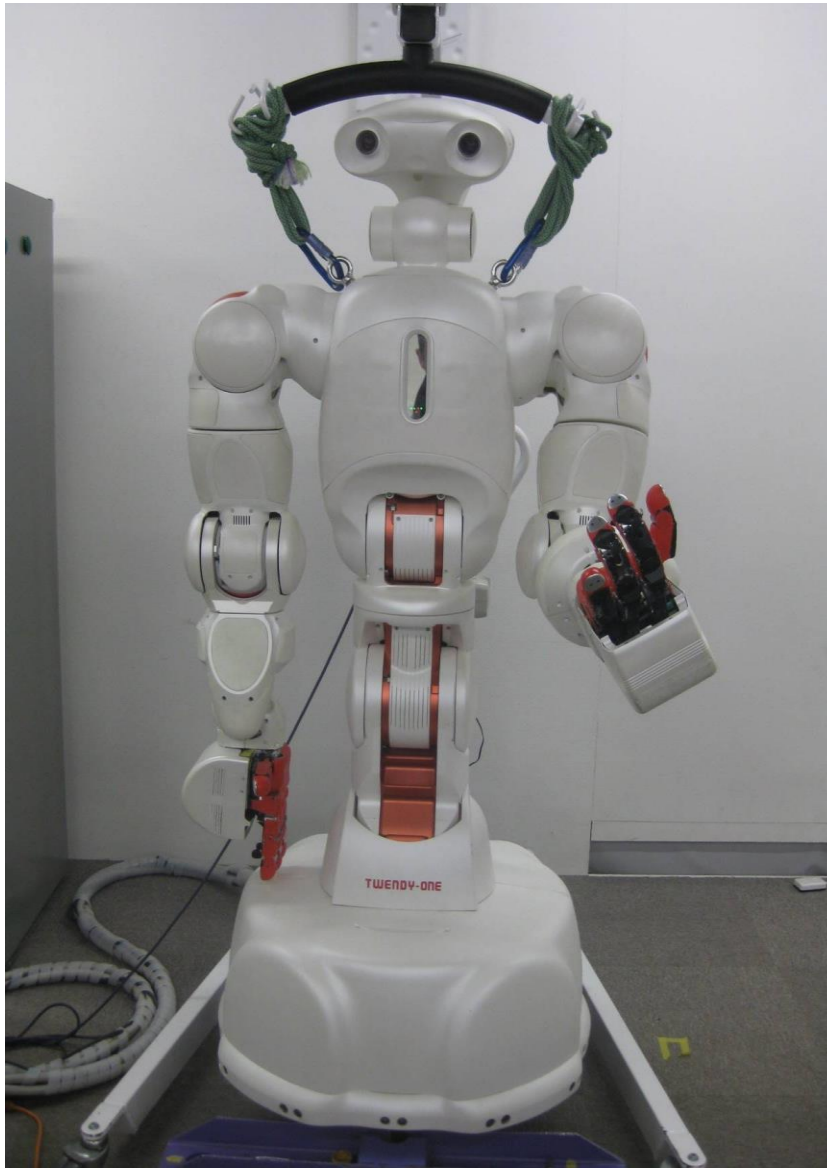


## Concept of future city - technological development

### Health care

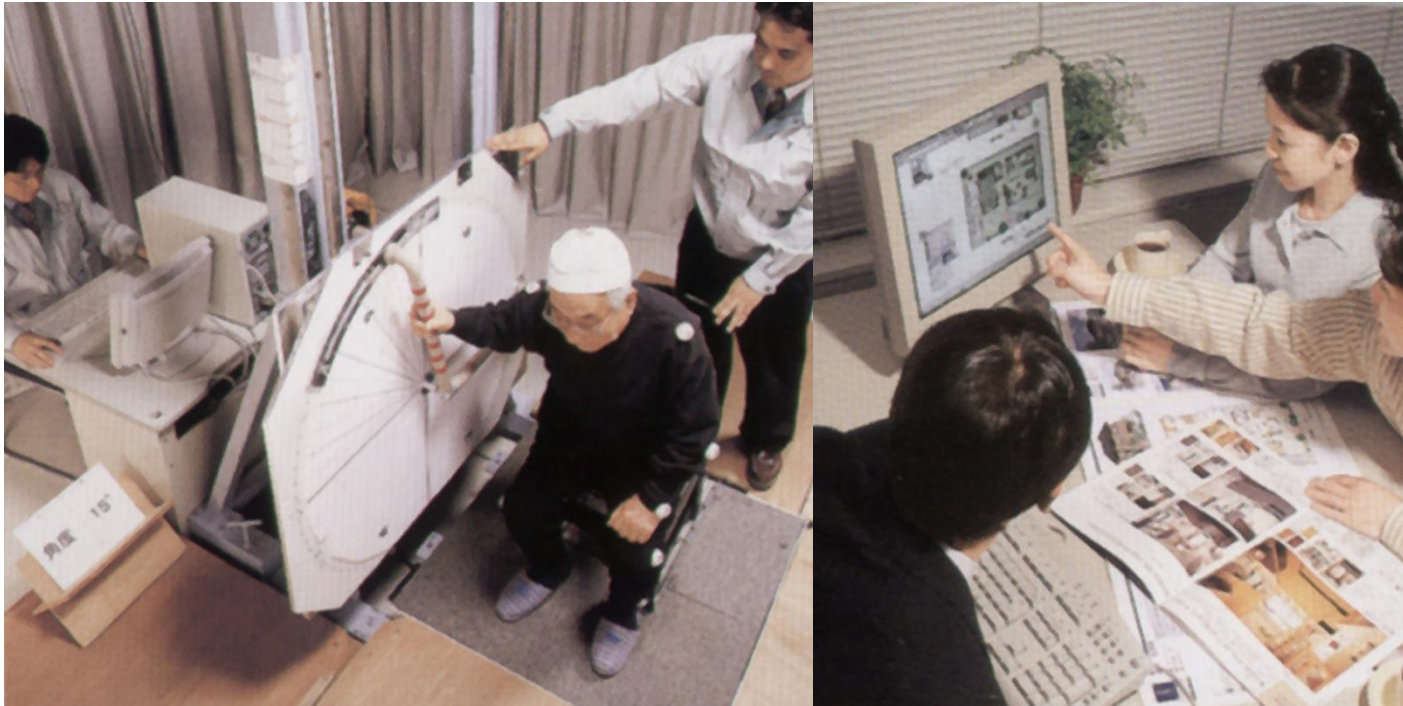


Robots are changing the medical industry and hospitals forever, in what many say is a technology overhaul that addresses shortages of staff and improvements to the level of service for patients, especially for hospitals farther away from experts.

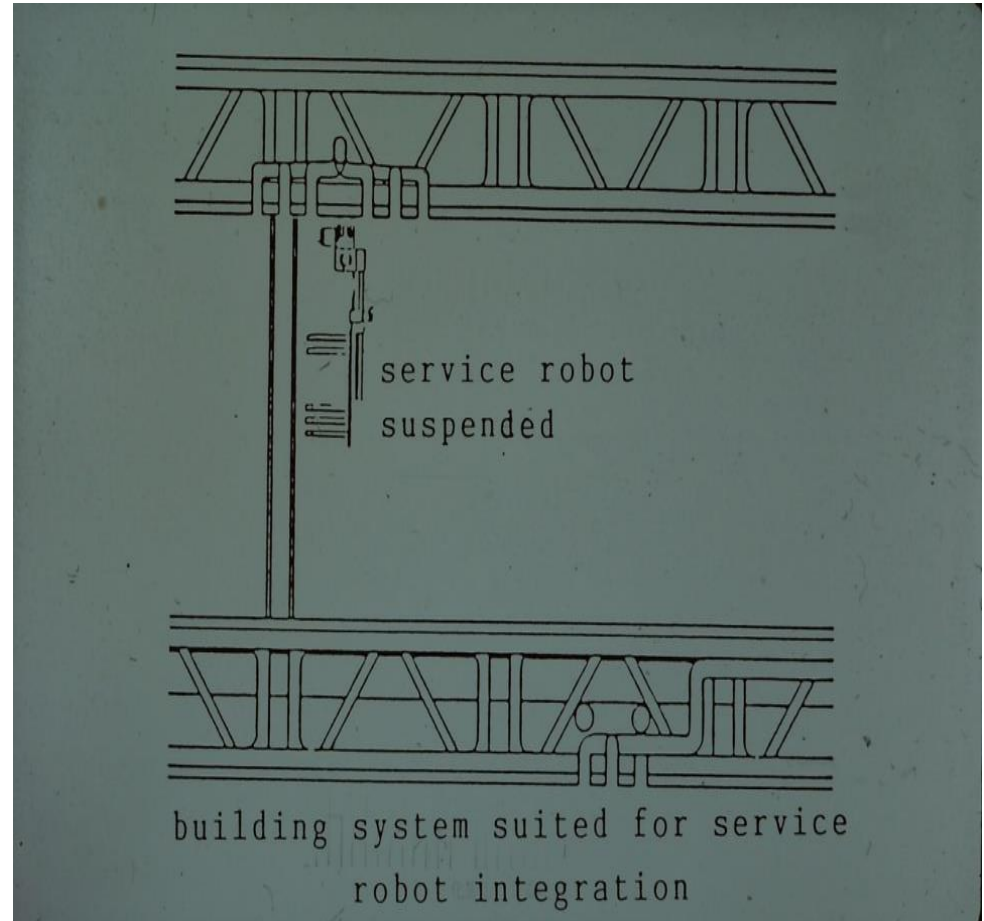
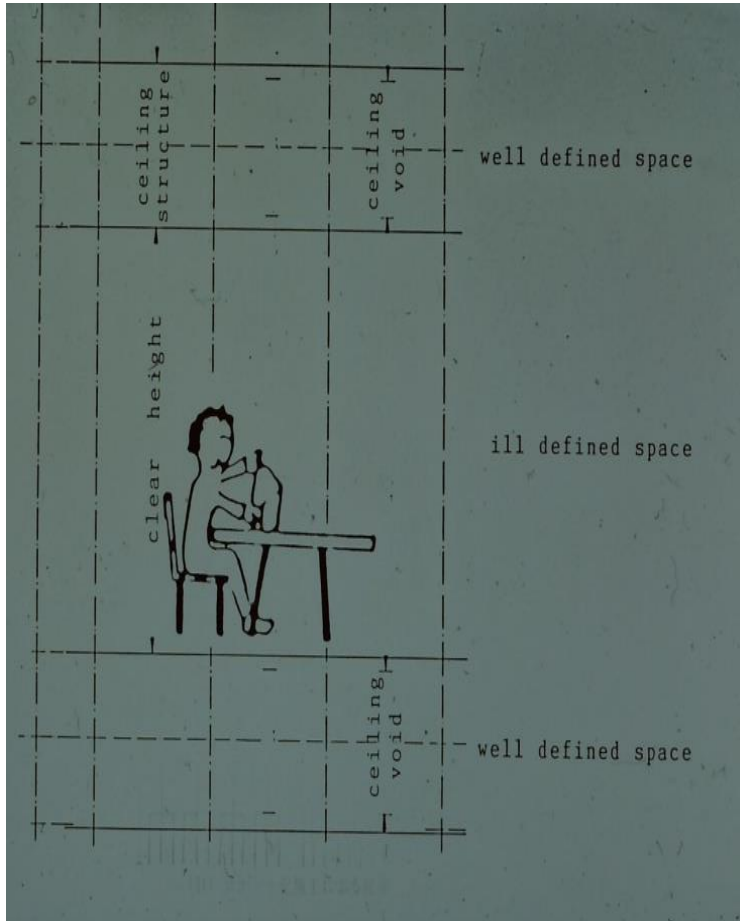




# Ausblick



# Robot Oriented Design – Dissertation UoT Bock 1984-89



# vision from the mid 80's from Comics to Reality: Life Support Systems

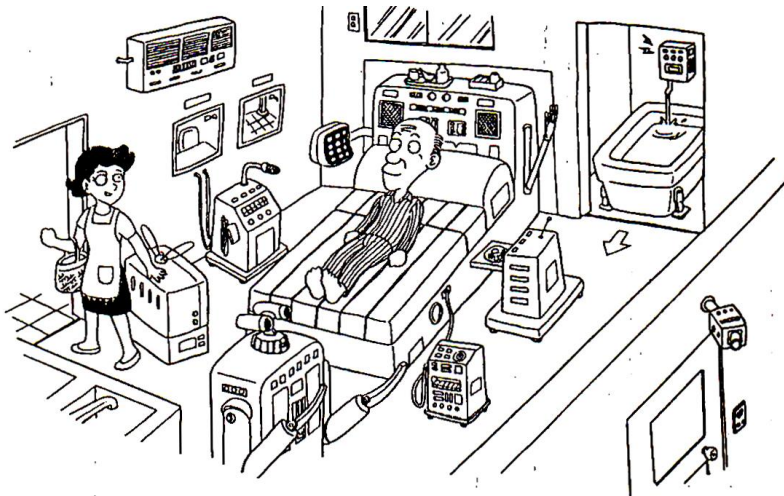


図7-1 在宅介護の概念構想〔作成：黒沢R&D技術事務所、'85.5、以下同じ〕

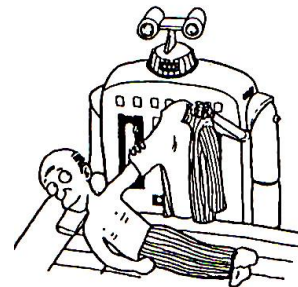


図7-4 身廻り介助（着衣交換）

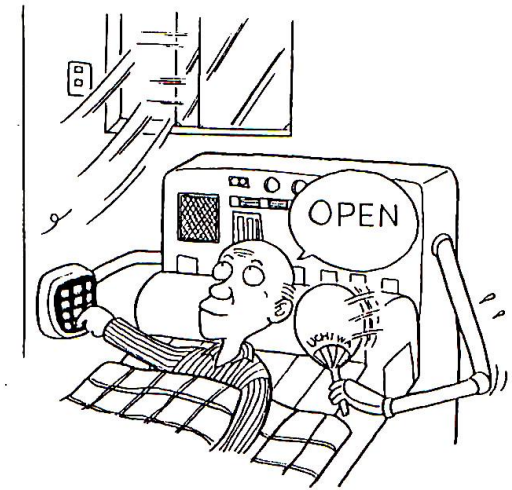


図7-5 環境制御の1例

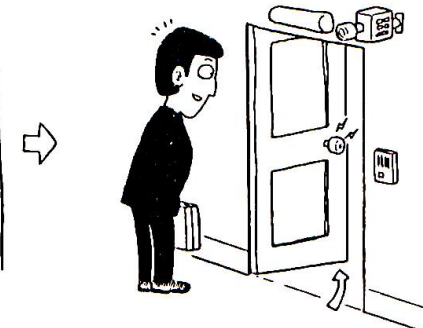
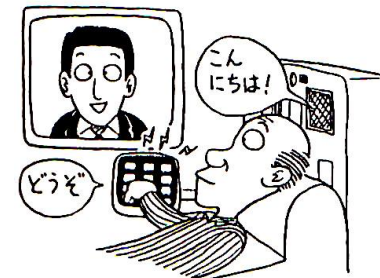
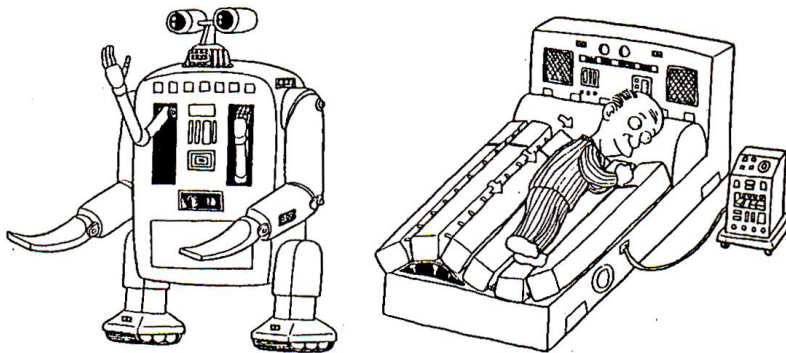


Image: T. Bock



## Vision from the 80's

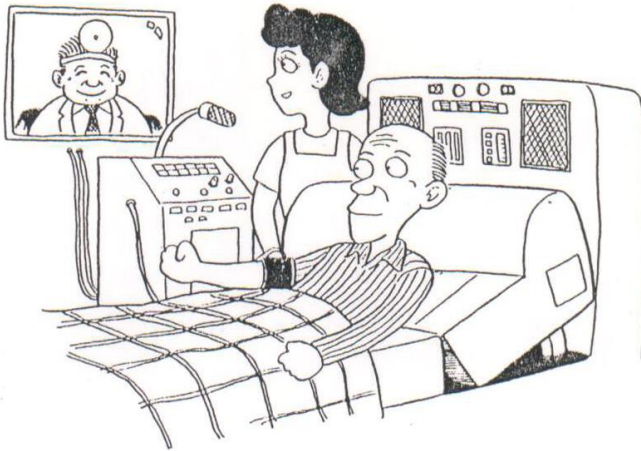


図 7-7 寝たきり者用 TV 電話

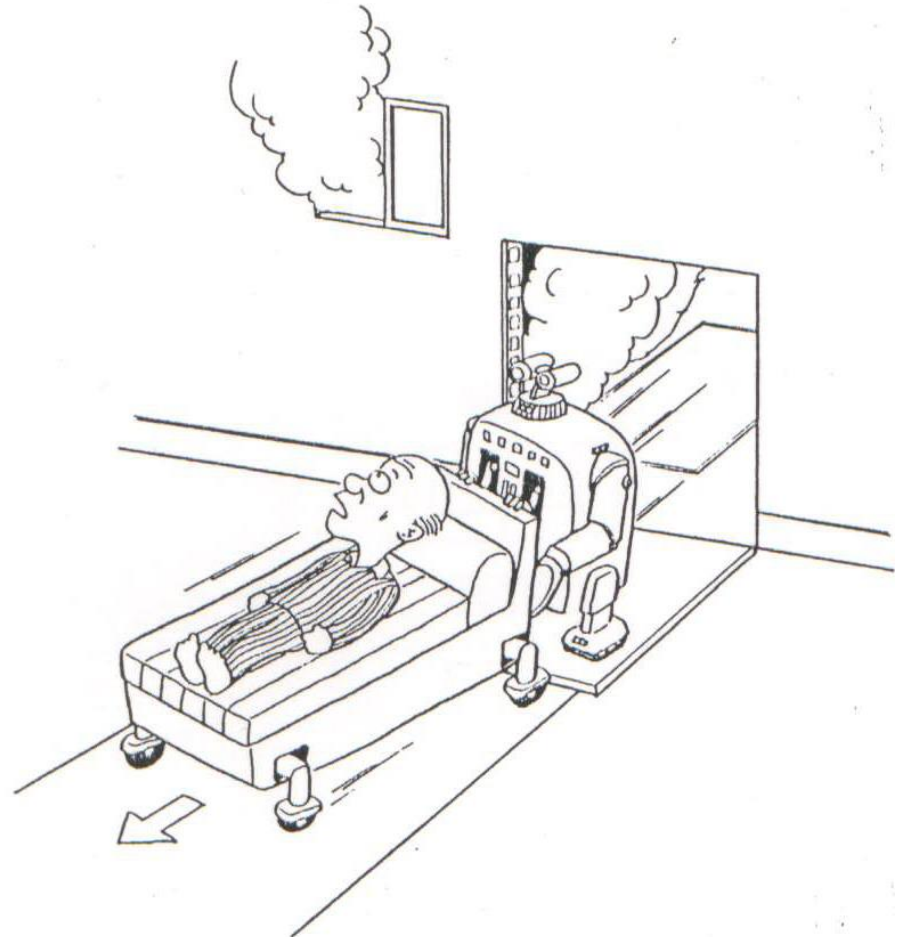


Image: T. Bock

# Vision from the 80's

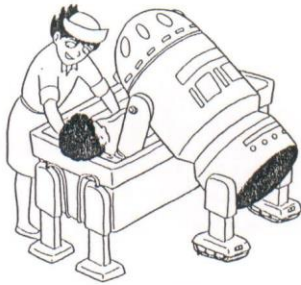
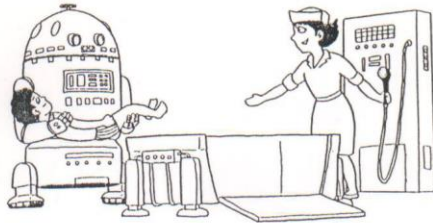


図 7-12 入浴介助

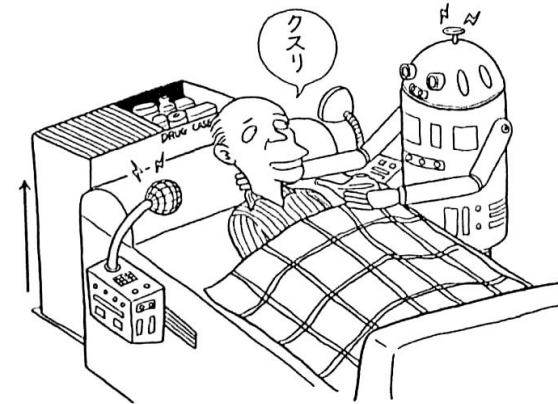
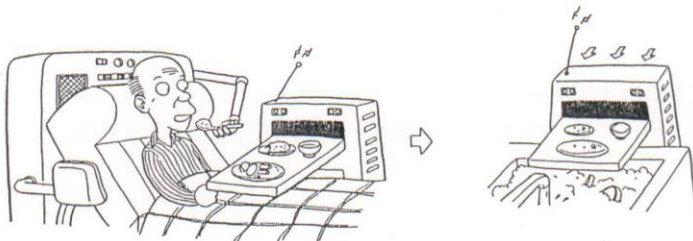


図 7-14 与薬介助

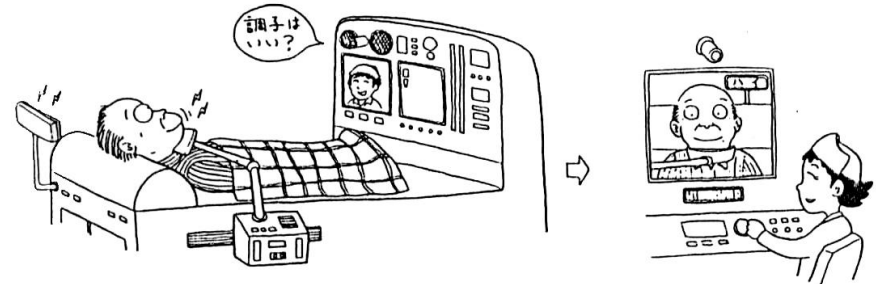


Image: T. Bock

# Vision from the 80's

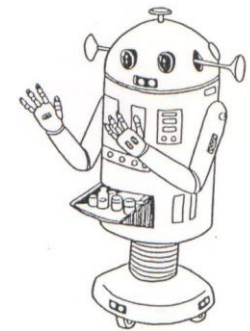
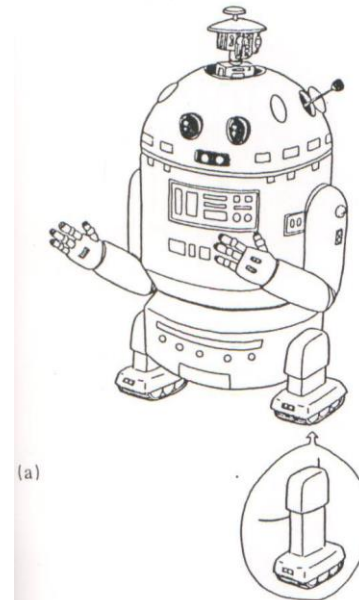
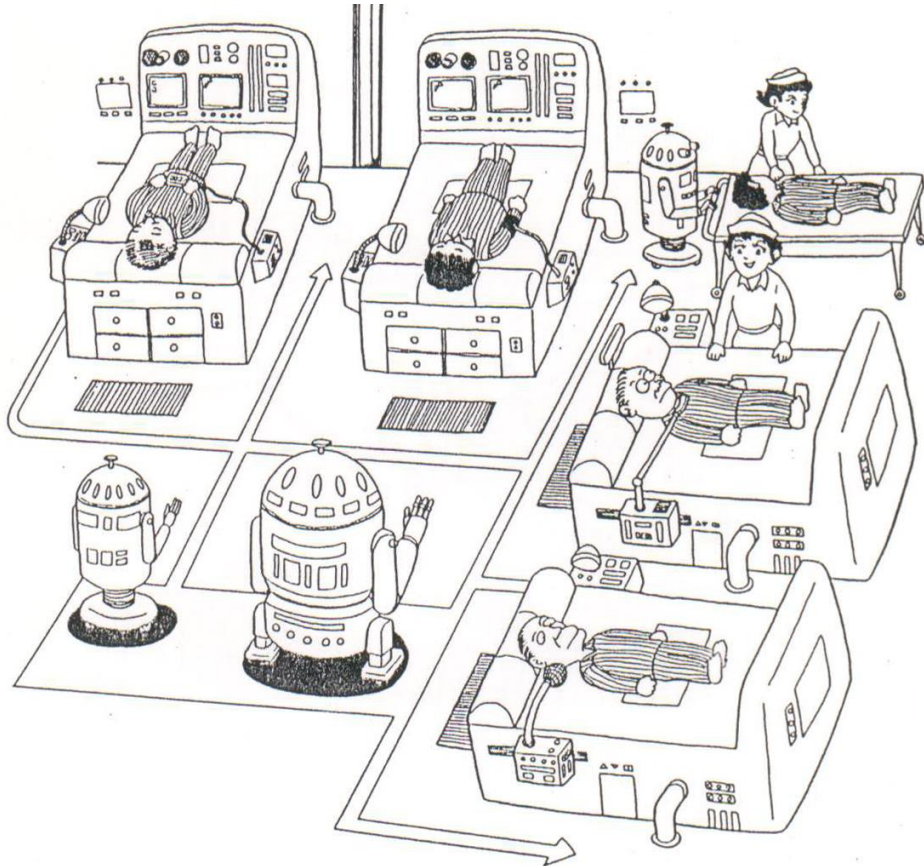
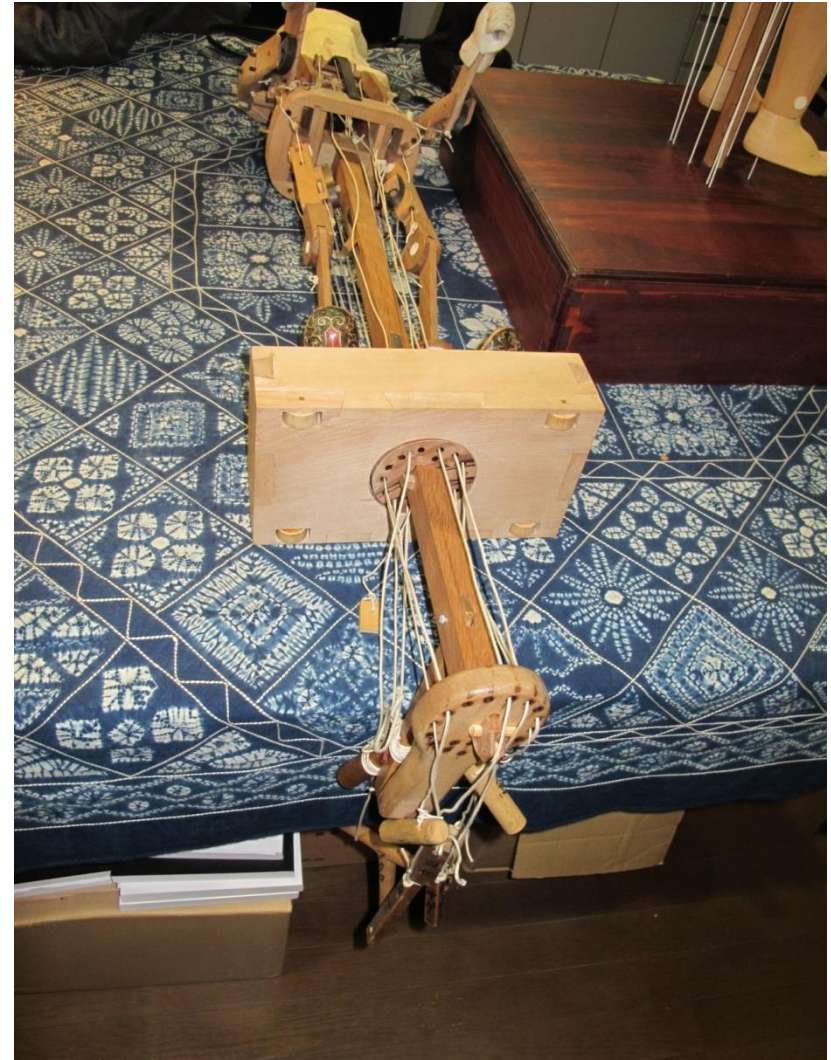


Image: T. Bock















Wadokei clock, designed by the Japanese inventor Hisashige Tanaka in 1673. This clock is designated as an important cultural asset by Japanese government.



万年時計 田中久重作 国立科学博物館蔵

同使用状態

懐中燭台 田中久重作 黒船館蔵



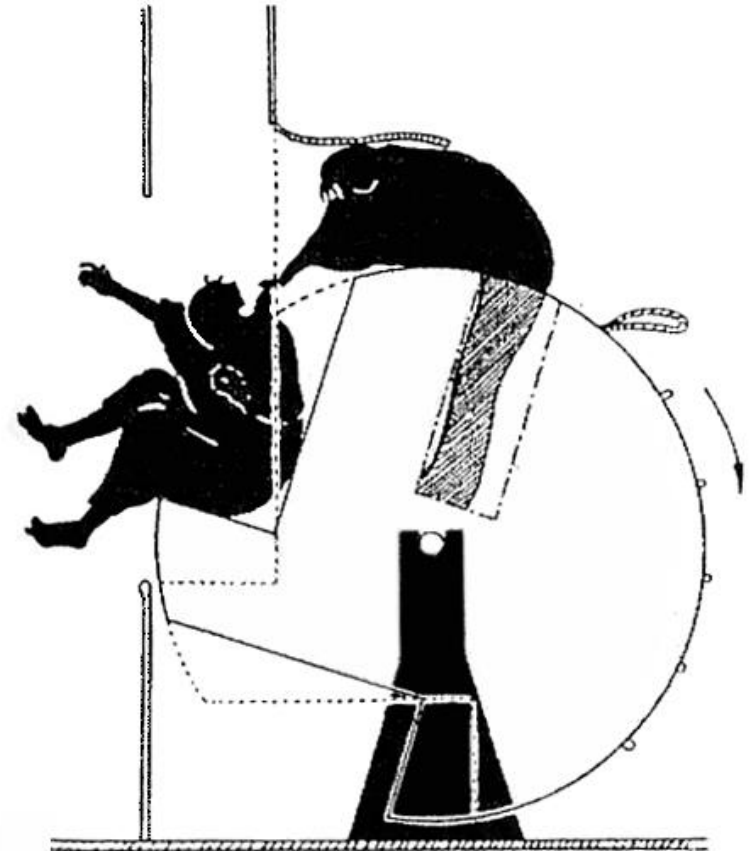
田中久重のからくりの引札 国立科学博物館蔵



# Cross-cultural thinking



Wadokei clock, designed by the Japanese inventor Hisashige Tanaka. This clock is designated as an important cultural asset by Japanese government. Source: <https://www.youtube.com/watch?v=l6r24uKbWug>  
<http://watchesbysjx.com/2017/05/portrait-masahiro-kikuno-japanese-watchmaker.html>





Gattai:

Life Work-Transformation?

**建設合体**

# ビルドタイガー

4,980円 電池付

**マクレーン** 1,980円 電池付

サイレンが  
鳴る!

パトライト  
が光る!

**パワージョー** 1,500円

**ダンプソン** 1,500円

けんせつしゃ たい がったい  
**建設車の3体が合体!**

パトライトが光る!  
サイレンが鳴る!!

**ビルドタイガー**

テレビアニメ「勇者警察ジェイテッカー」 25局26地区で放映中

■テレビ朝日(ANB) ■朝日放送(ABC) ■名古屋テレビ放送(NBN) ■九州朝日放送(KBC) ■北海道テレビ放送(HTB) ■青森朝日放送(ABA) ■東日本放送(KHB) ■秋田朝日放送(AAB) ■山形テレビ(YTS) ■福島放送(KFB) ■新潟テレビ21(NT21) ■北日本放送(KNB) ■北陸朝日放送(HAB) ■長野朝日放送(ABN) ■静岡朝日テレビ(SATV) ■瀬戸内海放送(KSB) ■広島ホームテレビ(HOME) ■山口朝日放送(YAB) ■愛媛放送(EBC) ■テレビ高知(KUTV) ■長崎文化放送(NCC) ■熊本朝日放送(KAB) ■大分朝日放送(OAB) ■鹿児島放送(KKB) ■琉球放送(RBC)

※一部地域により放映開始が遅れる場合がございます。

# Cross-cultural thinking





# **NEW SOCIO TECHNICAL SYSTEMS: LIFE SUPPORT SYSTEM ROBOTIC AMBIENCE FOR INDEPENDANT LIVING, WORKING, MOBILITY**

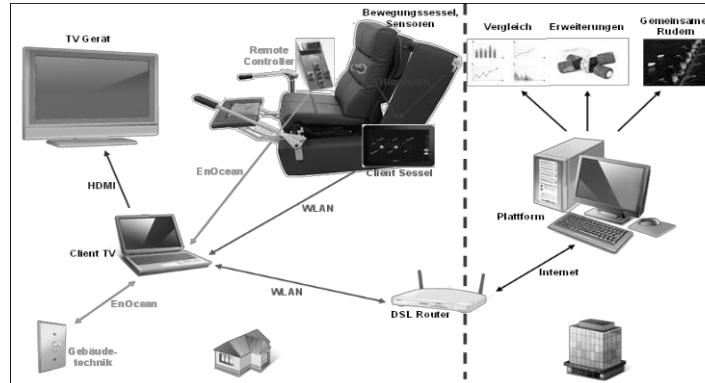




# Rejuvenation Oriented Design ROD

## GEWOS – Gesund Wohnen mit Stil

## HyLive: Healthy living with style



- ECG
- Oxygen saturation
- Blood pressure



- Body weight



**himolla**  
Polster für Menschen

Green. Smart. Wireless.  
**enocean**

**SOPHIA** mit PS

**ISA**

SPORTKREATIVWERKSTATT

**Fraunhofer**  
IIS

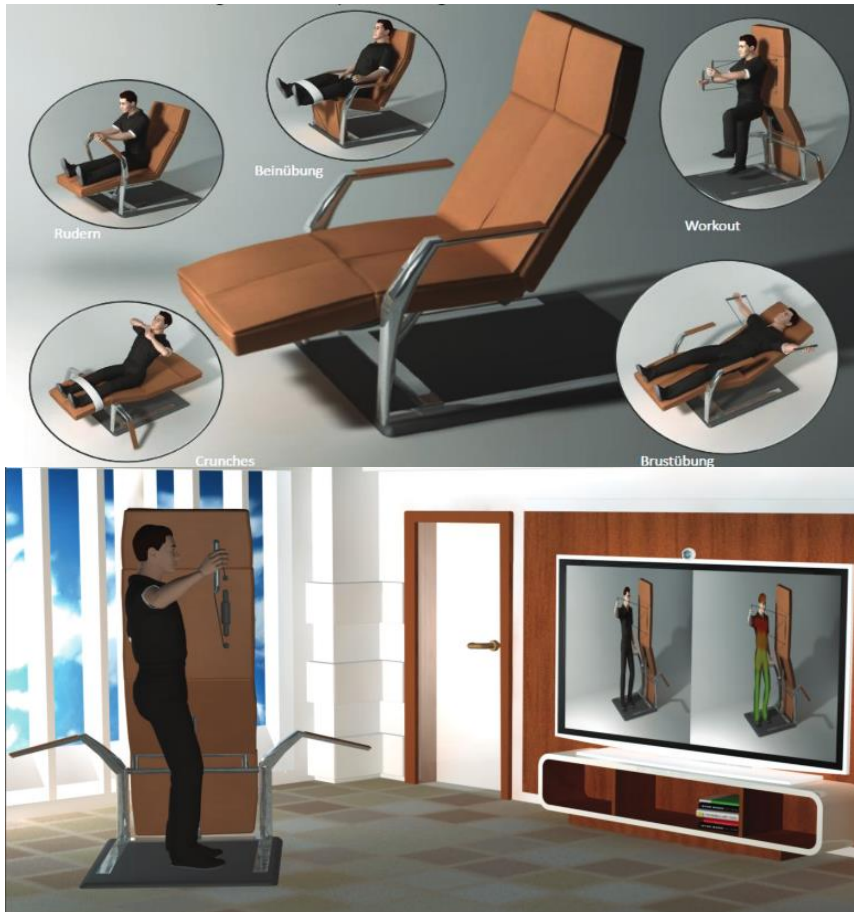
Technische Universität München **TUM**



# Rejuvenation Oriented Design ROD

## GEWOS – Gesund Wohnen mit Stil

### HyLive: Healthy living with style





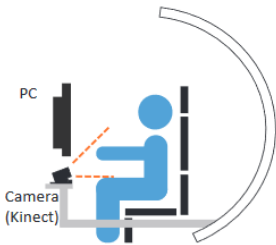
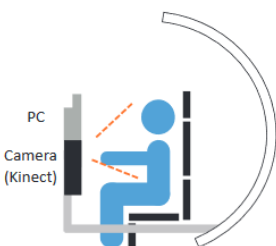
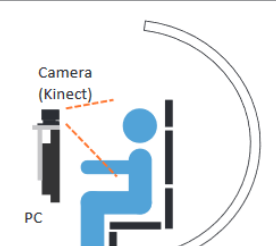
# Rejuvenation Oriented Design ROD

## Fatigue/depression prevention by emotion detection

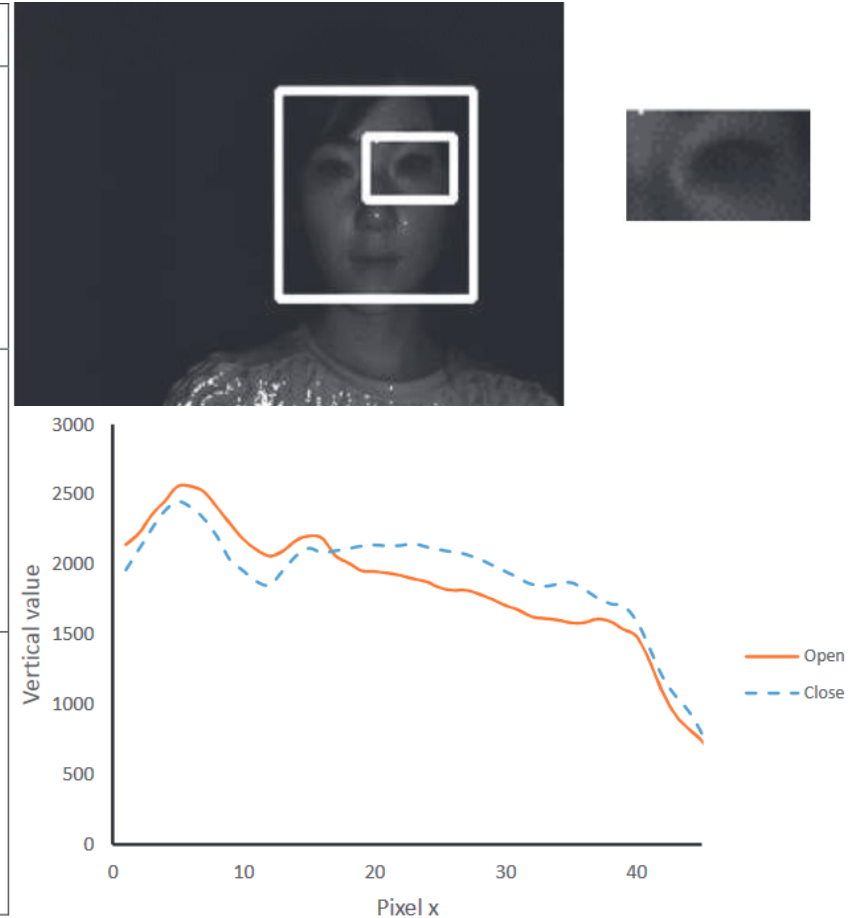
Liquifier Chair



Position Investigation

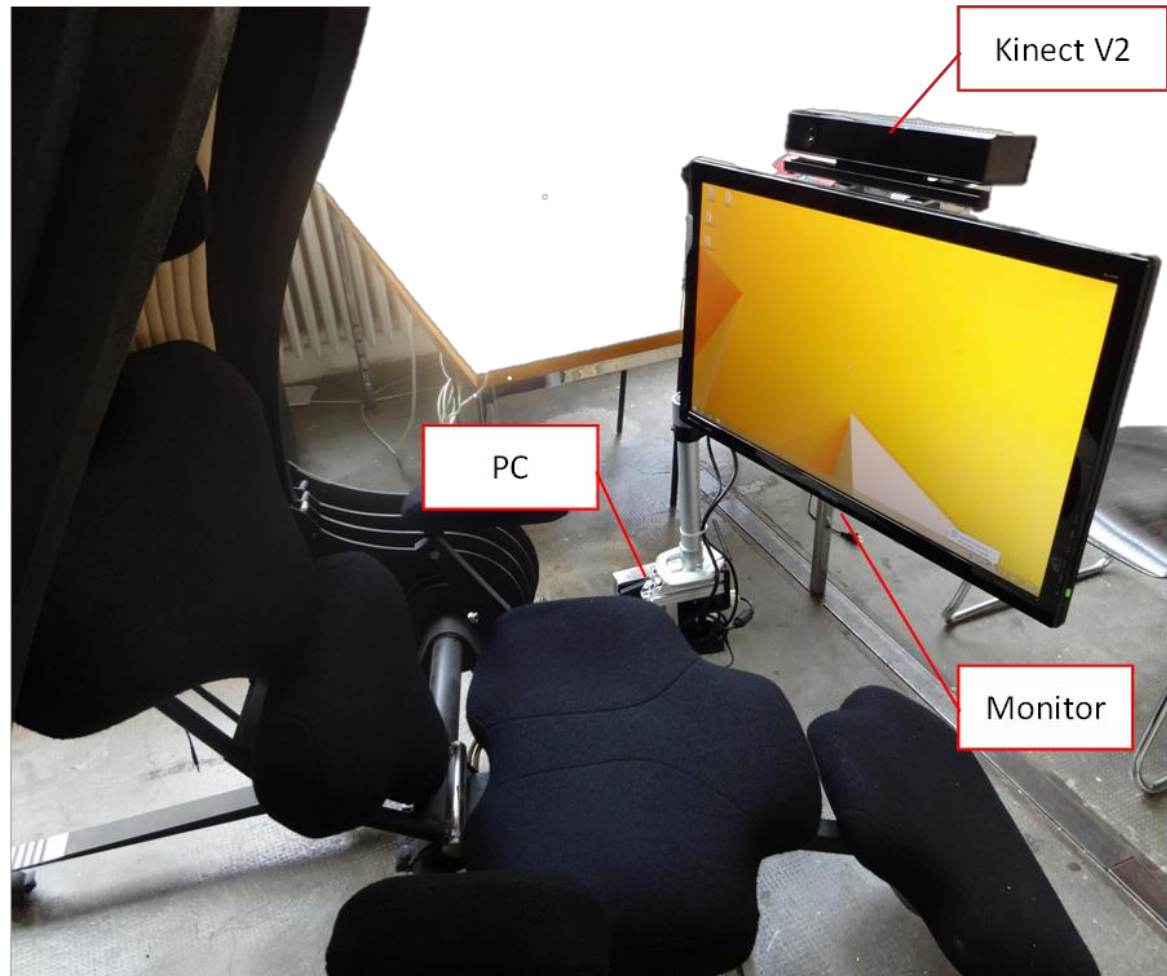
Position of Kinect	Image
Under PC	
Side PC	
On PC	

Fatigue detection on eye closure time and rate



# Rejuvenation Oriented Design ROD

## Fatigue detection



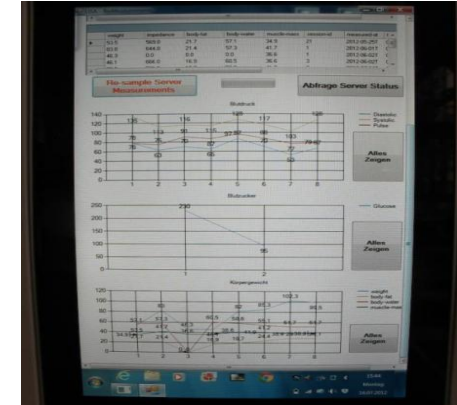
# Mechatronic Wall



Modularity on „Room Level“



Modularity on Software & Service Level



Modularity on „Wall Level“

Modular functional Ad-ons



Modularity on Cabinet Level





A Space Elevator Hotel - [www.shimz.co.jp](http://www.shimz.co.jp)



High Tech Toilet for Ageing Society



Process optimized High Tech Toilet for Space



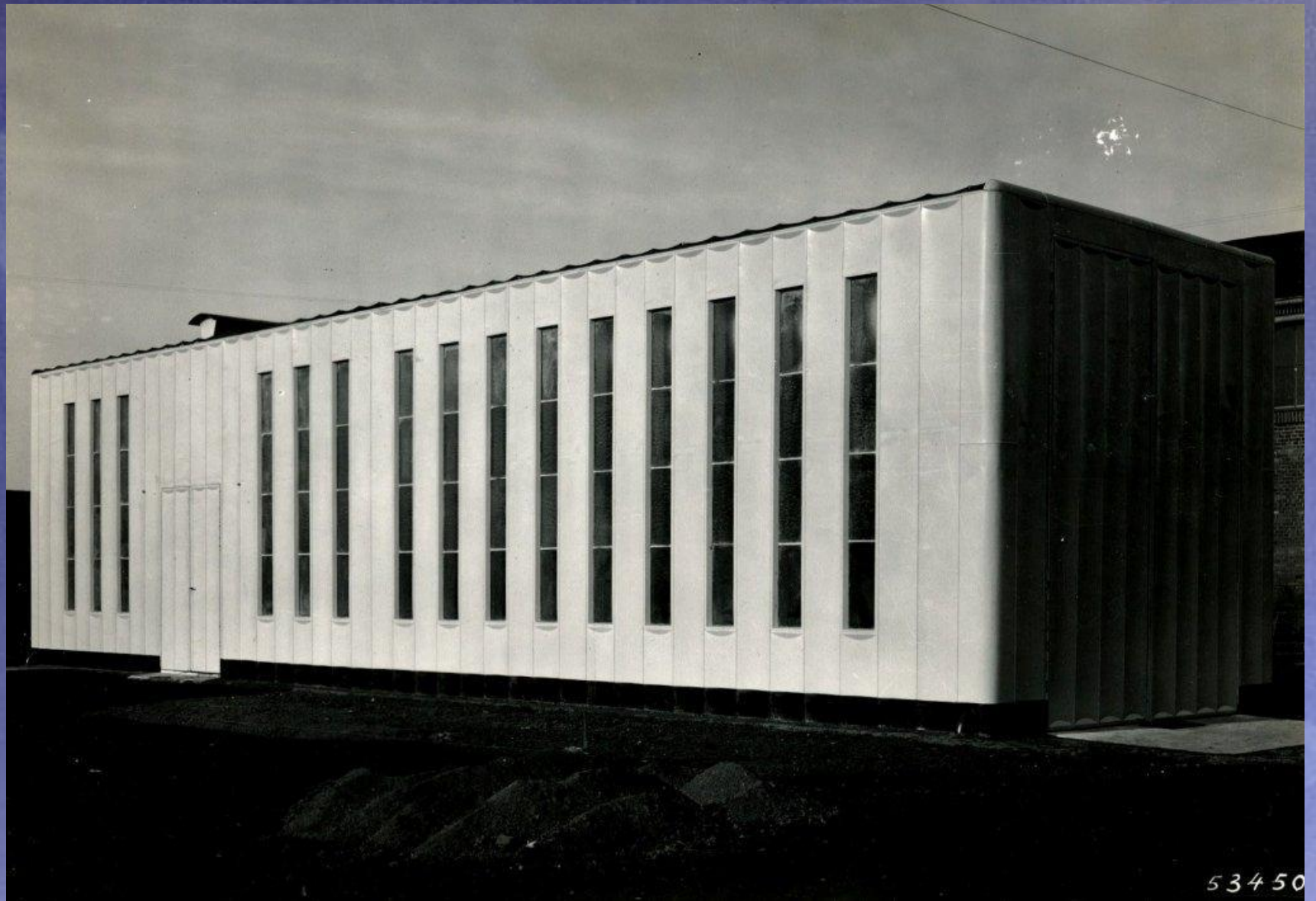


**Junkers Ju 52/3m Berlin Tempelhof  
2011 at Munich airport**



**Junkers Steel Furniture**





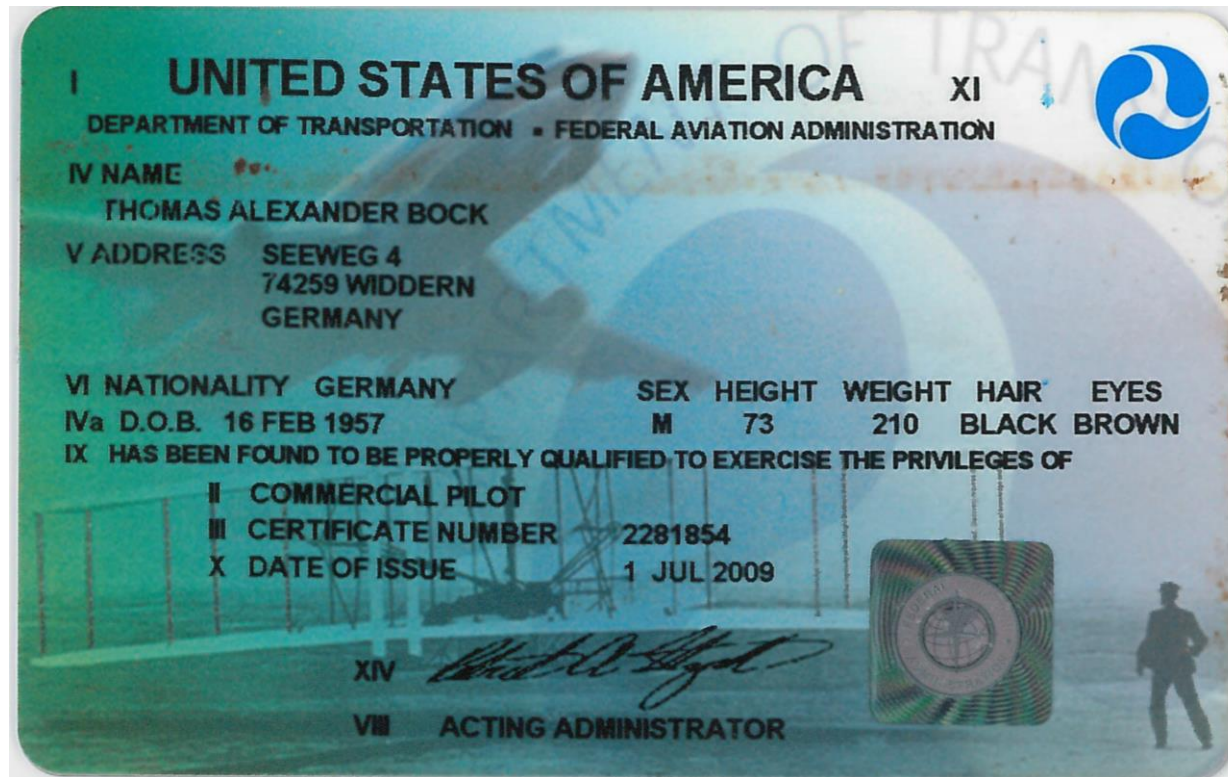
**Painting Booth**



**Roof Structure**

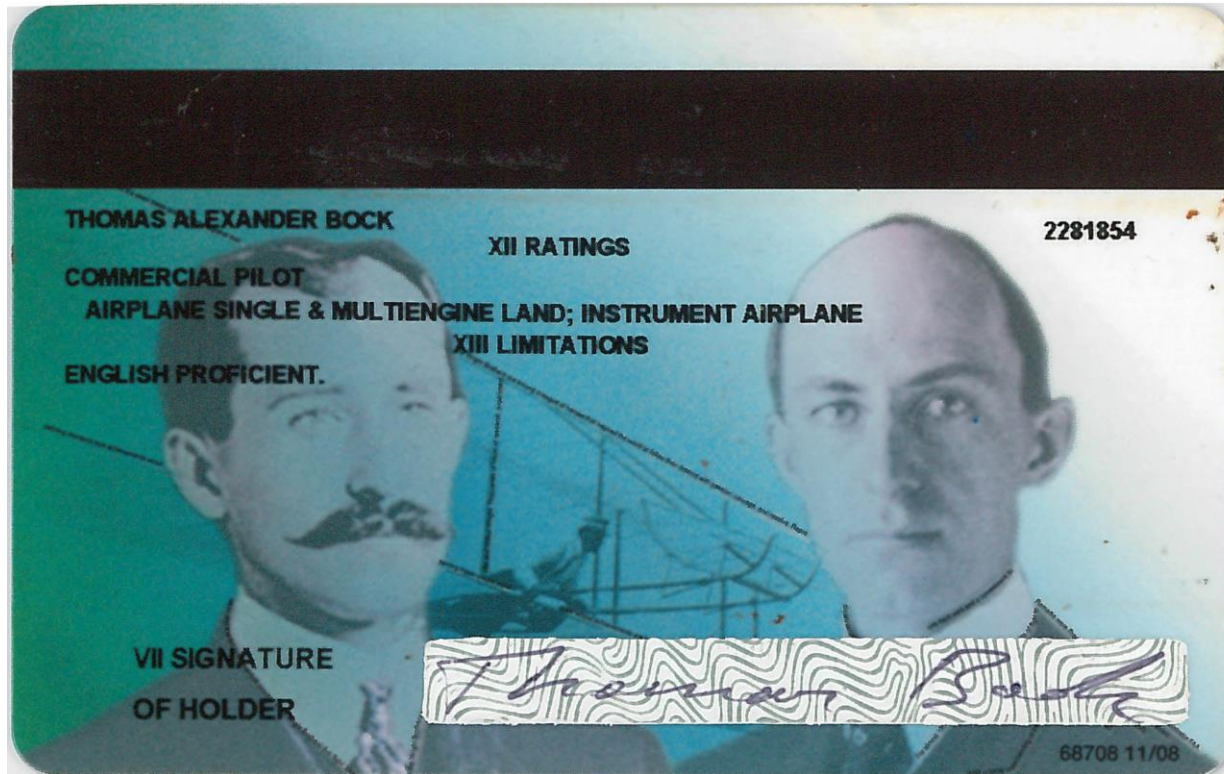


# FAA Commercial Pilot License, IFR, MEL (1979)





# FAA Commercial Pilot License



# Pilot's cockpits, aircraft technology

## CPL, IFR, MEL at Flight Proficiency Dallas Love Field, 1979



Image: Airbus A380 cockpit By Naddsy [CC BY 2.0 (<http://creativecommons.org/licenses/by/2.0/>)], via Wikimedia Commons



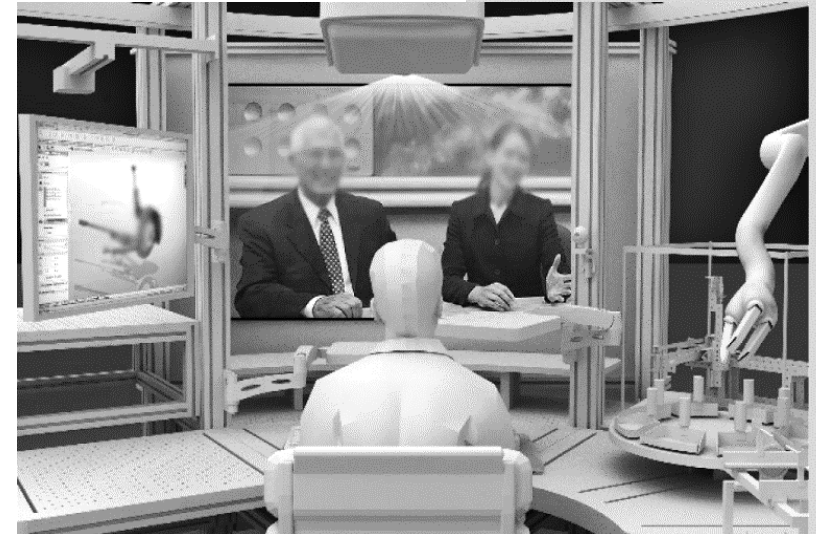
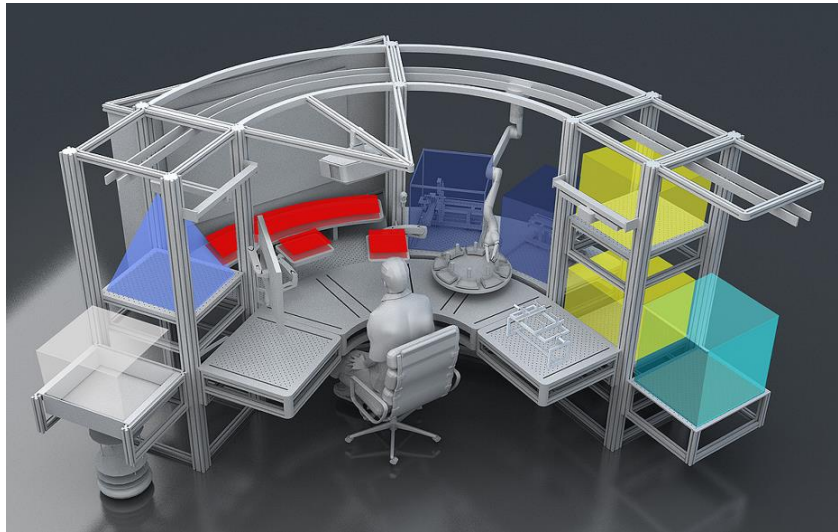
Image: Antonov An-124 cockpit By Dmitry Petrov (<http://russianplanes.net/D50699>) [CC BY-SA 3.0 (<http://creativecommons.org/licenses/by-sa/3.0/>) or CC BY-SA 3.0 (<http://creativecommons.org/licenses/by-sa/3.0/>)], via Wikimedia Commons



# Rejuvenation Oriented Design ROD

usa<sup>2</sup>:

ubiquitäres selbstbestimmtes arbeiten im alter  
(Robot Assisted Working & Cloud Manufacturing)



(br)<sup>2</sup> MCTS

Technische Universität München TUM



# Rejuvenation Oriented Design ROD

## Utilization of Robotic Elements, gesture detection/control



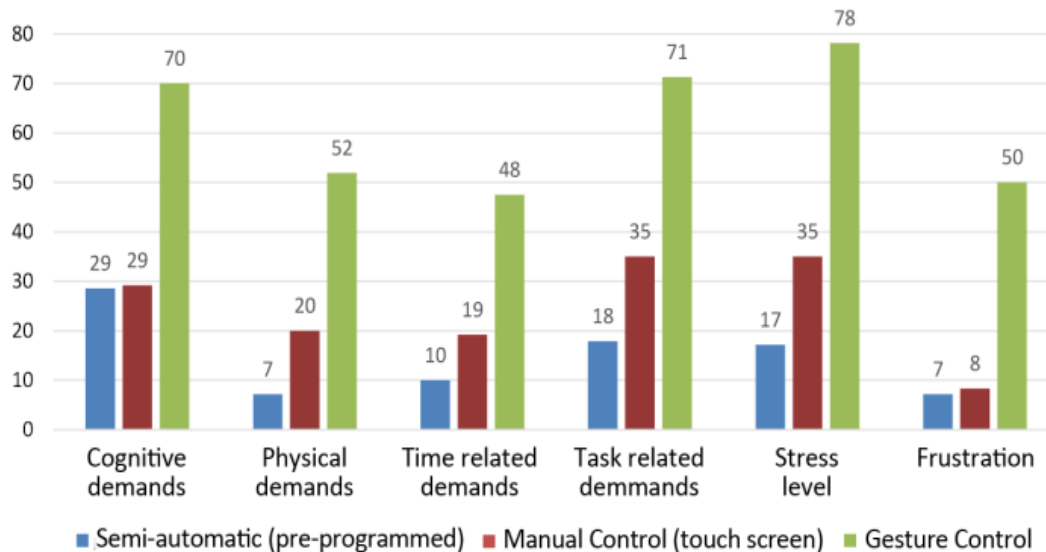
© Schlegelmilch

# Rejuvenation Oriented Design ROD

## User Integration and Usability

Evaluation collaborative work:

NASA TLX: average perceived task load levels (M) for test persons when operating the JRA in the collaborative assembly station by various, alternative control modes; N=21.



Control Mode 1:  
Semi-automatic



Control Mode 3: Gestures



Control Mode 2: Manual



# PASSAge: Personalized Mobility Assistance and Service Systems in an Ageing Society

SUNRISE  
MEDICAL.

metaio

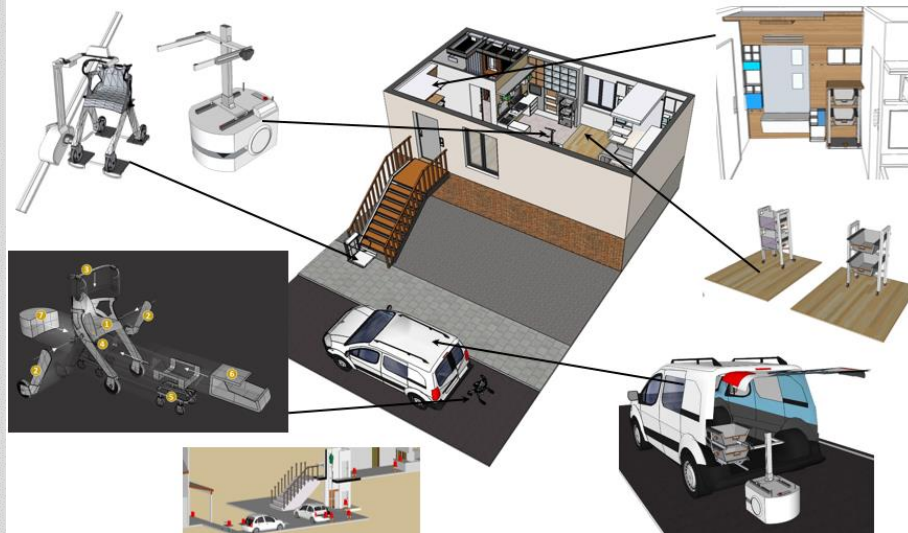


SOPHIA mit PS

HAAG  
REHATECHNIK

CITYSAX  
DIE ZUKUNFT FÄHRT ELEKTRISCH!  
WORAUF WARTEN SIE NOCH?

LMU  
Ludwig-Maximilians-  
Universität München

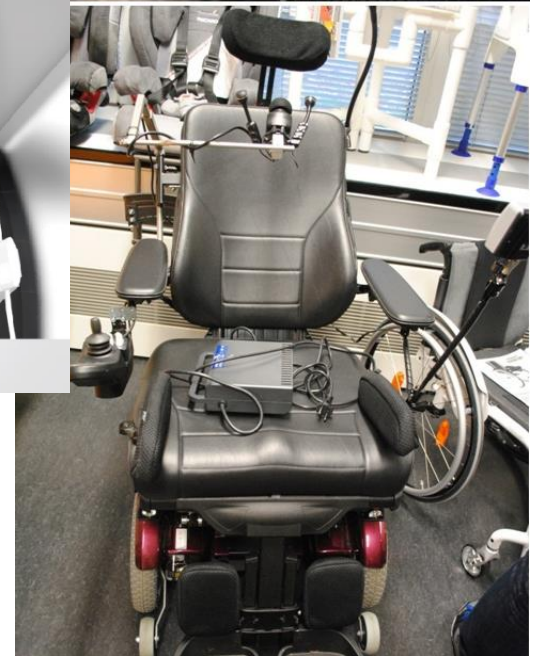
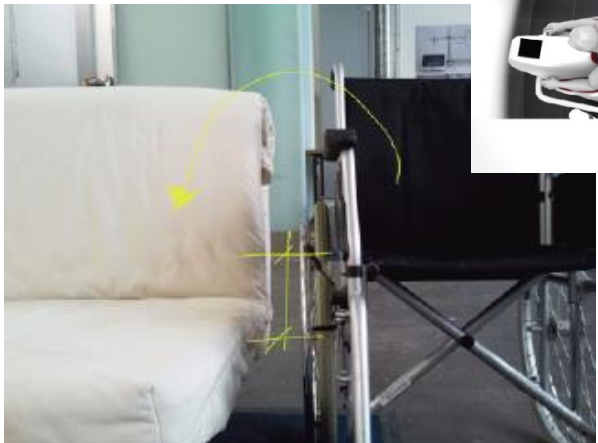
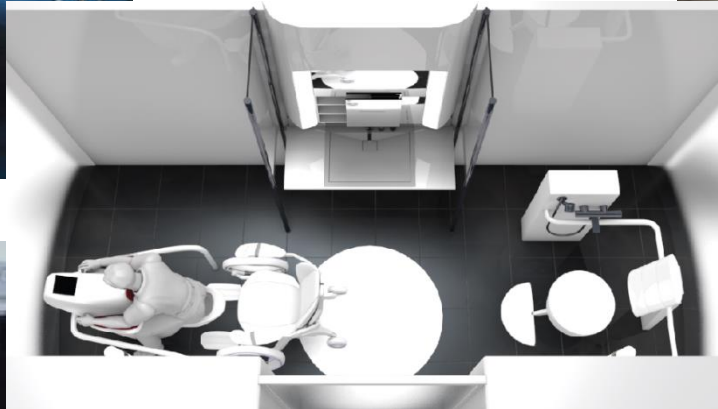




# Rejuvenation Oriented Design ROD Personalized Mobility Assistance and Service Systems in an Ageing Society



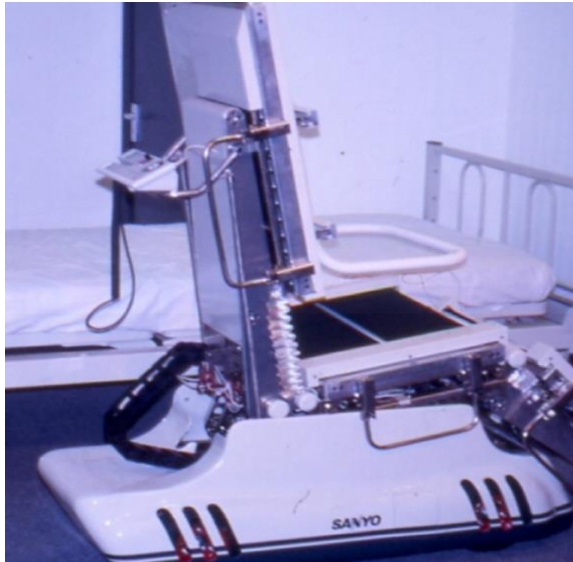
# In-House Mobility (PASSAge)



# Single Task Devices

## for example: Transfer Robots

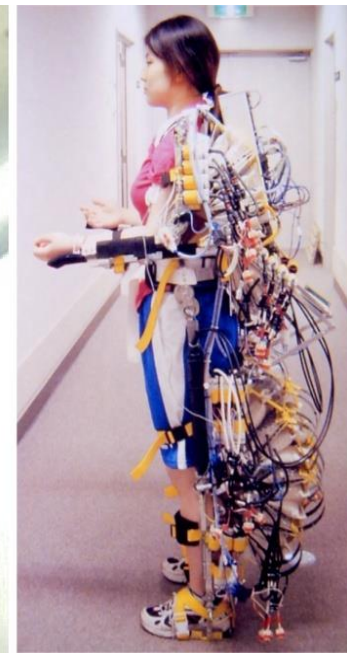
- Transferring is a **basic activity** of daily living
- Transferring is accounted as fundamental for **performing tasks** related to **bathing, dressing, toileting, continence** and **feeding**
- Transfer Robots support **elderly people** and **care givers**





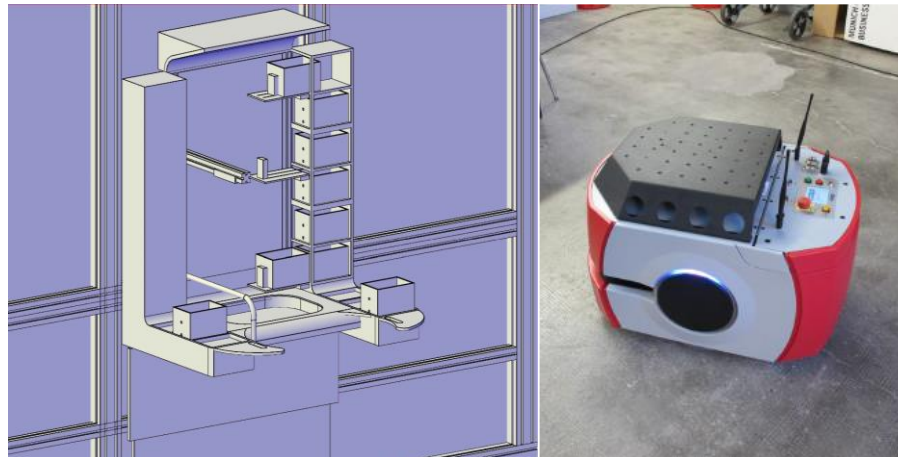
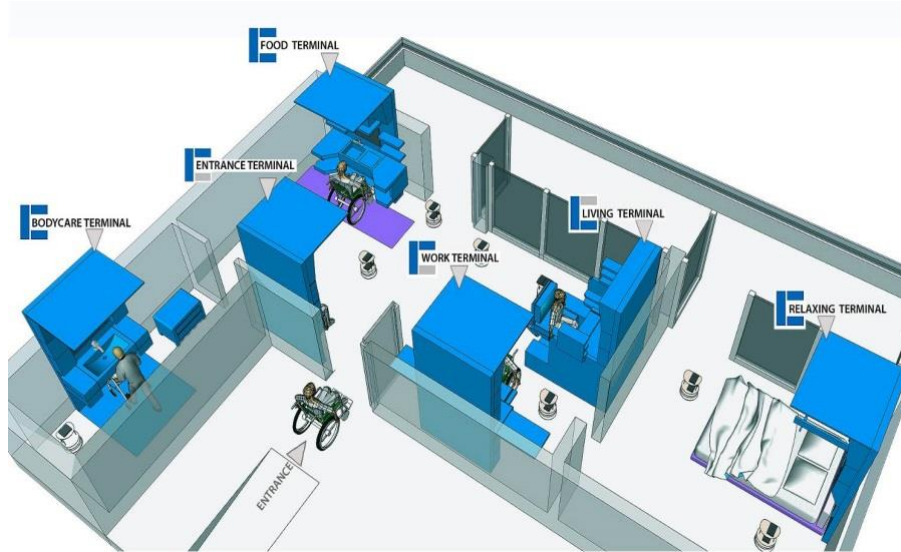
# Humanoids and Exoskeletons

- **Humanoids**: function and motion capability are, in most cases, **conceptually based** on their **equivalent in the human body**
- **Androids**: not only interpret the human body's function but are designed to **imitate human appearance and behavior**
- **Exoskeletons**: combining the **flexibility** and **intelligence** of human beings with the **speed** and **power** of robotic systems



# Rejuvenation Oriented Design ROD

## LISA: Living independently in Südtirol Alto-Adige



MM  
DESIGN

Pfeifer  
Planung

ELEKTRO  
a. haller  
OHG



lichten  
nals  
burg  
Begegnung & Bildung aus  
Innovation & Erneuerung

BIS  
Beratung & Planung  
Gesamtschulung GmbH

ELVH·APA  
In guten Händen. In buone mani.

Technische Universität München



# REACH (Responsive Engagement of the Elderly promoting Activity and Customized Healthcare)

## Research:



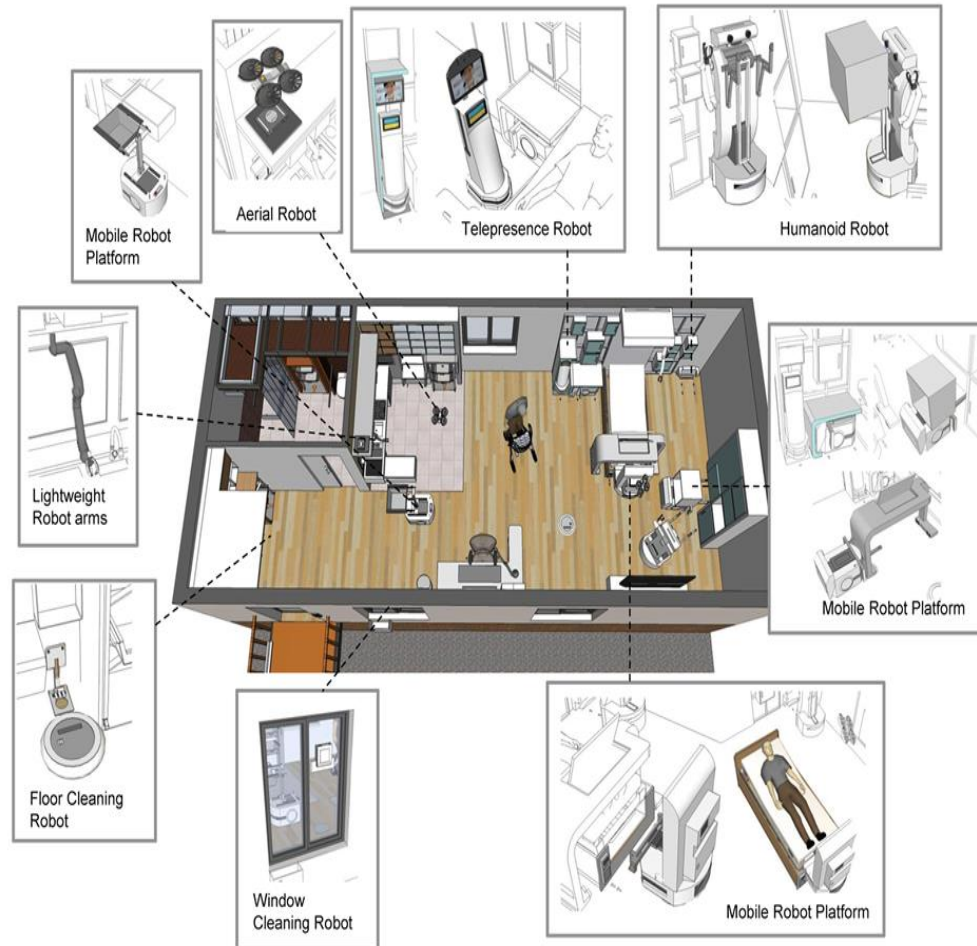
Technische Universität München



## Industry:



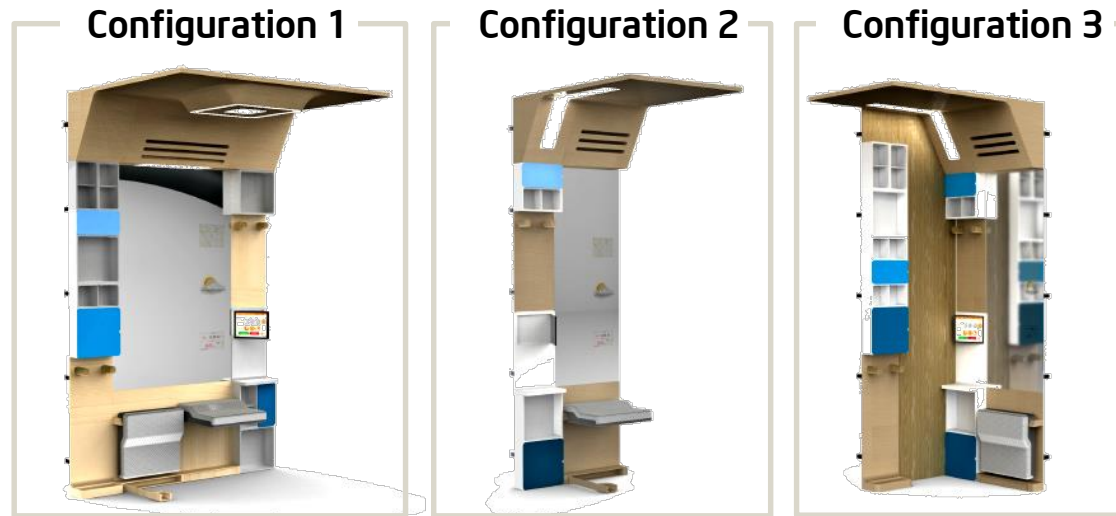
## Application:



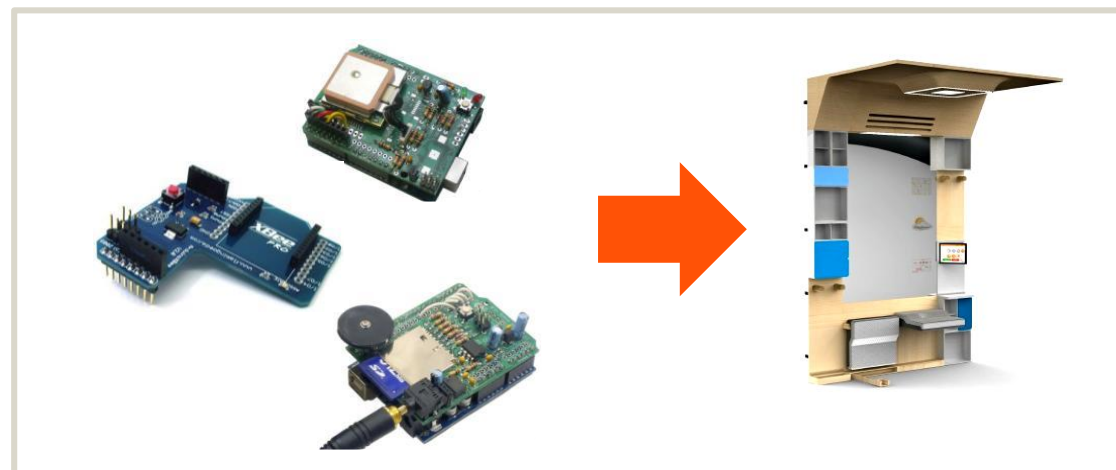
# Rejuvenation Oriented Design ROD

## Integration of Mechatronics into “Furniture”

Modularity



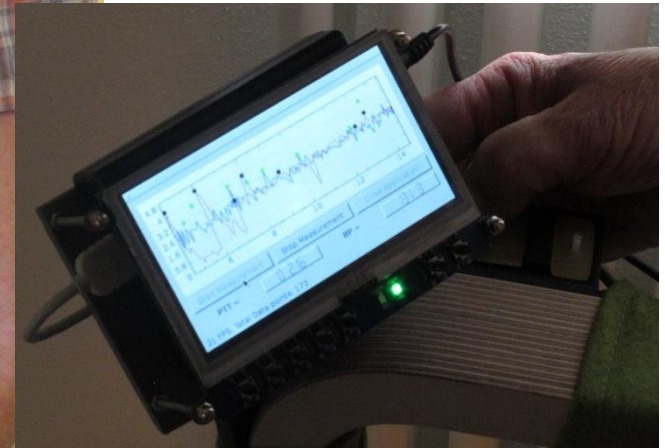
Integration of Mechatronics and Services



Images: LISA Industry Consortium & Chair of Building Realisation and Robotics



# Contactless/Ambient Sensing



# Contactless/Ambient Sensing

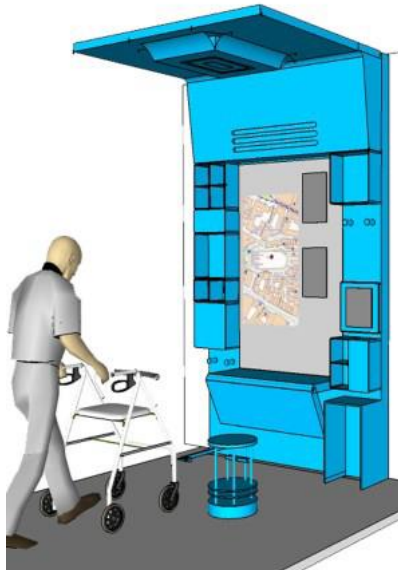




# Rejuvenation Oriented Design ROD

## LISA - Living Independently in Südtirol / Alto Adige

LISA Terminal



Reminder Module



# Rejuvenation Oriented Design ROD

## Modularity for upgrading and personalization

Modularity on „Room Level“



Modularity on „Wall Level“



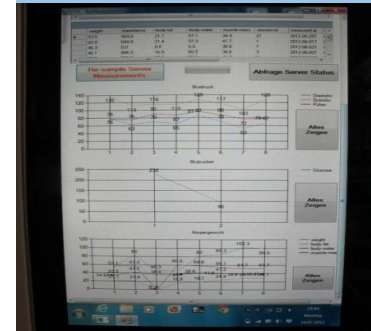
Modularity on Cabinet Level



Modular Functional Ad-ons



Modularity on Software & Service Level





# Rejuvenation Oriented Design ROD

## Rapid Installation / De-installation

Rapid De-installation (TUM br2, Germany)

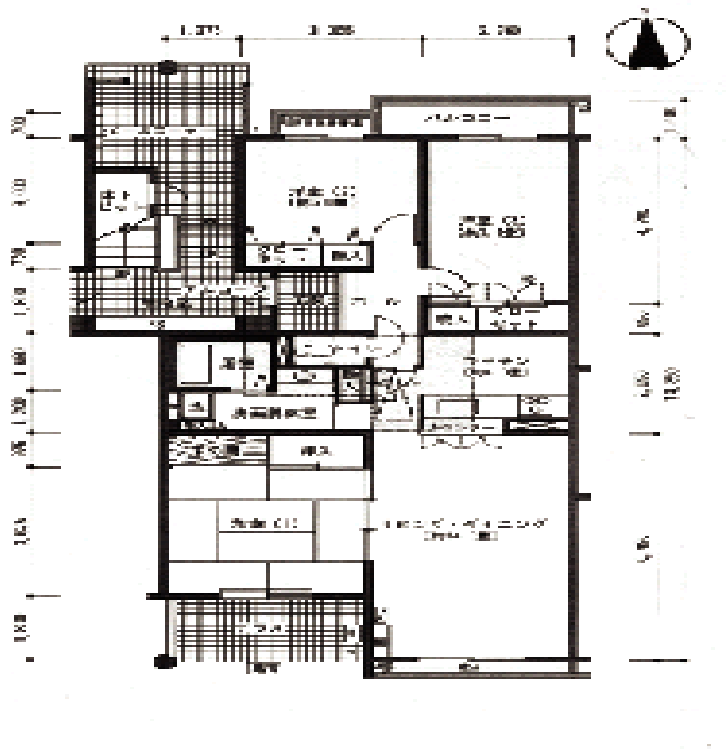


## Rapid Installation (Bozen, Italy)



Images: LISA Industry Consortium & Chair of Building Realisation and Robotics

# Age-based architecture in Japan





# Rejuvenation Oriented Design ROD

## LISA: Living independently in Südtirol Alto-Adige



A modern, minimalist hospital room with a white bed, a white desk, and a white cabinet. The room is brightly lit with a large circular light fixture on the ceiling. The bed has a white headboard and a white side table. The desk is white and has a white chair. The cabinet is white and has a white door. The room is clean and modern.

# Human Factors become Henning Factors

[www.br2.ar.tum.de](http://www.br2.ar.tum.de)