Socially Intelligent Robotics
L4 – Part 2: Dialog Design

Contents

Learning outcomes

Student can for a given human-robot conversation speficiy the characteristics of the conversation in terms of interlocutors, context, goals, and initiative.

Student can analyse, design, and implement the key conversational mechanisms: turn-taking, repair, and capability communication.

Student can apply relevant Grician maxims and design patterns when creating a dialog design.

Student can create an agent persona and a flow diagram for a given dialog design.

Student can implement a dialog design using the SIC framework.

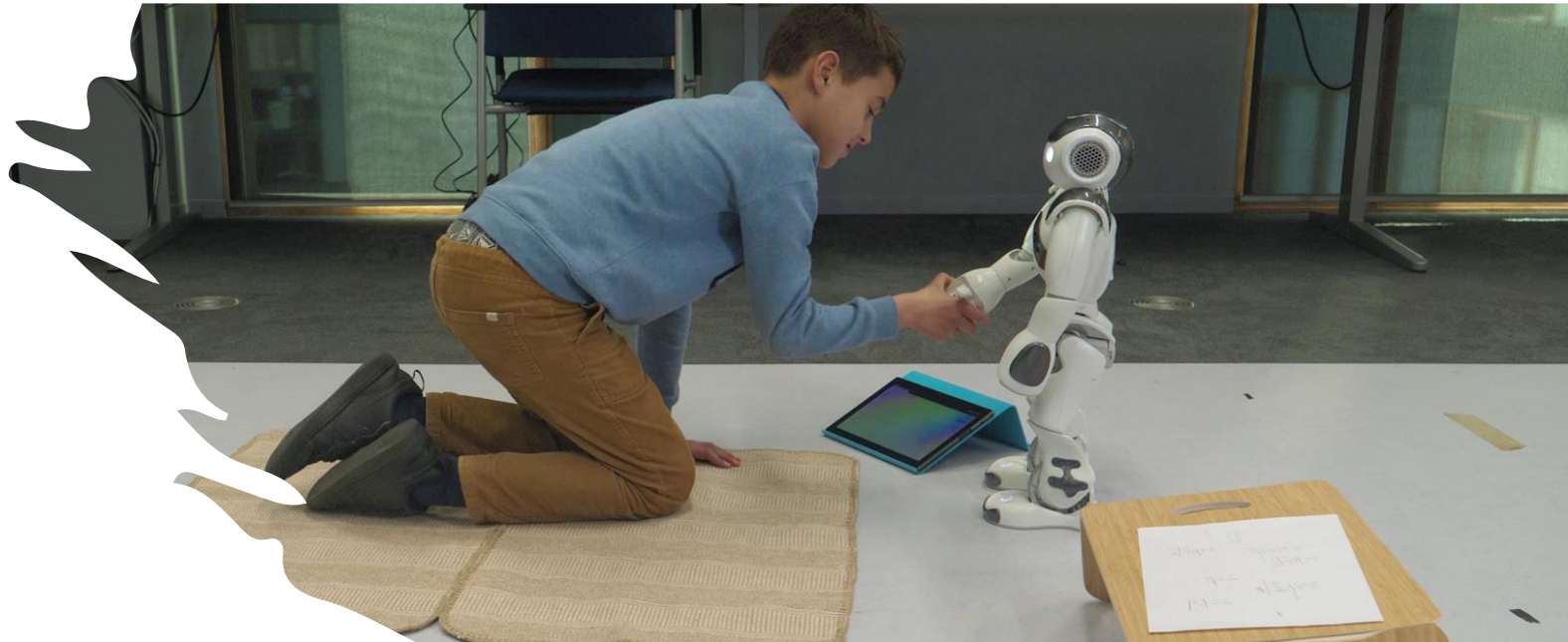# Characteristics of Conversation

- Interlocutors
- Context
- Goals
- Initiative

Who are you talking to?

- Dyadic vs multi-partner
- Children or (older) adults?
- (Cultural) backgrounds

Where is the conversation taking place?

Social rules / etiquette

Private or public space

Role and relationship of interlocutors

- Tutor and tutee
- Customer and shopkeeper
- Lobby robot

What is the goal of the conversation?

Typical multiple (sometimes conflicting) goals

Conflicts between interlocutors and within the robot

Service (hospitality and/or sales)

Educational (task performance and/or efficacy / motivation)

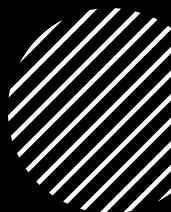Social support (protect privacy and/or signal for outside help)

Who has the initiative?

- Human – mixed - agent

Key conversational mechanics

- Turn-taking
- Repair
- Capability communication

Turn-taking

People are super proficient in turn-taking.

Robots are not.
- Interruptions
- Long pauses

Multi-modal cues: verbal cues, prosody, breathing, gaze and gestures

Bad turn-taking negatively impacts interaction
- Frustration
- Decrease in positive perception (e.g. sociability, competence)
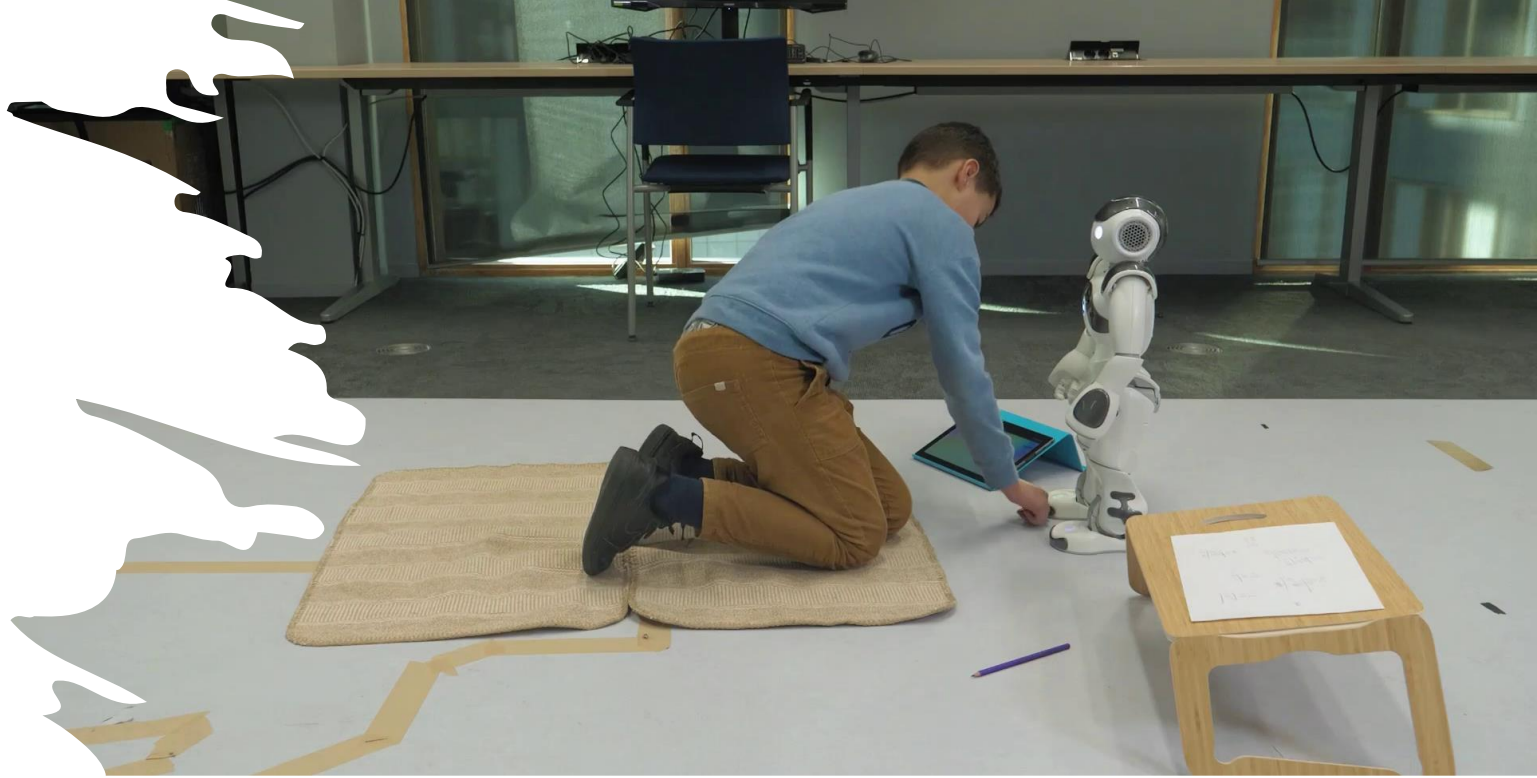- Decrease in effectiveness of intervention

Solutions:
- Improve multi-modal perception and communication
- Let people get into a rhythm with the robot.

Skantze, Gabriel. "Turn-taking in conversational systems and human-robot interaction: a review." *Computer Speech & Language* 67 (2021): 101178.
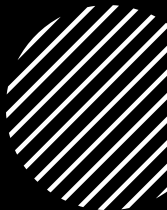
Repair

- Besides verbal repair look for alternatives in other modalities

Capability communication

Training

SMART communication strategies

How to create a dialog design?

- Cooperative principle and Gricean Maxims

- Design Patterns

- Agent persona

- Flow diagrams

Cooperative principle

Cooperative principles are the foundation of effective communication.

Developed by philosopher H.P. Grice, they help us understand how meaning is derived from conversations.

There are four key cooperative principles
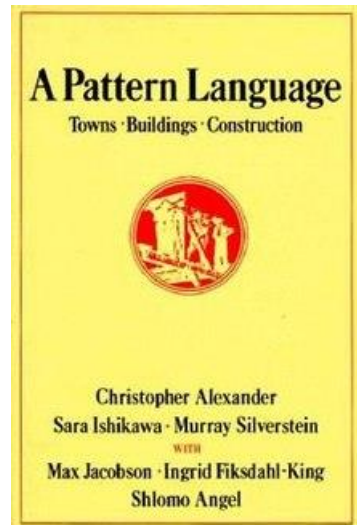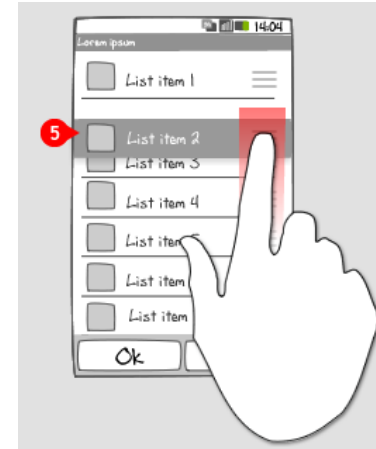
Gricean Maxims

Maxim of *Quantity*: Say no more and no less than is necessary for communication.

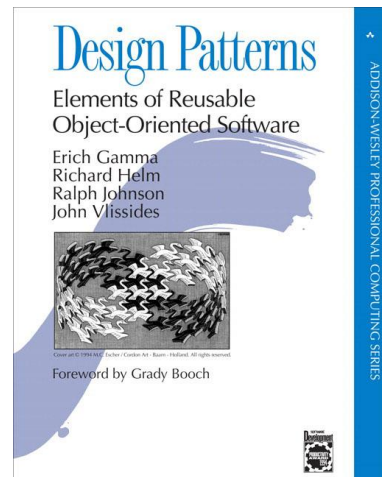Maxim of *Quality*: Be truthful and don't provide false or misleading information.

Maxim of *Relation*: Make your contribution relevant to the ongoing conversation.
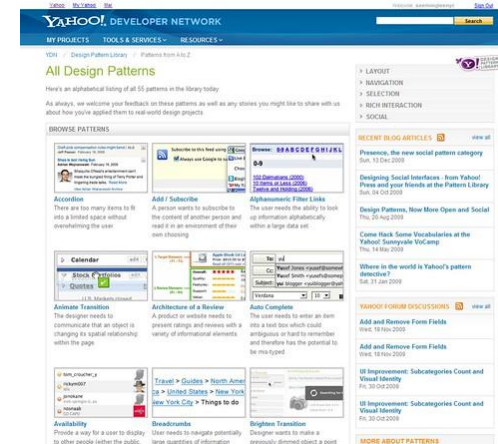
Maxim of *Manner*: Avoid obscurity, ambiguity, and unnecessary complexity
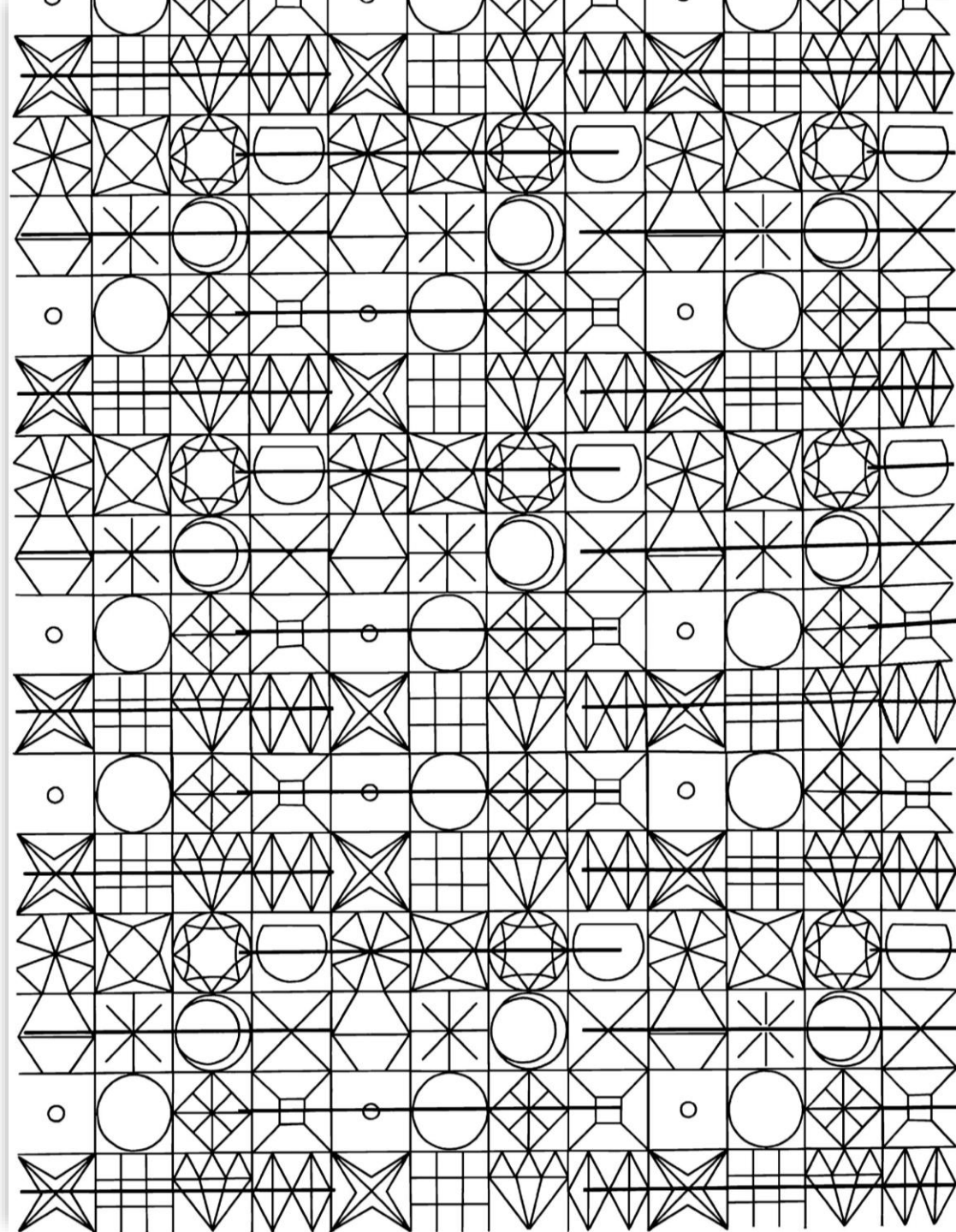
Design Patterns
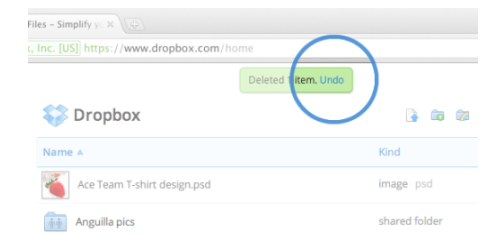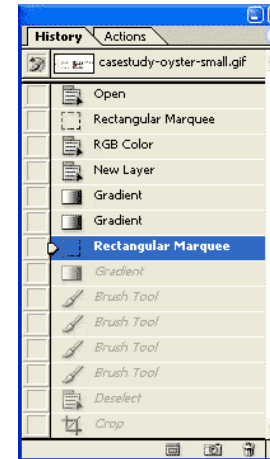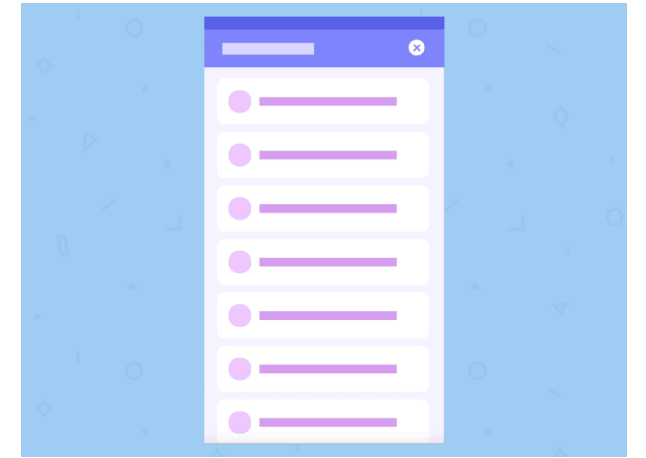

1977

1994

2006

?

Design Patterns

"Each pattern describes a *problem which occurs over and over again* in our environment and then *describes the core of the solution* to that problem, in such a way that you can *use this solution a million times over*, without ever doing it the same way twice."

- **Christopher Alexander**

Design Patterns | Undo

Design Patterns | Specifications
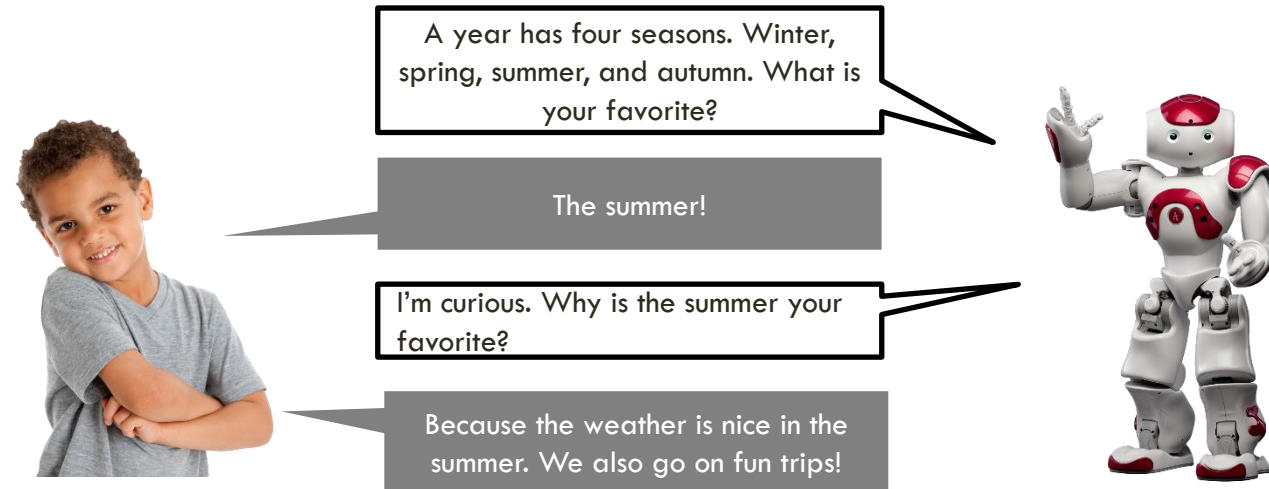
Problem

- Question-based interaction perceived as interrogation.

- Inhibits self-disclosure and friendship formation.

Principle

- Ideally children respond freely, but technically challenging.

- Speech activity detection *is* possible.

Solution

- Pair a closed-ended question with an open-question.

- Robot gets valid input and children can freely elaborate their answer.

A year has four seasons. Winter, spring, summer, and autumn. What is your favorite?

The summer!

I'm curious. Why is the summer your favorite?

Because the weather is nice in the summer. We also go on fun trips!

Evaluation results (N=812)

	Closed	**Open**
Response rate	96%	88%
Mean #chars	10±7	40±32

3.5% too verbose (ASR failure)
86% first attempt ASR success

Agent Persona

What

Robots designed with human-like characteristics, behaviors, and personalities.

Why

- Enhance Engagement: A persona robot can engage users on a deeper emotional level.

- Improve Communication: Personas help robots convey intentions, emotions, and responses effectively.

- Increase User Comfort: Personas can reduce the "uncanny valley" effect and make robots more relatable.
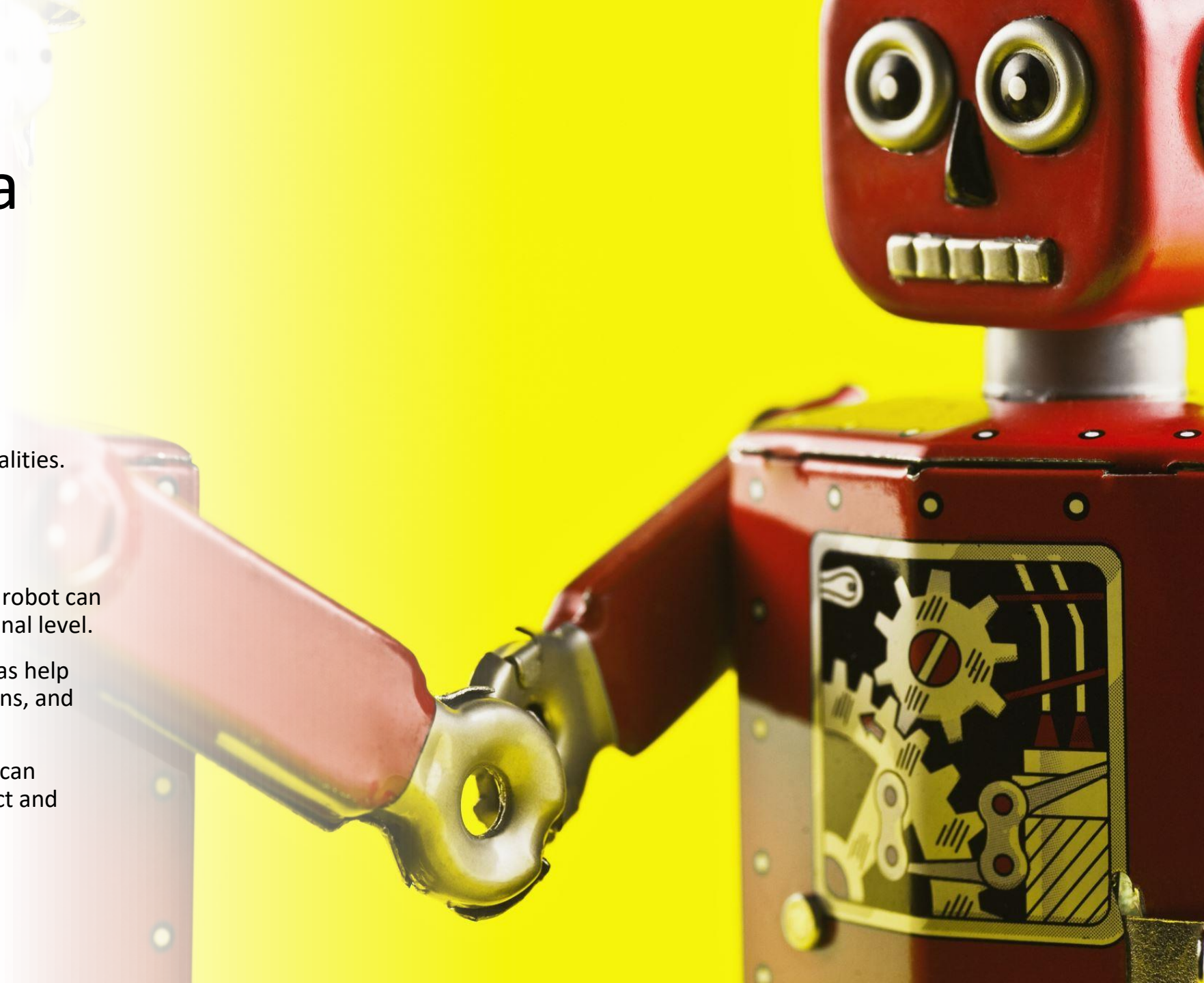
Agent Persona

How

- Create a storyworld – a transmedia narrative that situates the robot in a fictional world and connects it to the real world.
    - Ascribing it a personality and traits
    - Take into account its real physical and cognitive capabilities and limitations
    - Describe real world goals and fictional goals
- Create dialogs that are part of / consistent with the storyworld.
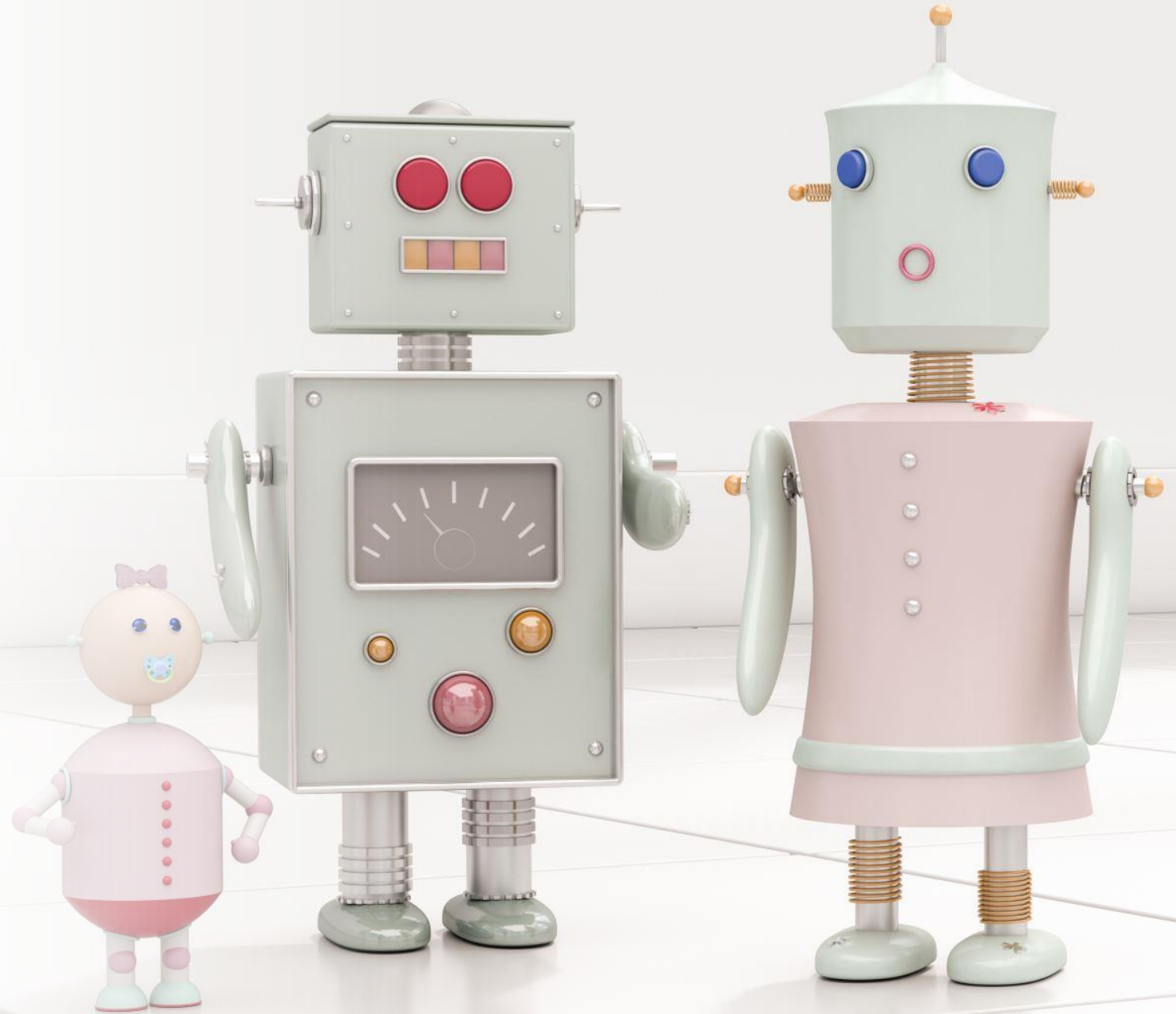
Agent Persona | Considerations

- Think about impact **on non-verbal communication**
    - Voice and Language: Select an appropriate voice and language style for communication
    - Gestures and Expressions
- **Ethical Concerns**: Consider the ethical implications of creating a persona for robots (e.g., privacy, deception).
- **Cultural Sensitivity**: Ensure that the robot's persona respects cultural norms and values. That different people can relate to the robot.

Flow Diagrams | Why

- **Visual Representation**: Flow diagrams provide a visual representation of the conversation structure.

- **Clarity**: They help clarify the conversation's logic and flow for designers.

- **User-Centric**: Flow diagrams keep the user's experience at the center of design.
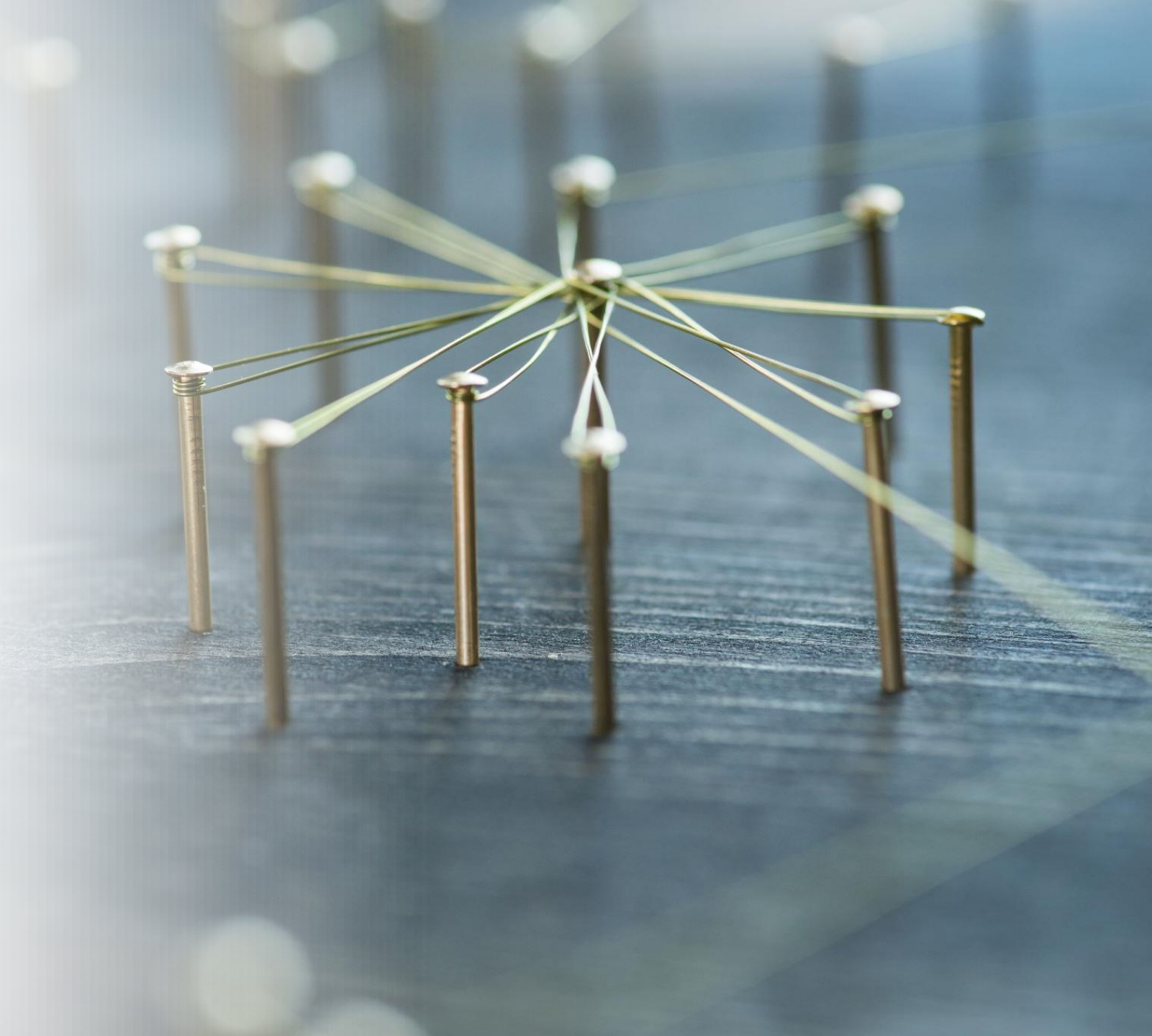
Flow Diagrams | User Journey

- Design user journeys, considering typical conversation paths (i.e. '**happy path**').

- Define **fallbacks** for handling unexpected user inputs or errors.

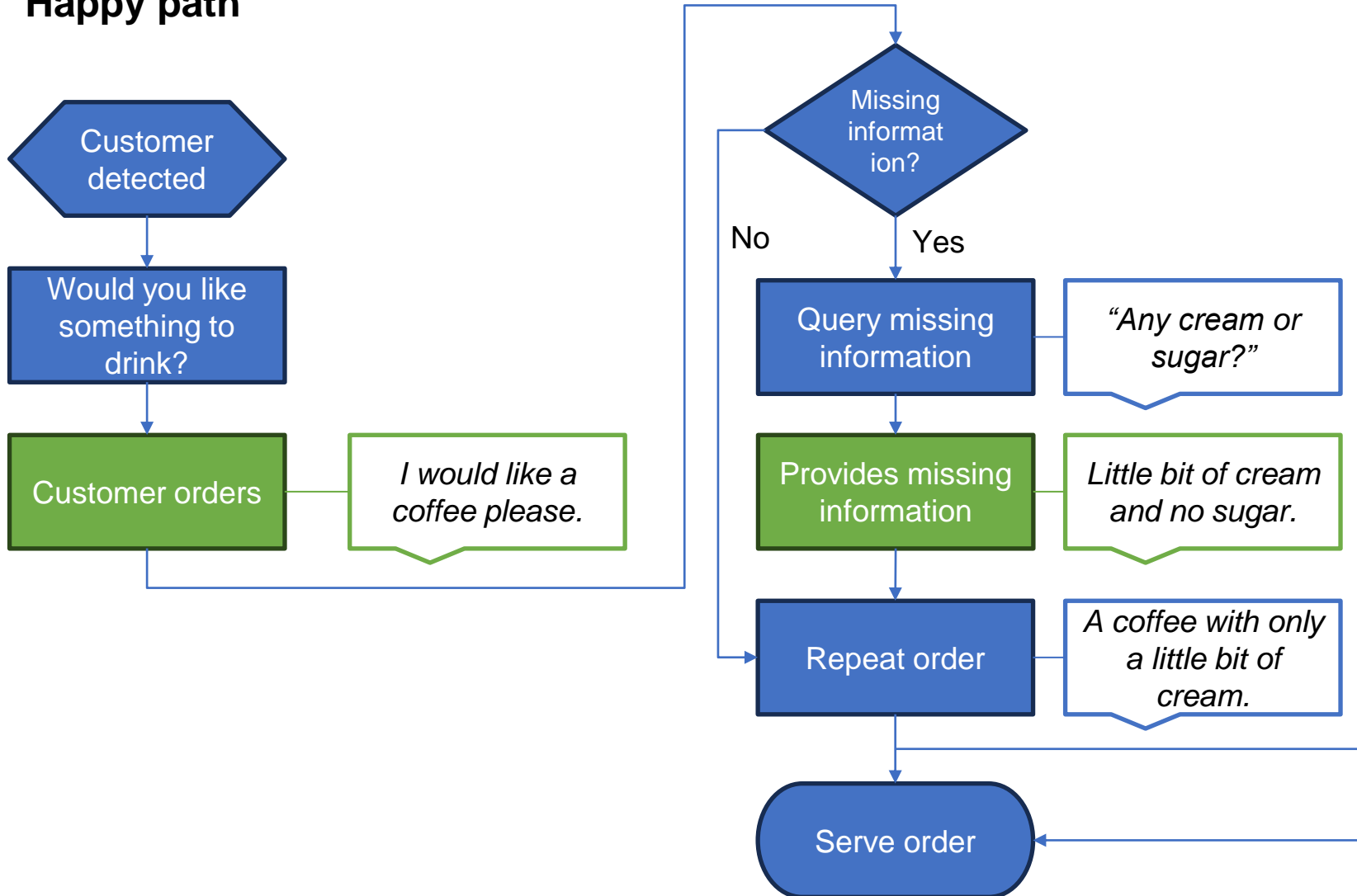- Incorporate options for **user choices** and preferences.

Flow Diagrams | Nodes

- **Start Node**: Where the conversation begins.

- **User Inputs**: Nodes representing user inputs and queries.

- **System Responses**: Nodes indicating robot responses and actions.

- **Decision Points**: Nodes for branching based on user input.

- **End Nodes**: Where the conversation concludes.
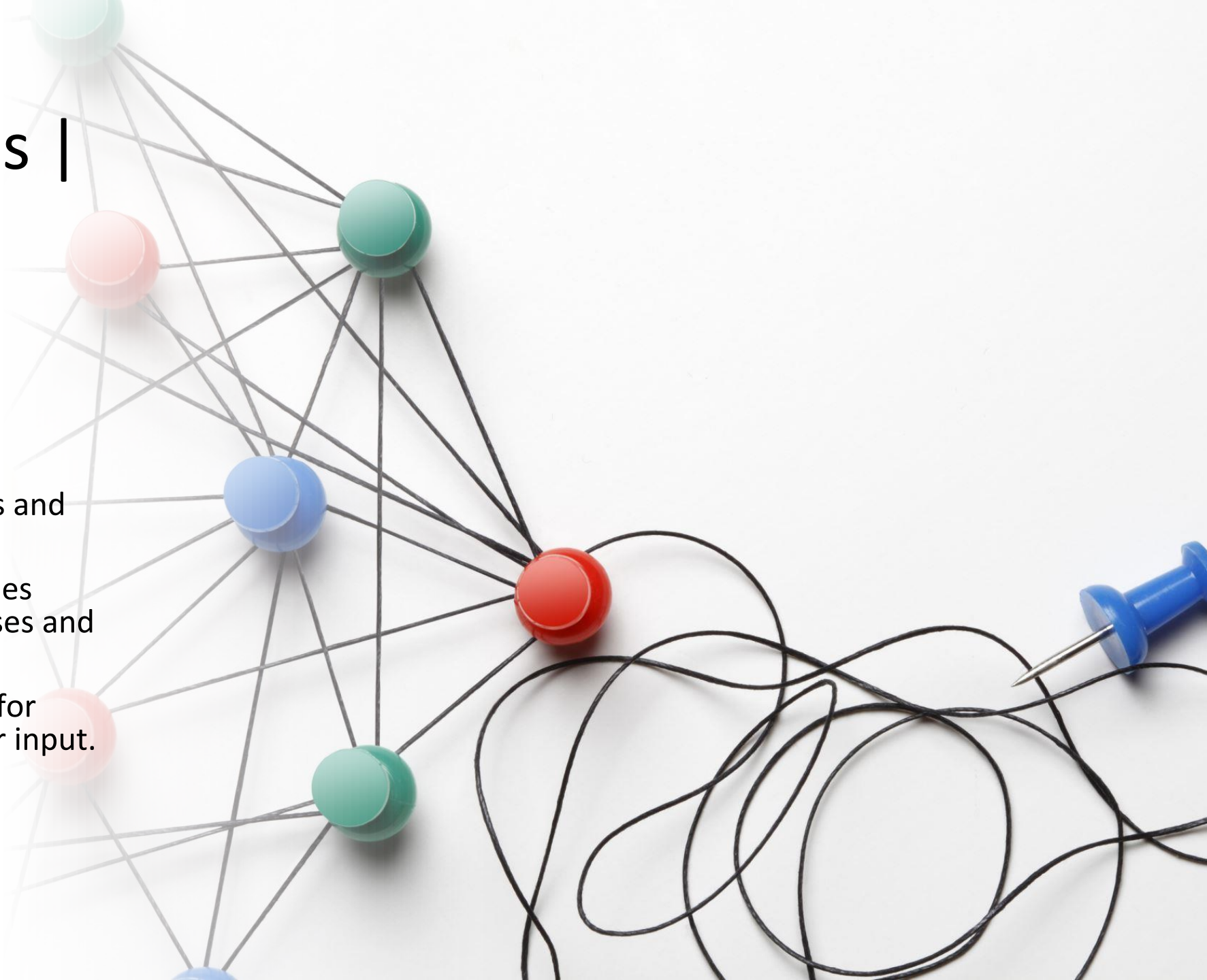
Flow Diagram | (Super basic) example

Happy path

Fallback