Canvas # 01

PROBLEM SPACE

SOCIAL ROBOT CO-DESIGN CANVASES

What problem are you solving?

USER

Group(s) Who are the users? Are there supporting users? For example: students and teachers.	Characteristics What are the users like?	Needs What do the users need?
primary users		
secondary users		

Goal(s)

What do the primary and secondary users want to accomplish?

	SHORT-TERM	LONG-TERM
primary users		
secondary users		

ROBOT

Task(s)

What task does the robot perform?

SHORT-TERM | LONG-TERM

Advantages

What advantages does using a robot bring (compared to a computer or human)?

Social skills	User's emotional response	Personalization	Precise tasks
Data collection with sensors	Mobility	Environment manipulation	Connection to systems

Canvas # 02

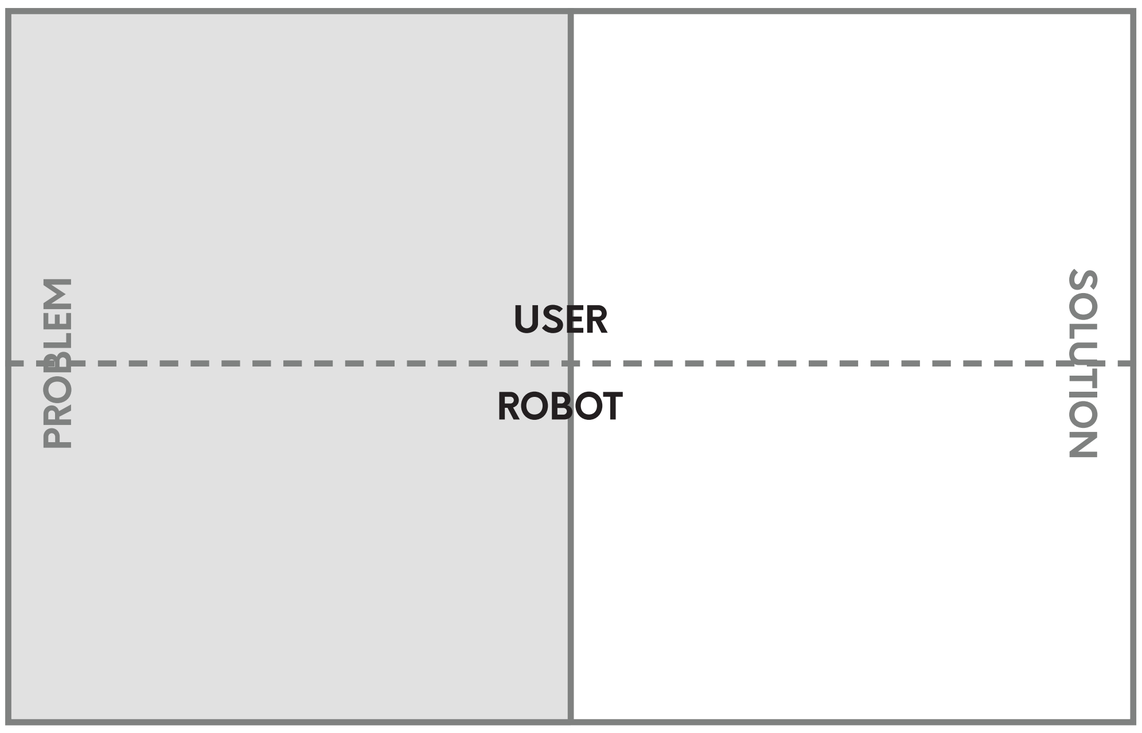
ETHICAL CONSIDERATIONS

SOCIAL ROBOT CO-DESIGN CANVASES

Consider potential ethical problems, and potential solutions –both from the user's and robot's perspectives.
Consider the boxes to be guidelines: you don't need to fill each one.

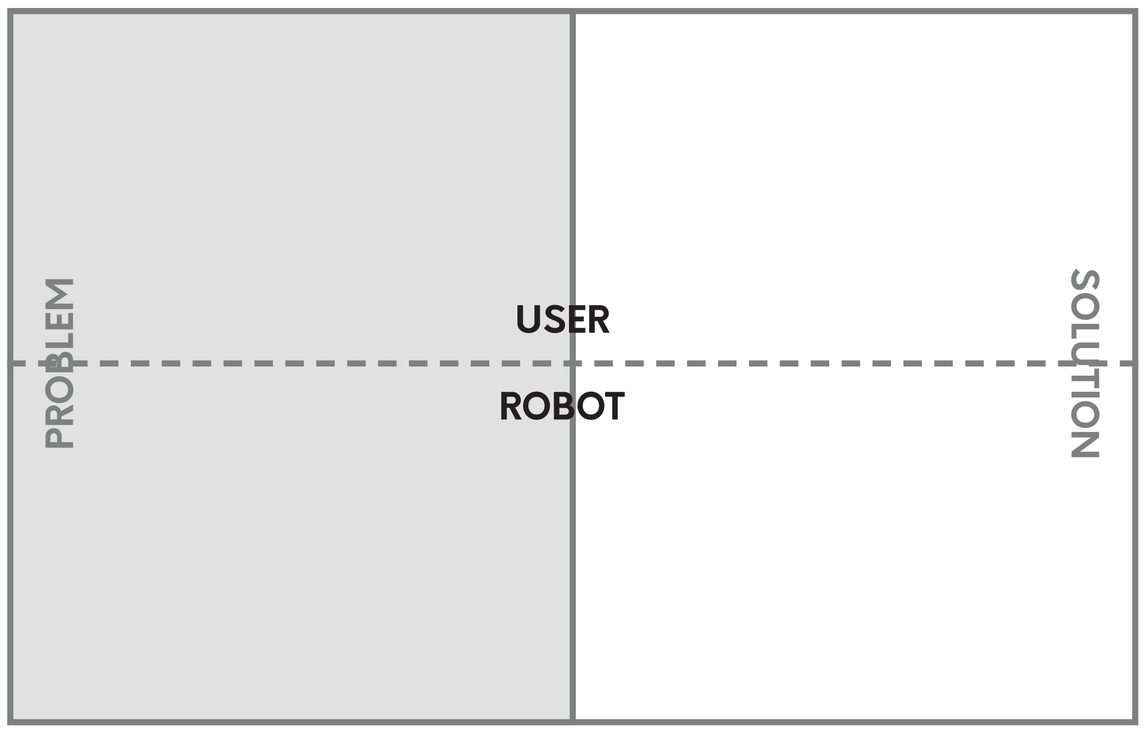
Physical safety

Machines can pinch or crush the user. How is this mitigated?



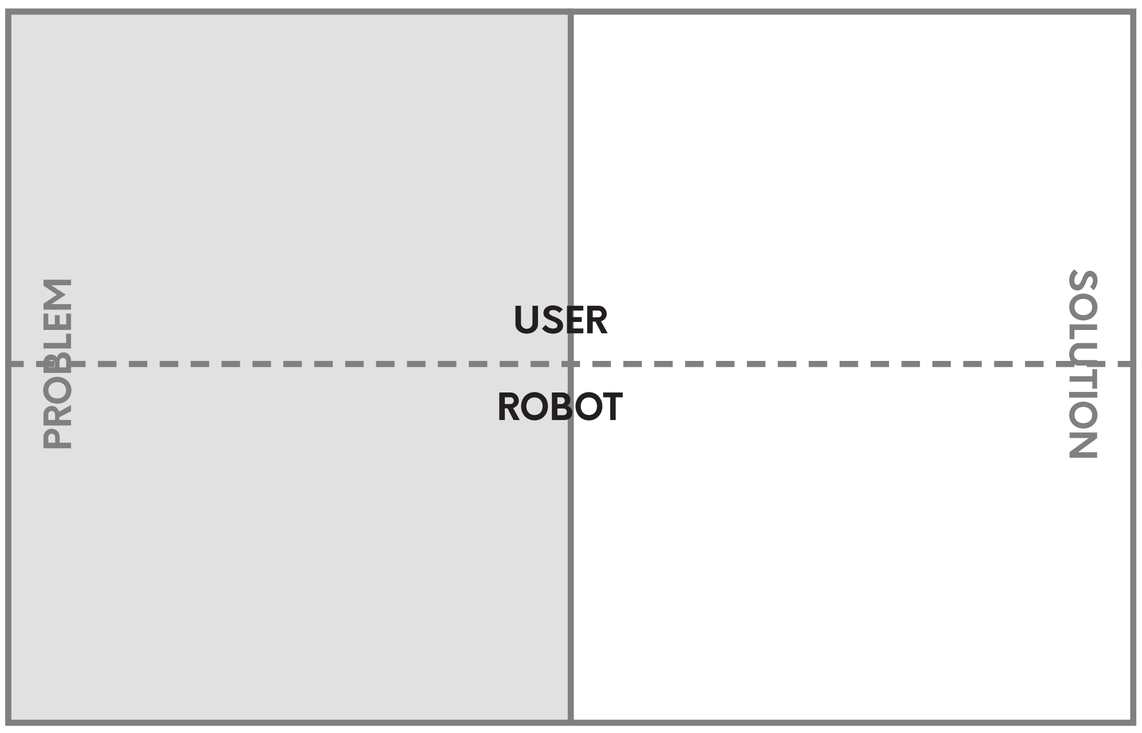
Data security

Is the robot in a unique data collection position? How is the user's data protected?



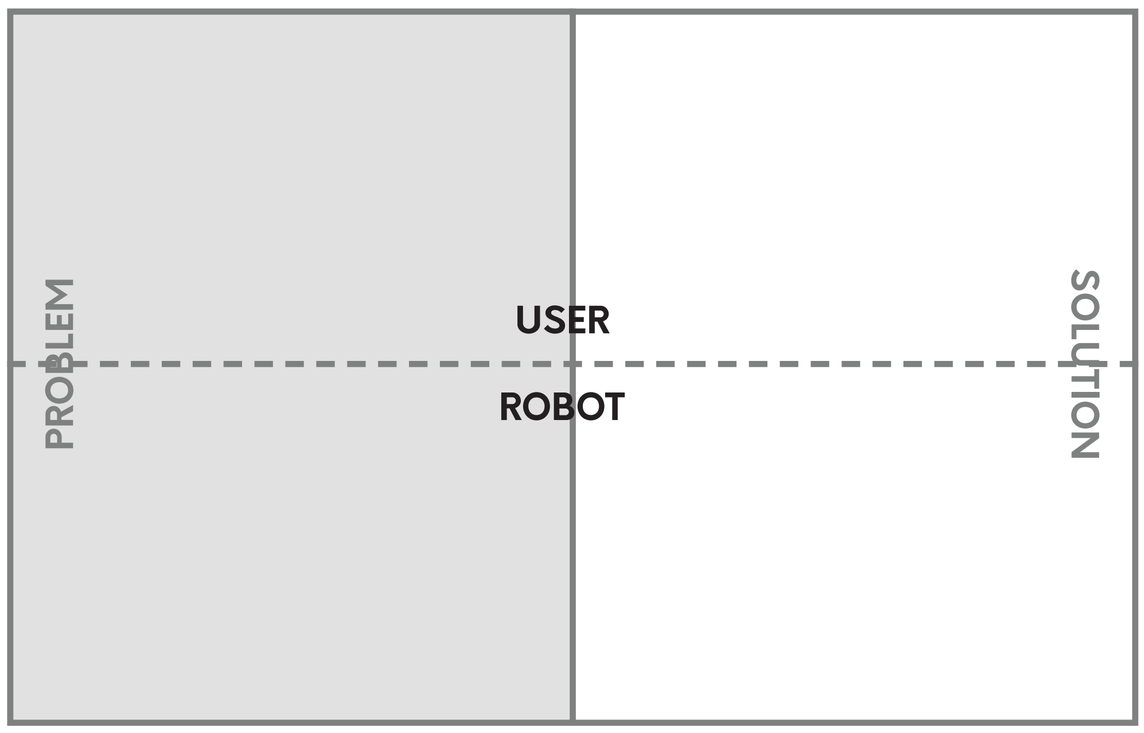
Transparency

How does the robot share an accurate perception of its abilities, intentions and constraints, so the user can evaluate their trust in it?



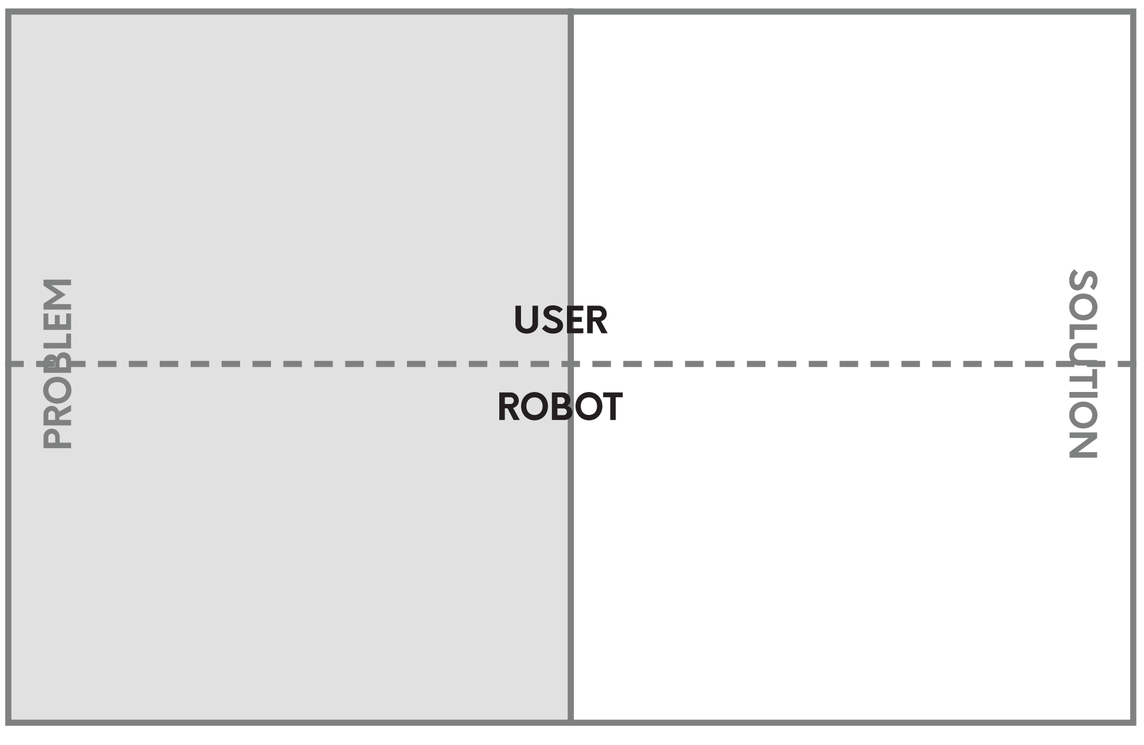
Equality across users

Robots' algorithms can be biased. A robot's appearance could reinforce harmful stereotypes. What are potential issues?



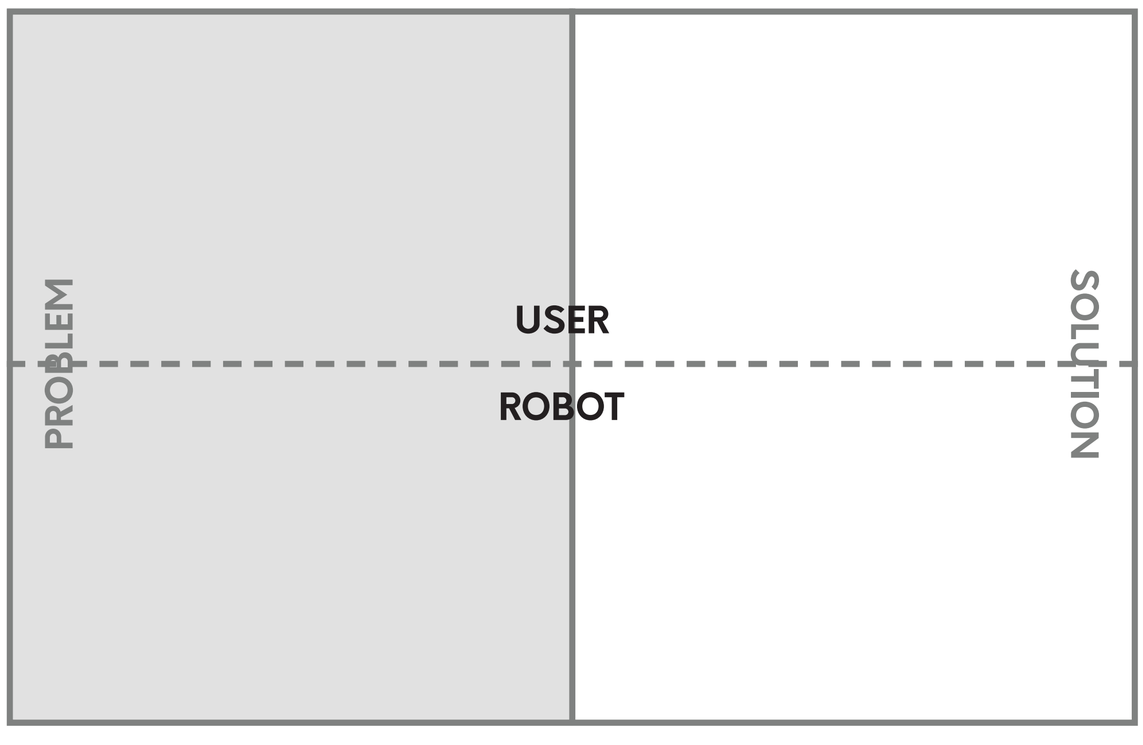
Emotional consideration

People have been shown to form emotional attachments to robots, as if they were alive. Is this a potential problem?



Behaviour enforcement

People could transfer their inappropriate behaviour, such as rudeness, from robots to humans. How is this mitigated?



Canvas # 03

DESIGN GUIDELINES

SOCIAL ROBOT CO-DESIGN CANVASES

What things are important to consider in the robot's design?

Advantage guidelines

What advantages can the robotic solution have?
Think back to what you defined in the solution space canvas.

Ethical guidelines

What ethical considerations does the robot have?
Think back to what you defined in the ethics canvas.

ROBOT DIMENSIONS

Environment guidelines

What should the robot's context be like?
For example:

- If users are especially vulnerable, should it optimize for support?
- If the robot is part of a strict process, should it optimize for efficiency and security?

Form guidelines

What guides the design of the robot's outward qualities?
For example:

- Should the robot be designed to appear especially approachable, or more industrial?
- Should it be simple, or detailed?

Interaction guidelines

What guides the design of interaction?
For example:

- Is the interaction multimodal, or is one modality optimized for efficiency?
- Should the user feel empowered and lead the interaction, or does the robot provide safety via leadership?
- Is the goal of the interaction to complete a task, or explore?

Behaviour guidelines

What guides the design of the robot's behaviour?
For example:

- Should behaviour be simple, or sensitive to context?
- Does the robot have internal drivers, or does it react to external stimuli?
- Does the robot have social skills?

Canvas # 04

ROBOT DESIGN MVP

SOCIAL ROBOT CO-DESIGN CANVASES

It's time to design your robot MVP (Minimum Viable Product)! Remember the guidelines you defined.

Where and when

What place?
What time of day?
Does the place or time change?

Robot's role

Is the robot a friend? Teacher? Helper?
Something else?

Draw a picture

What does the robot look like?
Is it attached to something?
Does it move around?
Can its appearance be modified?

Personality

Does the robot have specific characteristics?
Does it have emotional states, or needs?

Context-based behaviour

What external and environmental factors affect behaviour?
What data is used to adapt to context?

Connection to systems

Is the robot connected to external systems, such as software, databases, or other robots?
How does it use these systems?

Interaction modalities

What modalities are inputs to the robot? What modalities does the robot output?

INPUT			OUTPUT		
☐ voice	☐ movement	☐ screens	☐ voice	☐ movement	☐ screens
☐ sounds	☐ touch	☐ lights	☐ sounds	☐ touch	☐ lights
☐ gestures	☐ smell	☐ other _____	☐ gestures	☐ smell	☐ other _____
	☐ facial expressions _____			☐ facial expressions _____	

Interaction flow

Describe the most important interaction of the robot.
Note: only fill the bottom row if your robot is teleoperated.

	BEFORE	DURING	AFTER
USER			
ROBOT			
ROBOT OPERATOR (optional)			

Canvas # 05

ENVIRONMENT

SOCIAL ROBOT CO-DESIGN CANVASES

What is the robot's context of operation?
You can use the "Ecosystem" canvas to dive deeper into this topic.

Where

What place?
Does it change?

User(s)

Who is using the robot?

When

What time of day?
Does it change?

Secondary user(s)

Are there secondary users?
E.g. teachers that help students use a robot.

Data collection

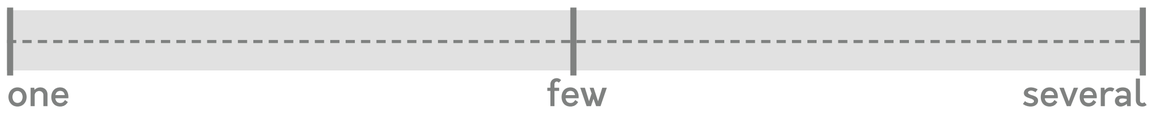
Does the robot collect data from its environment?
How is it stored?

TRADE-OFF:
More data collection requires more attention to data security.

Simultaneous users

How many users should be able to use the robot simultaneously?

TRADE-OFF:
More simultaenous users requires a more sophisticated robot.



External sensors and actuators

Does the robot use external sensors?
Does it have external actuators, such as lights or limbs?

Connection to systems

Is the robot connected to external systems, such as software, databases, or other robots?
How does it use these systems?

Canvas # 06

FORM

SOCIAL ROBOT CO-DESIGN CANVASES

What are the robot's outward qualities? If an existing robot is used, are its qualities modified?

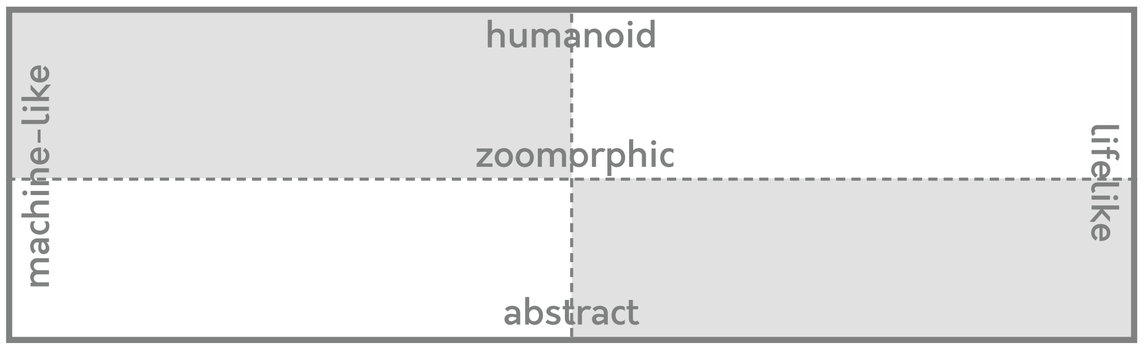
Draw a picture

What does the robot look like?
Is it attached to something?
Does it move around?
Can its appearance be modified?

Appearance

Is the robot more machine or lifelike? Is it human-shaped, animal-shaped, or abstract?

TRADE-OFF:
Robots that appear more human and lifelike are expected to be more sophisticated in features.

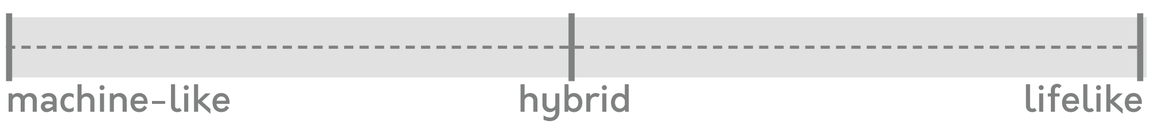


Size

How big is the robot?

Character of movement

What is the robot's movement like?



Voice & sounds

Does the voice have a gender or an age? What are pitch, speed and prosody like? Is the voice always the same?
Does the robot make sounds: music, "beep"s, animal noises?
When are these sounds heard?

Mobility

Does the robot move across space? Does it move in place?

Visual cues

Does the robot have expressions, lights, a screen or other visual elements?

Touch & smell sensations

Is the robot soft or rough, warm or cold?
How does the robot smell?
Touch and smell are especially important in close interactions.

Canvas # 07

INTERACTION

SOCIAL ROBOT CO-DESIGN CANVASES

How does the robot interact with the user?
You can use the “Experience Flow” canvas to dive deeper into this topic.

Interaction modalities

What modalities are inputs to the robot? What modalities does the robot output?

INPUT

- ☐ movement
- ☐ screens
- ☐ voice
- ☐ touch
- ☐ lights
- ☐ sounds
- ☐ smell
- ☐ other _____
- ☐ gestures
- ☐ facial expressions
- _____

OUTPUT

- ☐ movement
- ☐ screens
- ☐ voice
- ☐ touch
- ☐ lights
- ☐ sounds
- ☐ smell
- ☐ other _____
- ☐ gestures
- ☐ facial expressions
- _____

Interaction flow

Describe the most important interaction of the robot.
Note: only fill the bottom row if your robot is teleoperated.

	BEFORE	DURING	AFTER
USER			
ROBOT			
ROBOT OPERATOR (optional)			

Situation flow

How defined is the situation where the interaction takes place? Does the user always enter and exit at the same point?

predefined — flexible — freestyle

Leadership

Who initiates the interaction? Who determines what happens next?

robot-led — mutual / alternate — user-led

Goal

What is the user’s goal in the interaction? What describes the interaction?

task completion / informative — both — explorative

Robot’s name

Does the robot have a name which is used during interaction?

TRADE-OFF:
A robot with a name, creates more emotional bond.

Canvas # 08

BEHAVIOUR

SOCIAL ROBOT CO-DESIGN CANVASES

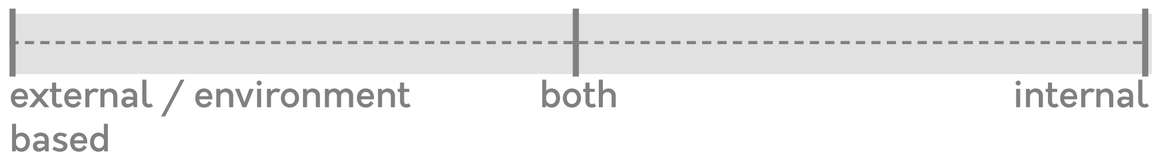
What factors guide the robot's behaviour?

Robot's role

Is the robot a friend? Teacher? Helper? Something else?

Motivation

How is the robot's behaviour motivated? Is it based on external data, internal models such as personality, or both?



Personality

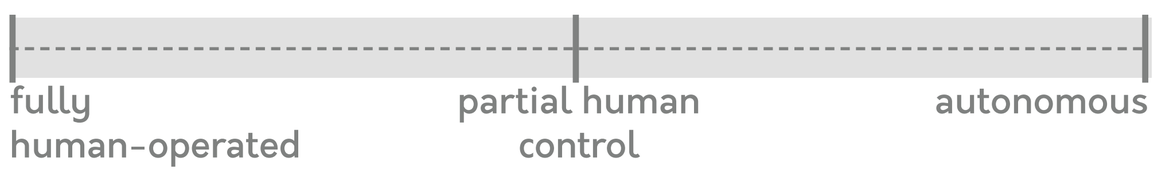
Does the robot have specific characteristics? Does it have emotional states, or needs?

TRADE-OFF:
More personality creates more emotional bond.

Mode of operation

Is the robot operating by itself, or is a human affecting behaviour? Is a human in full control?

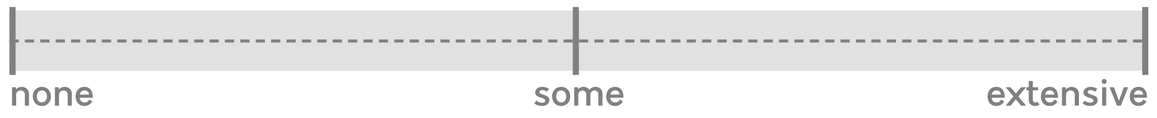
TRADE-OFF:
A human-operated robot requires a good user interface, an autonomous robot requires a good control logic.



Social skills

How good are the robot's social skills: does it greet a new person and ask their name? Does it follow people with its gaze?

TRADE-OFF:
Extensive social skills require a more sophisticated robot.



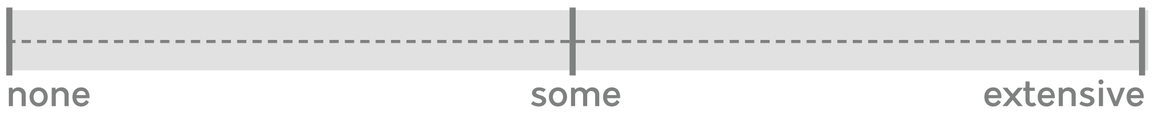
Social behaviours

What social behaviours does the robot exhibit?

Contextual adaptation

Does the robot's behaviour vary according to context, e.g. by weather or time of day?

TRADE-OFF:
More contextual adaptation requires a more sophisticated robot.



Context-based behaviour

What external and environmental factors affect behaviour? What data is used to adapt to context?

Personalization

Does the robot behave differently toward different people? Does it need to remember people, and store their data?

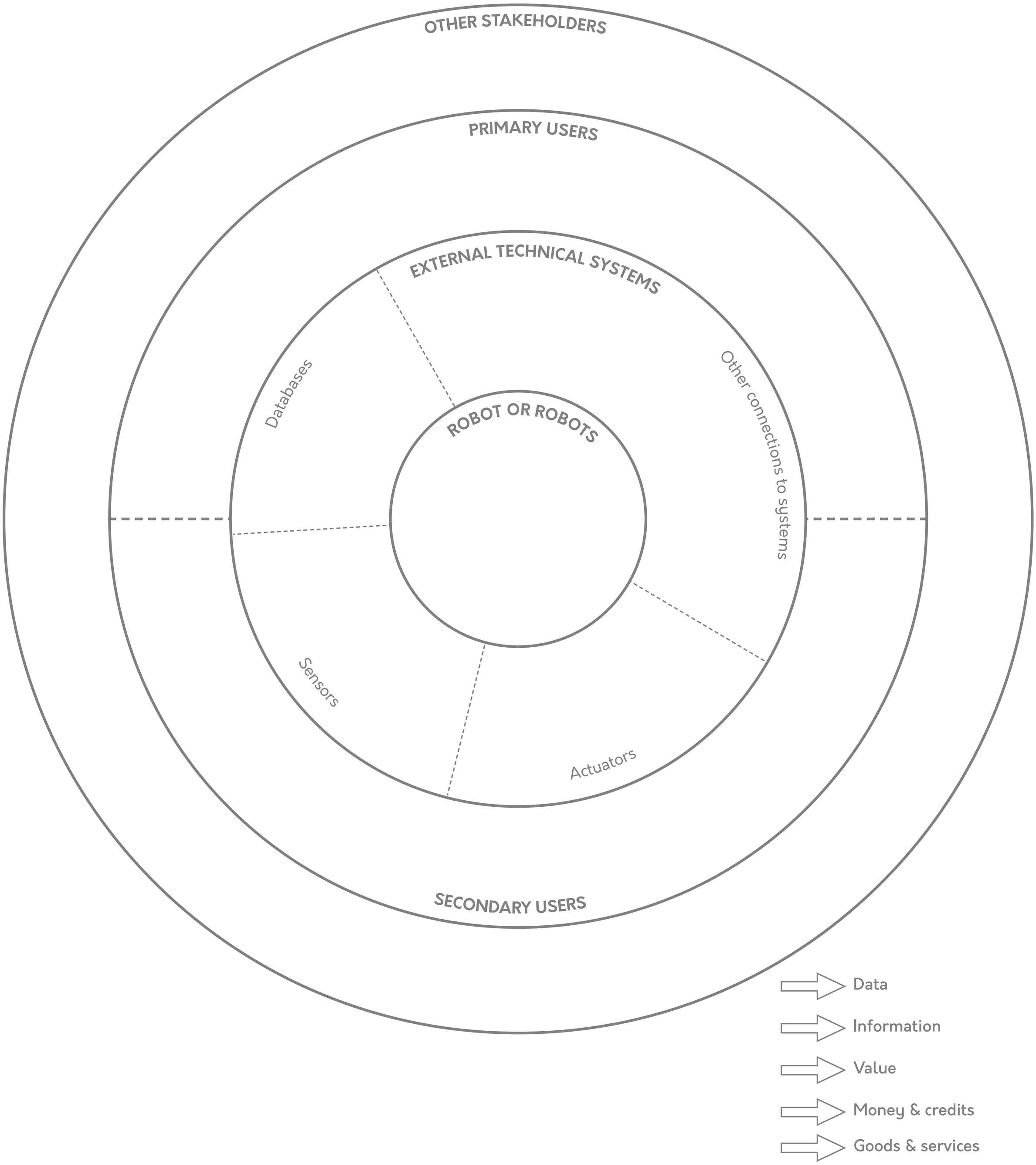
TRADE-OFF:
More personalization requires more personal data from the user.

Canvas # 09

SERVICE ECOSYSTEM

SOCIAL ROBOT CO-DESIGN CANVASES

What stakeholders does the robot's operation involve?
Draw sectors for different stakeholders.
Select a color for each of the resources, and draw arrows to show their flow from stakeholder to stakeholder.



Canvas # 10

EXPERIENCE FLOW

SOCIAL ROBOT CO-DESIGN CANVASES

Describe the most important interaction of the robot.
Note: only fill the bottom row if your robot is teleoperated.

	BEFORE	DURING	AFTER
USER	**FEELING** e.g. confused		
USER	**THINKING** e.g. “I need help.”		
USER	**DOING** e.g. pushes button		
ROBOT	**DOING** e.g. says “Hello!”		
ROBOT	**SENSOR INPUT** e.g. sees user’s face		
ROBOT	**CONNECTION TO SYSTEMS** e.g. records data in database		
ROBOT OPERATOR (optional)	**DOING** e.g. controls robot’s arm		

DESIGN PATH

SOCIAL ROBOT CO-DESIGN CANVASES

How to choose your canvases

START HERE

PHASE 1: PROBLEM SPACE

Canvas # 01

SOLUTION SPACE

Define the solution you're building.

Canvas # 02

ETHICAL CONSIDERATIONS

Think about ethical questions related to your solution.

PHASE 2: DESIGN GUIDELINES

Canvas # 03

DESIGN GUIDELINES

Decide what guides the design of the robot.

PATH 1:
A quick first draft of the robot design. Choose to create first ideas, or to choose between ideas.

PATH 2:
In-depth design of the robot and its four dimensions. Choose to create the final product design.

PHASE 3: SOLUTION SPACE

Canvas # 04

MVP (MINIMUM VIABLE PRODUCT)

Create a rough draft of the design of your robot.

Canvas # 05

ENVIRONMENT

Examine what factors surround the operation of the robot.

Optional:
Use to examine the robot's service ecosystem in-depth.

Canvas # 09

SERVICE ECOSYSTEM

Examine the service ecosystem the robot exists within.

Canvas # 06

FORM

Examine the outwardly perceptible qualities of the robot.

Canvas # 07

INTERACTION

Examine how the robot interacts with the user(s).

Optional:
Use to examine the user's experience in-depth.

Canvas # 10

EXPERIENCE FLOW

Create an interaction script of the robot and the user.

Canvas # 08

BEHAVIOUR

Examine what drives the robot's behaviour.

FINISHED