PROBLEM SPACE

DESIGNING A SOCIAL ROBOT

What problem are you solving?

USER

Group(s)

Who are the users? Are there supporting users? For example: students and teachers.

primary users: library customers looking for book

secondary users: librarians

Characteristics

What are the users like?

primary users: doesn't use library so often; interested in certain topic or author or book

secondary users: busy; good at performing complex tasks

Needs

What do the users need?

primary users: has positive experiences of consulting staff; wants value through information; easiness

secondary users: more time to focus on more complex tasks

Goal(s)

What do the primary and secondary users want to accomplish?

	SHORT-TERM	LONG-TERM
primary users	finding a certain book; customer saves time	customers learn to be more independent
secondary users	librarian saves time	money savings

ROBOT

Task(s)

What task does the robot perform?

	SHORT-TERM	LONG-TERM
	knowing where book is; going to book; checking if book is loaned; loaning book for customer?	recommending books; collecting data on which books and book categories are popular; finding e-books

Advantages

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

Social skills	User's emotional response	Personalization	Precise tasks
	help people with social anxiety, who have trouble inter-acting with humans		can understand and quickly give info about the whole li-brary service
finds book faster with RFID?	guiding people		can access a lot of data about the library
Data collection with sensors	Mobility	Environment manipulation	Connection to systems

ETHICAL CONSIDERATIONS

DESIGNING A SOCIAL ROBOT

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	SOLUTION
USER	
children might treat the robot roughly	design the robot to discourage this
ROBOT	
could drive on top of someone	sensors to stop this, e.g. MiR200

Data security

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

PROBLEM	SOLUTION
USER	
GDPR: the user should not be iden-tified, or the user combined with collected data on popular books and book categories	the library's own systems guarantee data privacy
ROBOT	

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	SOLUTION
USER	
robot could cause confusion	customers can find information on how robot works
ROBOT	

Equality across users

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

PROBLEM	SOLUTION
USER	
different languages accessibility: differ-ent physical limita-tions	the user has to have the option of talking to a human librarian
ROBOT	
	Finnish, Swedish, English

Emotional consideration

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

PROBLEM	SOLUTION
USER	
frustration if the robot doesn't work can the robot be trusted?	
ROBOT	
conflict: user wants fast service, but also appreci-ates unexpected additional information from librarians	human librarians made available

Behaviour enforcement

People could transfer inappropriate behaviour, such as rude-ness, from robots to humans. How is this mitigated?

PROBLEM	SOLUTION
USER	
bad behaviour to-ward librarians user might become accustomed to ro-bot's speed, and be frustrated if service is slow	librarians and ro-bots are different, make this clear
ROBOT	

DESIGN GUIDELINES

DESIGNING A SOCIAL ROBOT

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.

librarians save time, library saves money

Ethical guidelines

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

equality and accessibility

use of the robot should not be restricted based on the user's technical knowledge

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?

background noise

accessibility (can't be in the way)

changing library layout and furniture

avoiding collisions with people

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?

touch screen
--> activation
--> choices

mobility, guiding to books

RFID-reader to find books

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?

touch screen

robot can make noises, the user uses the touch pad and doesn't talk to the robot

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 stimulus?
- Does the robot have social skills?

treats users equally

ROBOT DESIGN MVP

DESIGNING A SOCIAL ROBOT

It's time to design your robot! Remember the guidelines you defined.

Where and when

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

Oodi library
3rd floor

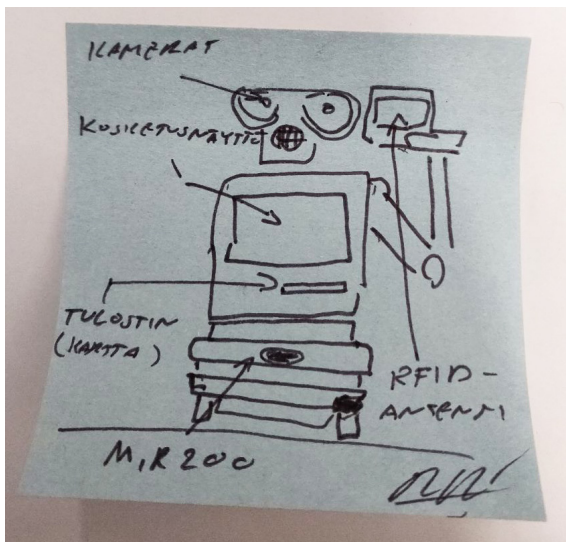
Robot's role

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

helper

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?

sincerely a machine – beeps expressively

Context-based behaviour

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

reacts to book location, mission success

Connection to systems

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

library Sierra database, MiR200 robot

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 googly eyes
	☐ 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	user activates robot		user searches for book	presses button	takes book, loans from machine
ROBOT	at 3rd floor, beeping (attracting user)	instructs user with text on screen	searches library database	guide to book OR if book not available: suggest reserving	returns to starting point
ROBOT OPERATOR (optional)					

ENVIRONMENT

DESIGNING A SOCIAL ROBOT

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?

at 3rd floor,
goes between
bookshelves at
non-fiction books

User(s)

Who is using the robot?

library customers,
who are looking
for non-fiction
books

When

What time of day?
Does it change?

during the day

test for one week,
make fixes based
on this

Secondary user(s)

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

librarians, don't use
robot themselves but
may inform library
customers about it

Data collection

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

mission success, number of
missions

no customer data

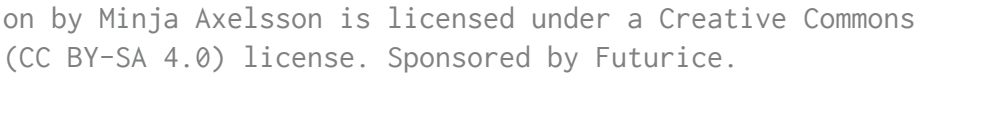
popular books and book
categories

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?

MiR200 robot has Lidar
sensors and wheels

Connection to systems

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

MiR200 navigation system,
library database Sierra

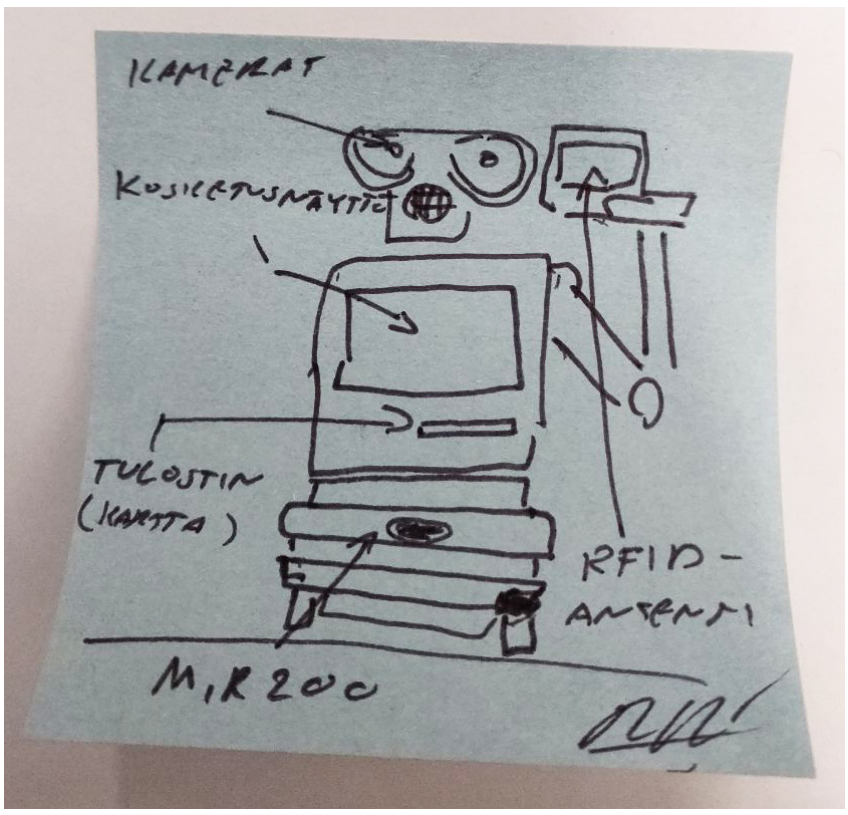
FORM

DESIGNING A SOCIAL ROBOT

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

Draw a picture

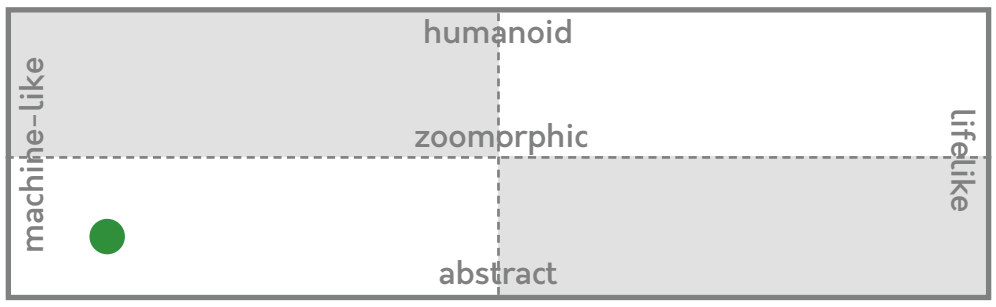
What does the robot look like?
Is it attached to something?
Does it move around?
Can its appearance be modified?



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.

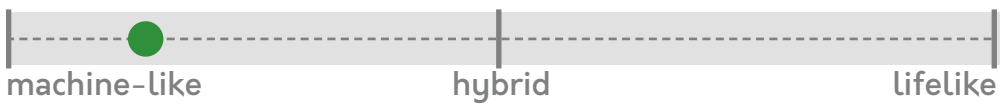


Size

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?

MiR200 navigation system, library database Sierra

Mobility

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

moves on wheels in library

Visual cues

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

lights, moving expressively, googly eyes to indicate direction of movement

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.

wood material gives warmer feel, references Oodi's architecture

INTERACTION
DESIGNING A SOCIAL ROBOT

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			OUTPUT		
☐ voice	☒ movement	☒ screens	☐ voice	☒ movement	☒ screens
☐ sounds	☐ touch	☐ lights	☒ sounds	☐ touch	☒ lights
☐ gestures	☐ smell	☐ other _____	☐ gestures	☐ smell	☐ other googly eyes
	☐ 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	user activates robot	user searches for book	presses button	follows robot	takes book, loans from machine
ROBOT	at 3rd floor, beeping (attracting user)	instructs user with text on screen	searches library database	guide to book OR if book not available: suggest reserving	returns to starting point
ROBOT OPERATOR (optional)		NOT APPLICABLE			

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.

Veera

BEHAVIOUR
DESIGNING A SOCIAL ROBOT

What factors guide the robot's behaviour?

Robot's role

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

helper

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?

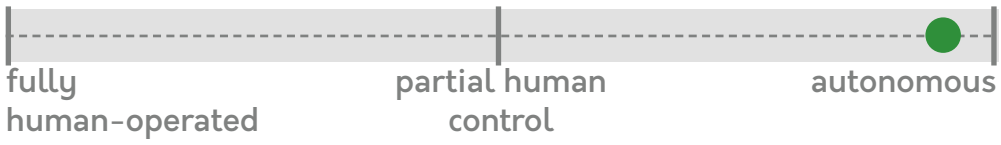
sincerely a machine – beeps expressively

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 behaviours

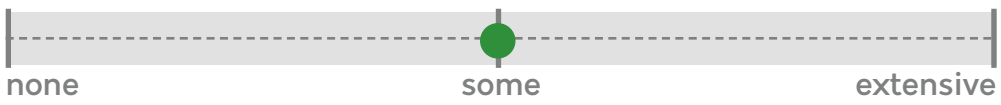
What social behaviours does the robot exhibit?

looks in direction it is moving in, looks around to attract attention, can express hesitation with movement

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?

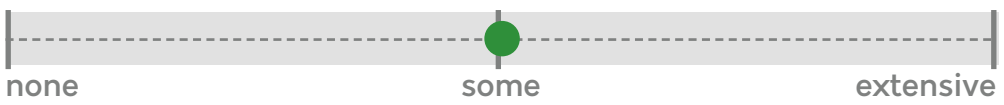
TRADE-OFF:
Extensive social skills require a more sophisticated robot.



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?

attracts customers if no missions, expresses frustration if fails missions often

Personalization

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

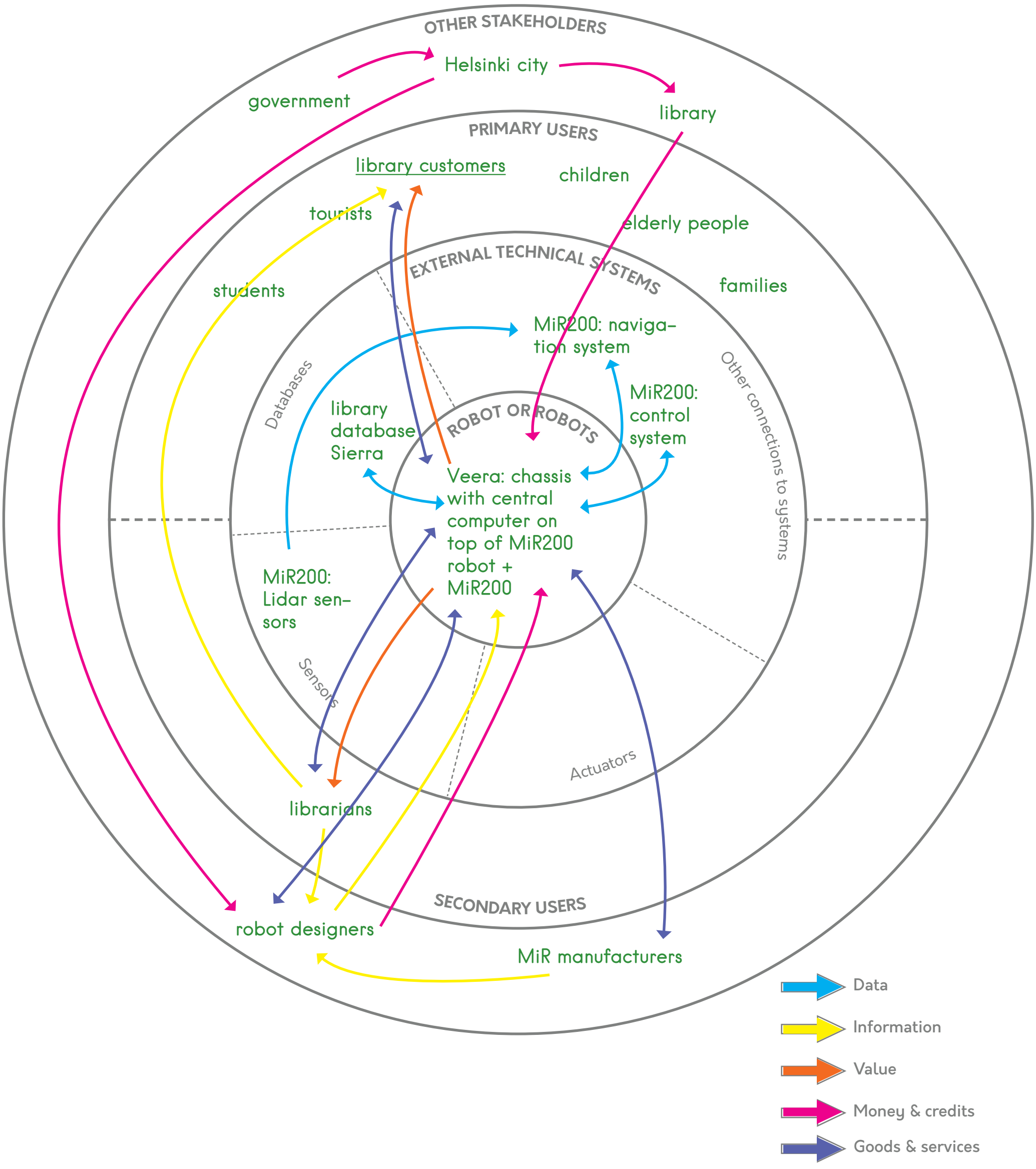
no personalization

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

SERVICE ECOSYSTEM

DESIGNING A SOCIAL ROBOT

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.



EXPERIENCE FLOW

DESIGNING A SOCIAL ROBOT

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	confusion	interest	curiosity		pleasant surprise	satisfaction, excitement
THINKING e.g. "I need help."	"I want to find this book, but I don't know the library well."		"I wonder if I can use this robot to find what I want, and if it works."		"It seems to be guiding me in the right direc–tion!"	"Great, I found the book I wanted." OR "The book wasn't here, but the experience was pleasant."
DOING e.g. pushes button	user sees robot	user activates ro–bot		user searches for book	presses button	starts follow–ing robot	takes book, loans from machine
ROBOT						
DOING e.g. says "Hello!"	at 3rd floor, beeping (attracting user)		instructs user with text on screen	searches library database	guide to book OR if book not available: suggest reserving	returns to starting point
SENSOR INPUT e.g. sees user's face		screen registers button press OR registers search term			Lidar used to avoid customers walking in library	
CONNECTION TO SYSTEMS e.g. records data in database		IF search term, searches library data–base Sierra		returns info if book is available	MiR system returns "Done" when robot in correct position	
ROBOT OPERATOR (optional)						
DOING e.g. controls robot's arm	NOT APPLICABLE					