PROBLEM SPACE
SOCIAL ROBOT CO-DESIGN CANVASES

What problem are you solving?

USER

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

Goal(s)
What do the primary and secondary users want to accomplish?

primary users

secondary users

SHORT-TERM   LONG-TERM

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

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?

PROBLEM | USER / ROBOT | SOLUTION

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

PROBLEM | USER / ROBOT | SOLUTION

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

PROBLEM | USER / ROBOT | SOLUTION

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

PROBLEM | USER / ROBOT | SOLUTION

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

PROBLEM | USER / ROBOT | SOLUTION

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

PROBLEM | USER / ROBOT | SOLUTION

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?

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?

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

Robot's role
Is the robot a friend? Teacher? Helper?
Something else?

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

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

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)			

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:
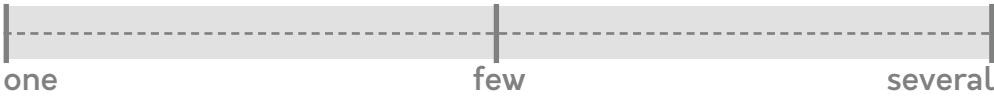More data collection requires more attention to data security.

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

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

one   few   several

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?

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?
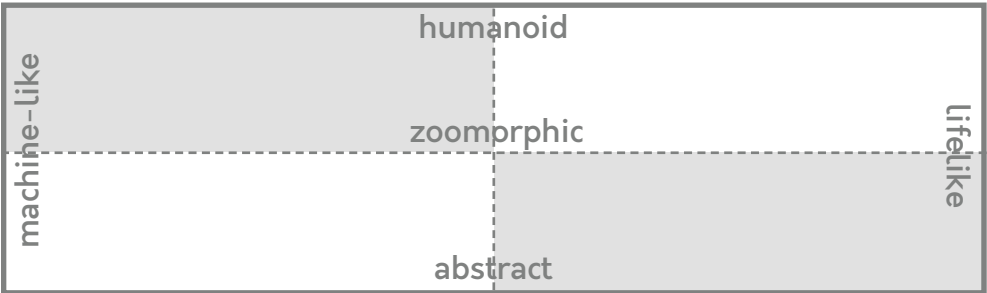Does it move around?
Can its appearance be modified?

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.

	humanoid	
machine-like	zoomprphic	lifelike
	abstract	

Size
How big is the robot?

smaller — human-size — bigger

Character of movement
What is the robot's movement like?

machine-like — hybrid — lifelike

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.

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

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

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.
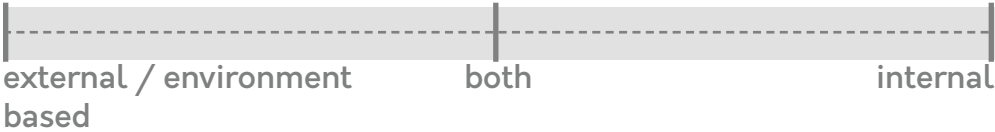
BEHAVIOUR
SOCIAL ROBOT CO-DESIGN CANVASES

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?

external / environment based   both   internal

Personality

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

⚖ TRADE-OFF:
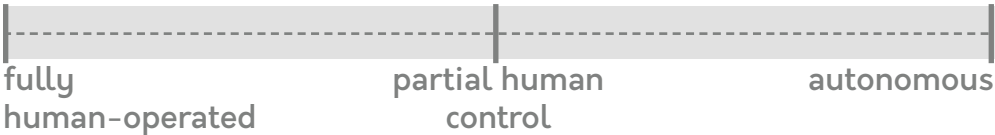More personality creates more emotional bond.

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.

fully human-operated   partial human control   autonomous

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.

none   some   extensive
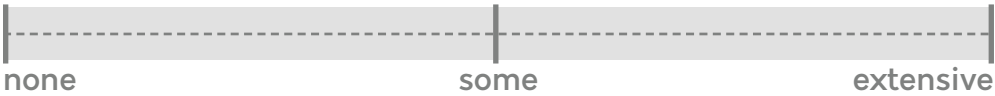
Social behaviours

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.
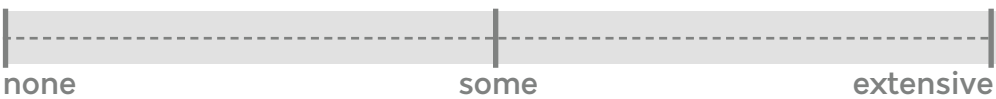
none   some   extensive

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.

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.

OTHER STAKEHOLDERS

PRIMARY USERS

EXTERNAL TECHNICAL SYSTEMS

Databases

Other connections to systems

ROBOT OR ROBOTS

Sensors

Actuators

SECONDARY USERS

⟹ Data
⟹ Information
⟹ Value
⟹ Money & credits
⟹ Goods & services
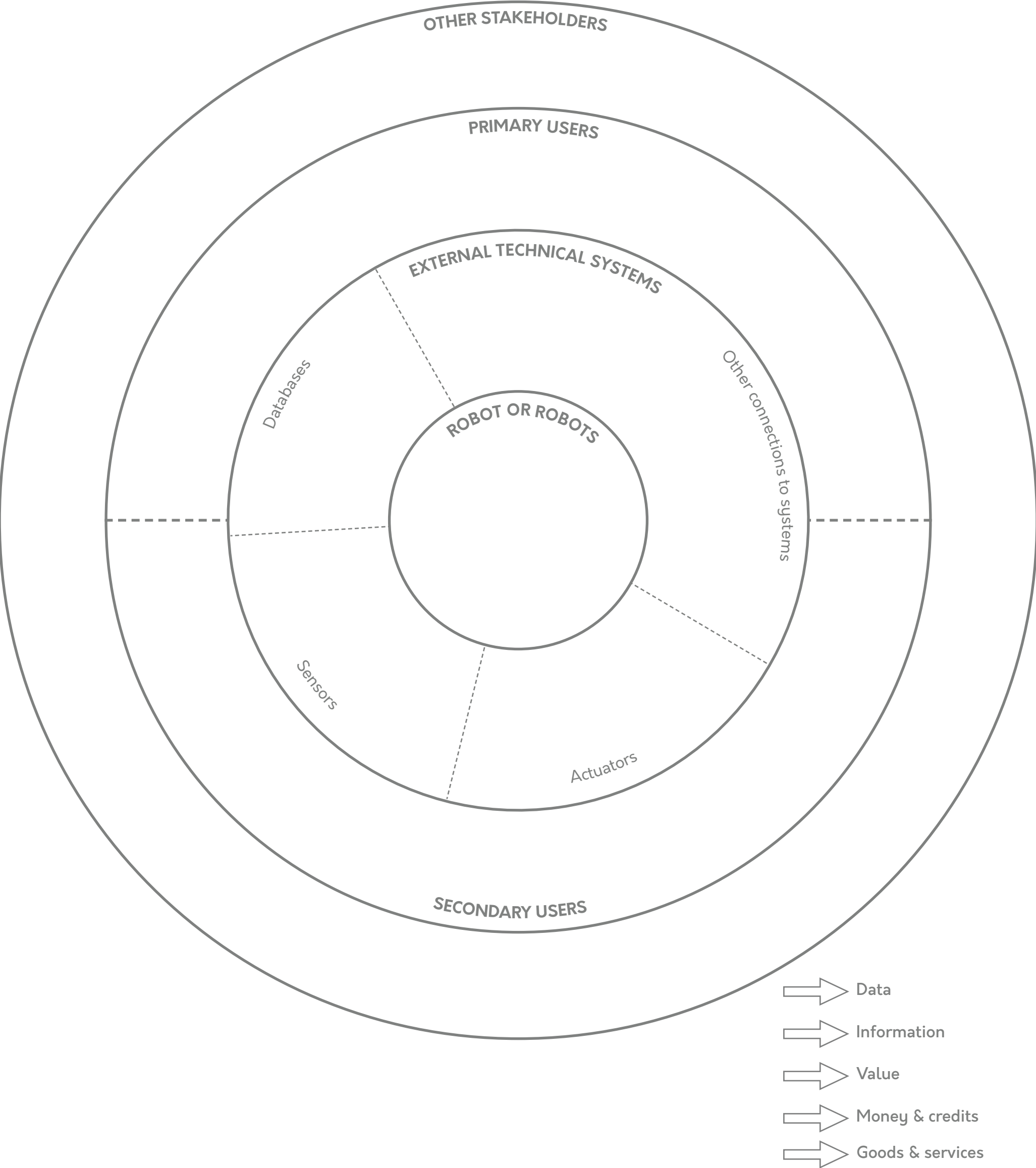
EXPERIENCE FLOW
SOCIAL ROBOT CO-DESIGN CANVASES

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			
THINKING e.g. "I need help."			
DOING e.g. pushes button			
ROBOT — **DOING** e.g. says "Hello!"			
SENSOR INPUT e.g. sees user's face			
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

Canvas # 01

SOLUTION SPACE

Define the solution you're building.

Canvas # 02

ETHICAL CONSIDERATIONS

Think about ethical questions related to your solution.

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.

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