33rd Annual INCOSE international symposium

hybrid event

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R. van Zijl, T. Raub, T.J.L. van Rompay, K. Nizamis & G.M. Bonnema
(University of Twente, the Netherlands)

Involving Non-Technical Stakeholders in System Architecture Design: a Case-Study on the Cleaning Industry

Introduction

Technology Adoption

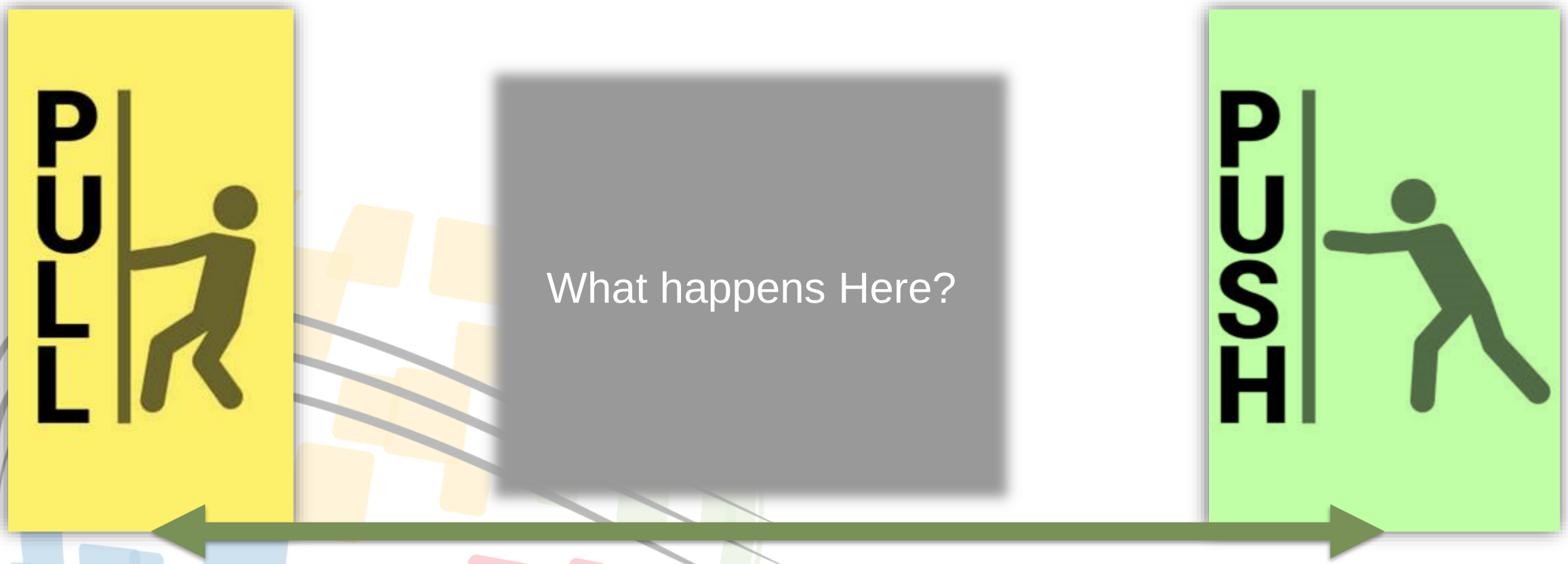
Market-Pull

- Demand
- Clear Goals
- Target Group involved in Design Process
- Limited Creative Freedom
- Good Chance of Successful Adoption

Technology-Push

- Innovations
- Reliant on Early-Adopters
- Uncertainty on Adoption

Technology Adoption



Problem Exploration Process

Stakeholders

- Identification
- Mapping
- Involvement

Needs & Requirements

- State of the Art
- Desires
- Architecture Design

Technological Innovations in the Dutch Cleaning Industry

Case Study Introduction

Case Study: Dutch Cleaning Industry

Cleaning Work

- Old Population 
- Low Levels of Education
- Labor Shortage

Personal Issues

- Injuries 
- Stigmas – Cleaners feel ‘Invisible’

Case Study: Dutch Cleaning Industry

Project

- Responsible Technology Implementation into the Cleaning Industry
- Improving Quality of Work

Challenges

- Conservatism
- Cleaners feeling ‘Replaced’
- What Part of Cleaning to aid? – Function Analysis

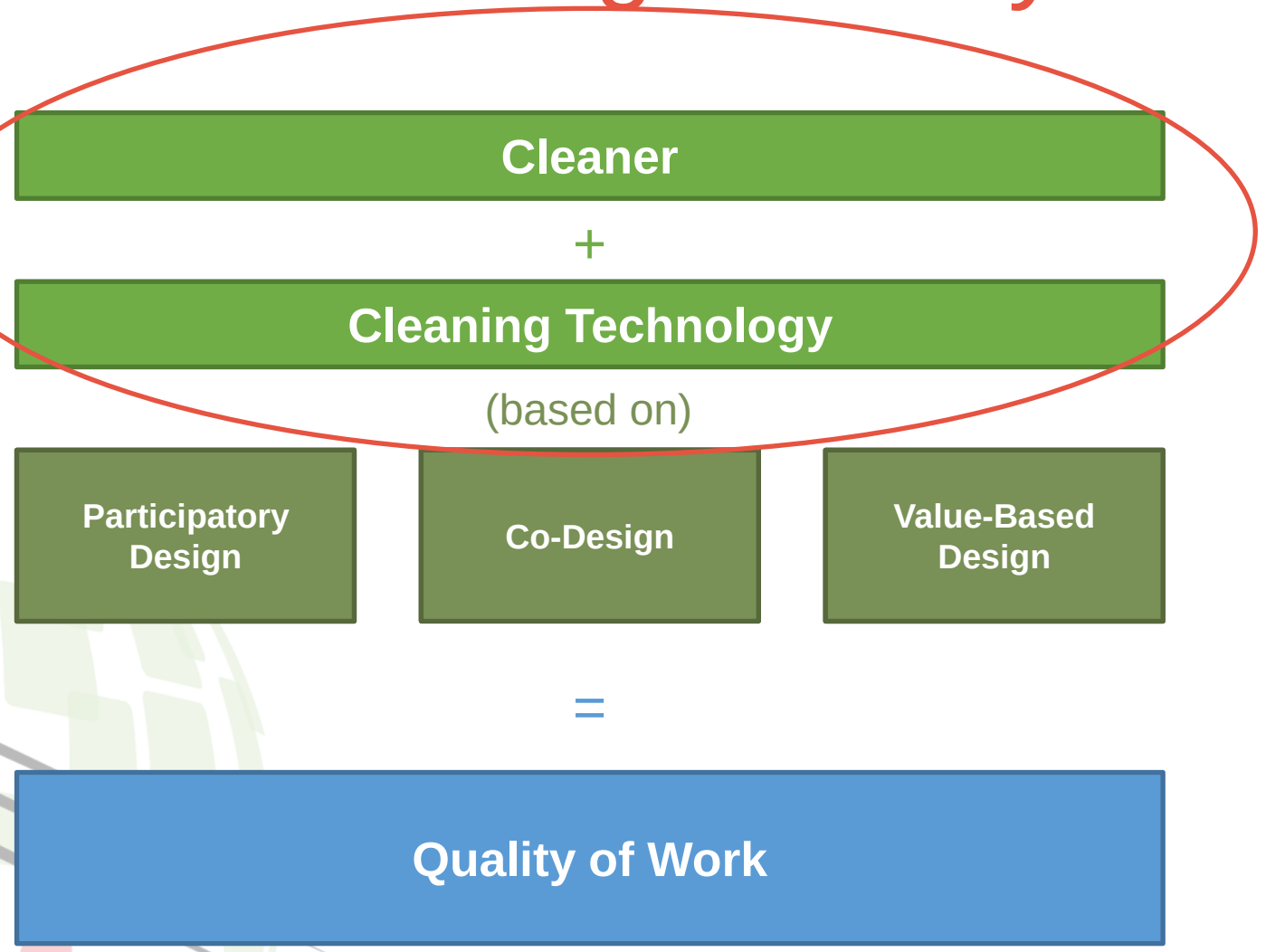
Case Study: Dutch Cleaning Industry

What is our S.U.D.?

Systems Engineering

+

Human Centered Design Approach



Problem Exploration Process

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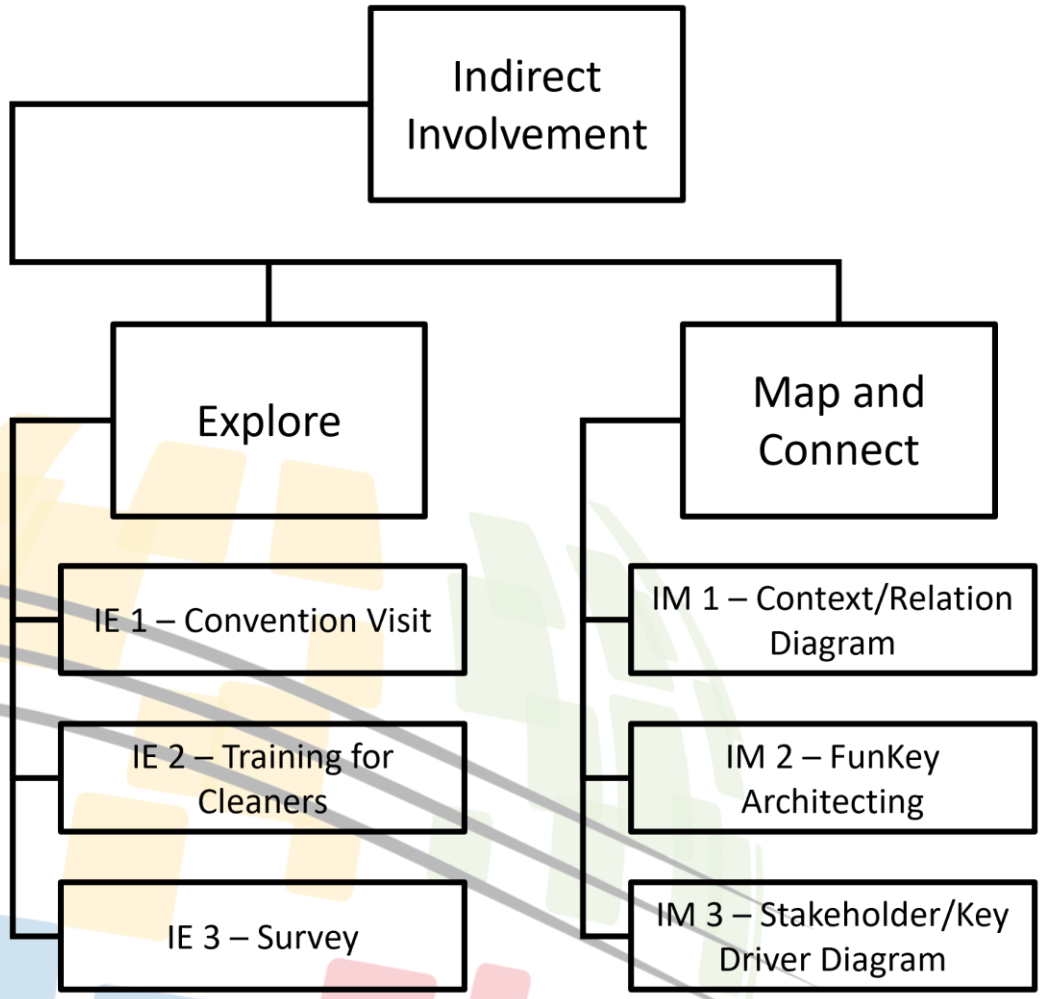
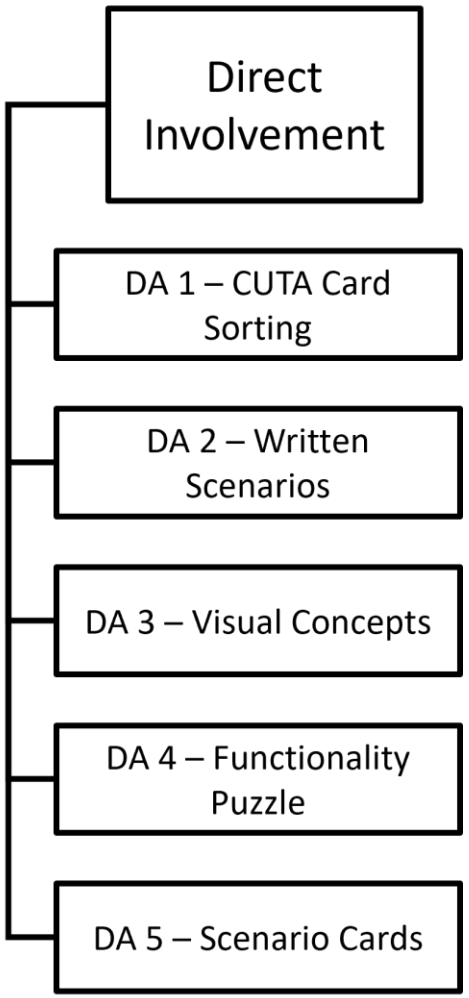
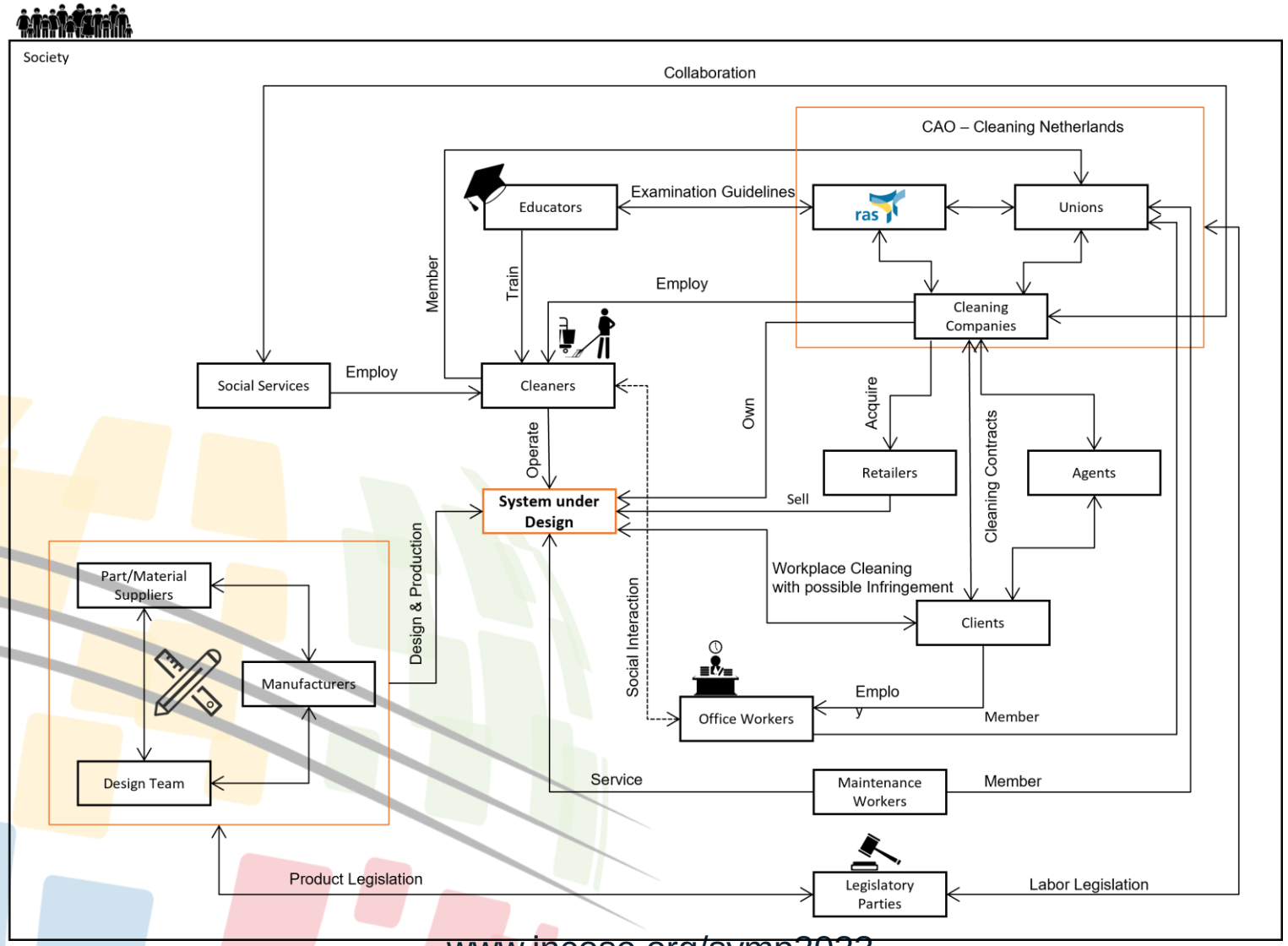




IE 1: Convention Visit

Interclean Amsterdam 2022

IM 1: Context/Relation Diagram



IM 3: Stakeholder/Key Driver Diagram

Stakeholders / Drivers	Cleaning Effort	Speed of Cleaning Process	Safety	Cleaning Quality	Robustness	Consistency	Work Satisfaction	Social Perception	Hygiene	Cost
Cleaners	x		x		x	x	x	x		
Unions	x		x				x	x		
Society								x		
Social Services	x		x				x	x		
Legislatory Parties	x		x		x	x			x	
Cleaning Companies	x	x	x	x	x	x	x	x	x	x
Agents		x		x						x
Clients		x		x						x
Office Workers		x	x	x						
Maintenance Workers			x		x	x			x	
Retailers	x	x	x	x	x	x				x
Design Team	x	x	x	x	x	x				x
Part/Material Suppliers			x		x	x				x
Manufacturers			x		x	x			x	x
Educators	x		x				x	x		
RAS	x		x				x	x		

DI 1: CUTA Card Sorting

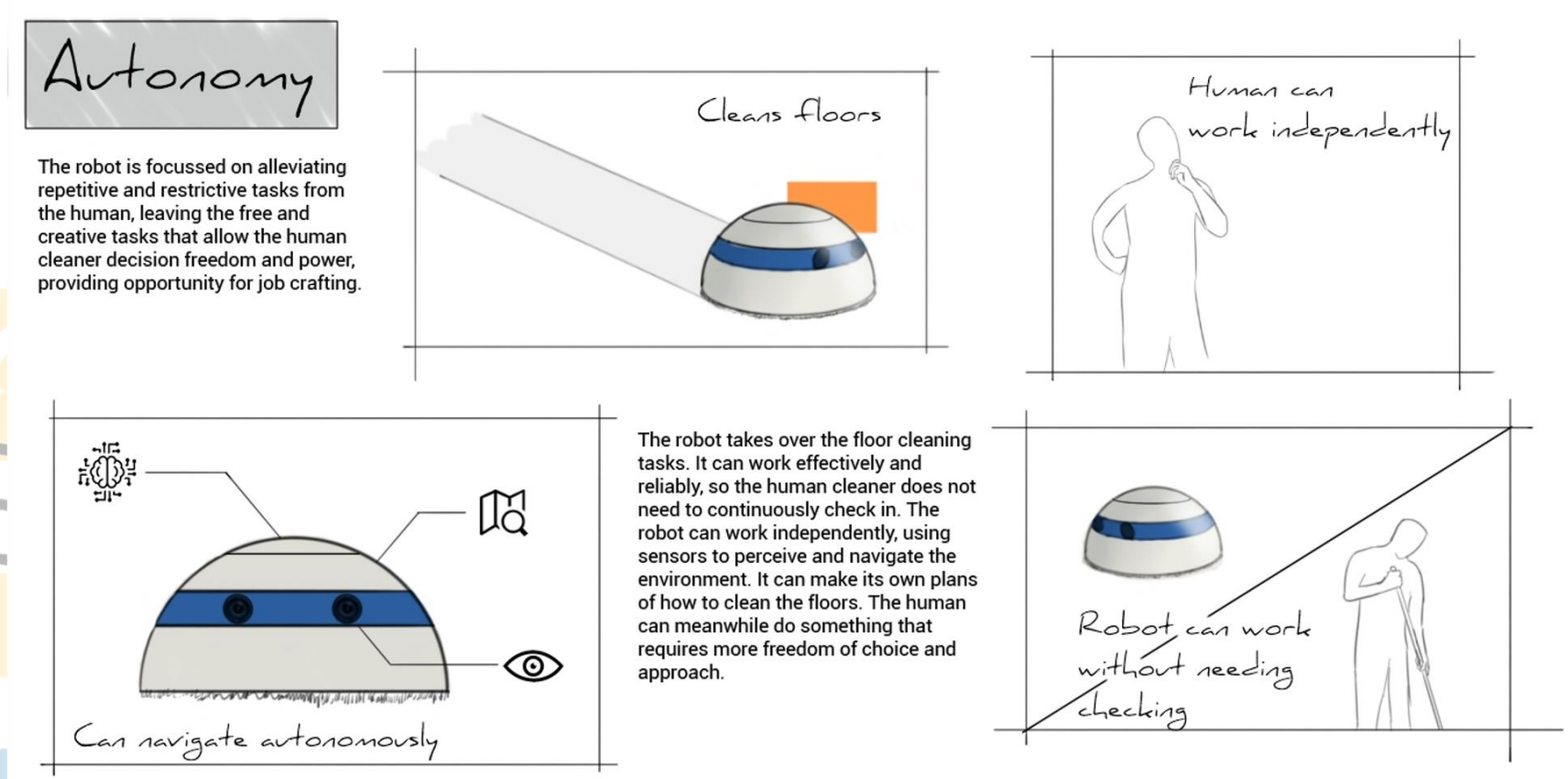
Task: Vacuuming

Occurrence: Daily

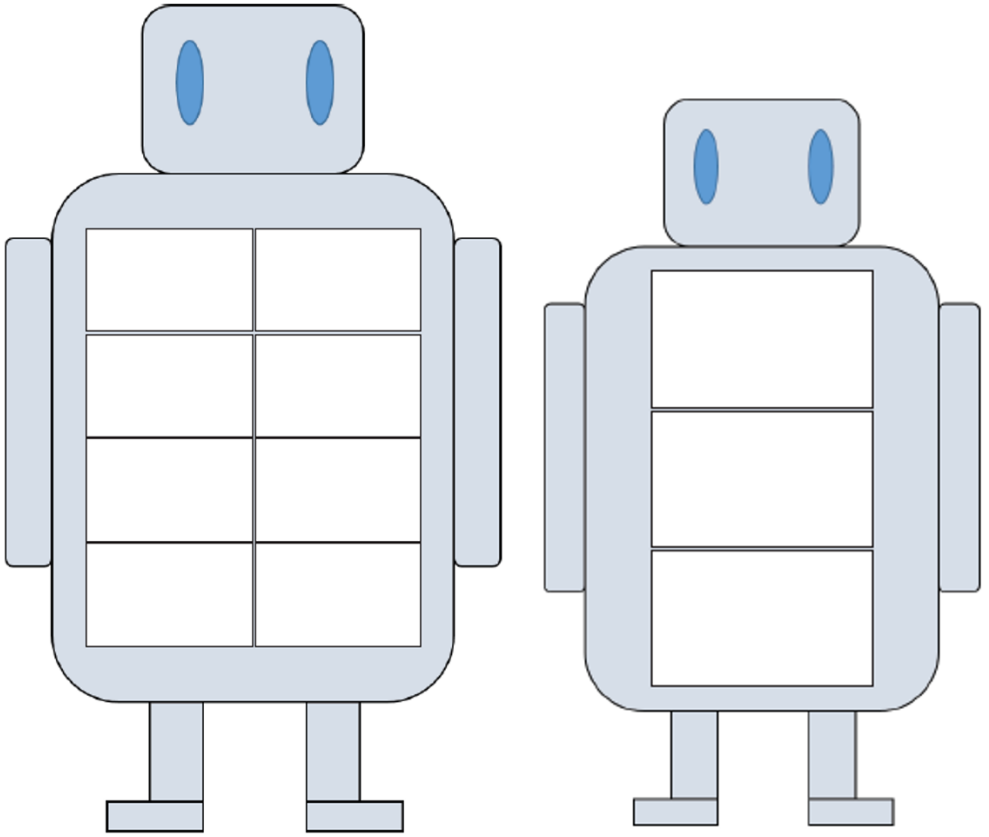
Task: Cleaning Inner Glass

Occurrence: Weekly

DI 3: Visual Concepts - SDT



DI 4: Functionality Puzzle



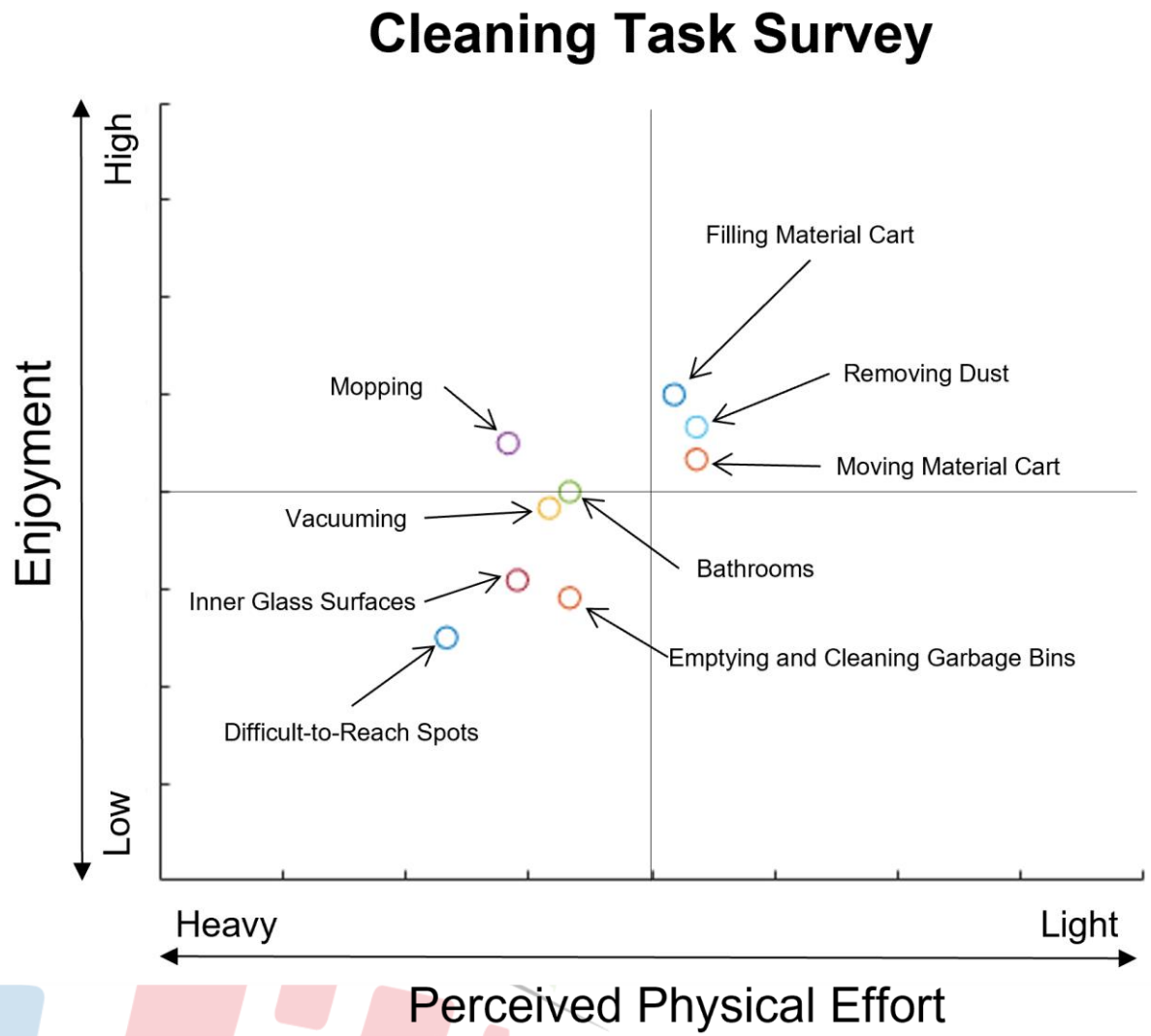
DI 5: Scenario Cards

Results & Evaluation

Results & Evaluation: Explore

Activity	Goal	Lessons Learned
IE 1 – Convention Visit	State-of-the-art Identification Stakeholder Relations and Desires Identification	Keep bigger picture
IE 2 – Training for Cleaners	Practical Experience	Involvement with target group, keep the designer perspective
IE 3 – Survey	Stakeholder Needs Identification	Prejudice in answers based on distribution type Statistical accuracy

Results & Evaluation: Explore 2



Results & Evaluation: Map & Connect

Activity	Goal	Lessons Learned
IM 1 – Context /Relation Diagram	Stakeholder Identification and Mapping. Involvement Determination	Inter-stakeholder relations
IM 2 – FunKey Architecting	Function and Key Driver Validation	Requires knowledge on functions
IM 3 – Stakeholder – Key Driver Diagram	Stakeholder Acceptance Validation	Adaptable throughout process

Results & Evaluation: Direct Involvement 1

Activity	Goal	Results	Evaluation
DA 1- CUTA Card Sorting	Identification of Current Conditions	Cleaning toilets is most annoying task. Floor-cleaning most physically demanding task.	Experience based – close to heart for non-technical stakeholders. Introduction to subject for session
DA 4 – Robot /Technology Puzzle	Identification of Stakeholder Priorities	Floor Cleaning has priority. 'Fun' functions desirable if budget to spare.	Non-ambiguous Easy to execute Clear prioritizations Coherence between presented functions

Results & Evaluation: Direct Involvement 2

Activity	Goal	Results	Evaluation
DA 2 – Written Scenarios	Discussing Views on Future Vision	Robots/Technology needs to have a collegial/human side	Designers: Creative out of the box solutions. Thinking about context. Cleaners: Not a lot of solutions, but some 'safe' solutions. Anecdotes about experiences with technologies of similar situations. Literal interpretations.
DA 3 – Visualized Concepts			
DA 5 – Scenario Cards	Ideation Based on Current Technologies and Situations	Familiar or similar technologies are desired	

Discussion

Discussion: Benefits

HCD Approach

- Connection to Stakeholders
- Engagement to fill Gaps/Uncertainties
- Support for Final Design

Systems Engineering

- Overview of System(s) and Context
- Determination of Types of Stakeholder Involvement

Discussion: Challenges

Context Thinking

- Designers think of Context, Application and Underlying Messages
- Cleaners interpret literally and fall back on own Experiences

Communication

- Visualizations
- Ambiguity

Discussion: Limitations

Personal Preference

- Quantitative Research required

- Direct Active Involvement Sessions consisted of Limited Amount of Cleaners

Interaction Cleaners - Designers

- Sessions were either only Cleaners or Designers

Conclusions & Future Work

Conclusions & Future Work

Problem Exploration

- Stakeholder Needs and Requirements Definition
- Promising Way of involving all Stakeholders meaningfully

Further Design Phases

- Needs to be investigated
- Managing Trade-Offs of Different Creative Levels; Designers and other Stakeholders

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www.incose.org/symp2023