

# Contextualised Value Model

Designing a Robotic Model for Understanding the Context  
Dependency of Values for Enhanced Conversation Relevance

Tom Saveur





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## Designing a Robotic Model for Understanding the Context Dependency of Values for Enhanced Conversation Relevance

by

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# Preface

It took some time, but now I can finally say that I am done. I am proud of what I have achieved, even with all the setbacks. It took a lot of effort (and stress) to get where I am right now, finally able to hand in my Master's Thesis and graduate.

There are a bunch of people that I would like to thank for getting me where I am right now. As a start, Mark Neerincx and Catharine Oertel, we had some issues getting started, and we came up with a lot of different ideas of what to do, but I would like to show my immense gratitude for sticking with me for so long, and the fact that you never stopped believing in me. I hope you see how much I have grown and learned from the experience, and I hope we will meet again later in my career, your enthusiasm for this topic made me realise what I want to do with my knowledge of computer science.

Similarly, I would like to thank Franziska Burger, without whom it would have taken me much longer to start my experiment, brainstorming about ideas and helping with your experiment were the things that helped me improve a lot. I would like to thank all the other PhD students who helped me by brainstorming ideas or helping with the analysis, there are too many to mention, but special thanks to Deborah ...?, without your help I would not have been able to finish my analysis on time. Furthermore, I would like to thank Sole Pera, who has assisted Mark and Catharine with grading this thesis. Last, but definitely not least, I would like to thank Ruud de Jong, without your assistance and trust I would have never been able to finish the design of the conversation and show the cool NAO robot to my roommates.

After thanking all the supervisors and academic personnel who assisted me throughout my journey to graduate, there are even more people that I would like to express my biggest gratitude towards, my parents, especially my mom, who helped me with discussing ideas from a psychologists point of view, and helped me read through my report, without your help I would not have been able to have the dialogue setup that I have right now. I would also like to thank, and again say sorry, to my girlfriend, who had to deal with the stressful mess that was me during my graduation period, reading through my report and helping me with statistical analysis. I would also like to thank all of my roommates for having to deal with me and providing moral support while writing my thesis. Last but not least, all the participants to my experiment, I hope you all read this since you do not know how much I appreciated the time you all took to help me with my experiment, I hope you all enjoyed it, and maybe even learned something about what I am so passionate about.

*Tom Saveur  
Delft, March 16, 2024*



# Abstract

The promotion of desirable behaviours, such as socially appropriate or health-promoting actions, can be bolstered through a deeper understanding and awareness of the values that underpin the associated behavioural choices. Various implementations for promoting behaviour change based on goals already exist in Human-Robot Interaction, but, since values are the building blocks for our behaviour an agent can use values for behaviour change. By reflecting on value-related choices in a conversation, a conversational agent can assist in identifying the values at stake. This is particularly significant as these agents serve as accessible and non-judgemental platforms for discussing various concerns in a private setting. Such reflective conversations are time-consuming and may span multiple sessions, necessitating some form of memory (e.g., to reflect on earlier statements and compare the choices made for different situations).

While various robotic agents have been developed to provide behavioural support (e.g., for human health), the absence of a comprehensive memory structure and dialogue strategies capable of fostering personalised, reflective conversations based on the appreciation of certain values and actions in various scenarios through contextualised values remains a challenge. To address this, this study introduces the **Contextualised Value Model** – a dynamic memory model designed to facilitate value-based reflection and support personalised interactions between humans and robotic agents.

To realise this robotic memory, a conversational agent was designed that could elicit values from participants by discussing various scenarios that happen in daily life and reflecting on said values using perspective-taking and other dialogue strategies.

The evaluation of the **Contextualised Value Model** focused on three primary aspects: the *model's accuracy*, the influence on *likeability* and *intelligence*, and the effect on participants' *value awareness*. The model was evaluated during a between-subjects experiment ( $N = 54$ ), consisting of two conditions, one where the robot was able to update and use the **Contextualised Value Model**, and another one where the **Contextualised Value Model** was random throughout the conversation.

The outcome measures indicated that the integration of the memory model in conversations led to a personalised and relevant conversation, highlighting the potential of the **Contextualised Value Model** in enhancing conversation personalisation. Although participants' value awareness and perception of the robot's likeability and intelligence did not significantly differ based on the memory model, the study emphasised the need for extended observation to thoroughly evaluate long-term impacts.

Overall, the **Contextualised Value Model** presents a promising framework for enhancing personalised interactions in various real-world applications, emphasising the need for further research in this area. The *ePartner4all* project could be further developed to complement the efforts of primary school teachers and parents in supporting children's self-learning of socially, mentally, and physically desirable behaviours.

**Keywords:** Social Robots, Conversational Agents, Memory, Dialogue, Human-Robot Interaction, Values, Contexts, Contextualised Values, Reflection

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# Introduction

People have been trying to live a healthy life and improve their well-being for a long time. Even back in the 1800s, when the first official diet plans [1, 2] and books on mental health [3, 4] became popular. Currently, research is done to support behaviour change and live healthier lives using robots. Robots can, for example, assist people with diabetes [5–7] by providing motivating feedback and improving intrinsic motivation, provide general food education [8] through reflection, and serve more general educational purposes [9]. But there is a problem – changing behaviour takes a long time, and providing a memory that supports this prolonged conversation is a big challenge for the Human-Robot Interaction community.

Existing implementations of robotic memory models for long-term interaction and behaviour change use goal-based, conversational, or information-based memory models [6, 10, 11]. These models allow robots to provide personalised support, discuss shared experiences, or adapt conversations based on educational progress. However, there's a primary focus on feedback and goal-oriented memory, lacking adaptability to individuals' needs and values, which are important for fostering effective, long-lasting, behaviour change [12, 13].

Consider a scenario where an individual seeks to enhance mental well-being through mindfulness but finds rigid schedules stressful. A personalized robot could suggest spontaneous mindfulness moments throughout the day, aligning with the person's needs and values. Values, which guide actions, shape identity, and influence decisions [14], play a pivotal role in behaviour change.

Values are the core beliefs that guide individuals in various aspects of life, such as benevolence, achievement, and self-direction [14]. Understanding and incorporating these values into conversations can significantly enhance the effectiveness of behaviour change interventions [15], since they provide intrinsic motivation, ensuring that rewards come from within, which fosters sustainable change [15, 16].

However, values are not rigid; they can be influenced by situational factors such as location, social context, or ethnicity [17, 18]. Understanding contextual differences is crucial, as values can manifest differently based on situations. Consider someone valuing both honesty and kindness. At work, they prioritise honesty to stay transparent when providing feedback. With friends, however, kindness may take precedence, providing supportive communication to reduce stress in the friendship. To facilitate personalised value-based conversations that account for the context-dependency of values, this report introduces the **Contextualised Value Model**, a dynamic memory model tailored for Human-Robot interactions. This model enables the storage of values along with their contextual dependencies, allowing for nuanced and adaptive dialogue. Additionally, the report presents a dialogue framework designed to elicit, refine, and reflect on value-related memories. By centring on the values of the individual learner, this dialogue framework aims to support behaviour change by fostering personalised conversations aligned with the learner's core values.

The primary goal of this research is to explore the elicitation, storage, and application of values within

human-robot interactions to facilitate personalised behaviour change. By leveraging reflective dialogue and value representation, this study aims to establish a value model for the development of future robotic systems aimed at meaningfully assisting individuals in attaining their behavioural objectives and improving their overall well-being through conversations tailored to their core values. This memory implementation is part of the broader *ePartners4All* project, developing robotic partners to enhance Dutch primary school children's health and well-being through discussions on personal well-being with a robotic conversational agent [19].

## 1.1. Research Questions

Recent research has explored various methods for eliciting values, primarily relying on questionnaires [20], image-based techniques [21], or single scenario-based [22, 23]. However, exploring (open) conversations as a means of value elicitation remains an active area of investigation. To contribute to this area, this thesis addresses the following research question:

**RQ1:** How can context-dependent values be elicited during conversation?

After eliciting the values they should be stored in the **Contextualised Value Model**. To do this effectively this thesis addresses the following question:

**RQ2:** How should context-dependent values be modelled in memory?

It is important for the **Contextualised Value Model** to properly distinguish the differences between the various contexts discussed during the conversation since this might change the preference for certain values over others [18]. To evaluate whether the agent can properly model the value preferences of the learner, the thesis begins by examining the level of agreement towards the **Contextualised Value Model** designed by the agent, addressing the question:

**RQ3:** Does the **Contextualised Value Model** created from the dialogue accurately represent the values of the user?

To measure the effectiveness of the conversation the effects of the **Contextualised Value Model** on value awareness are evaluated by addressing the question:

**RQ4:** Does adapting the conversation to a user's values improve the value awareness of the user?

Questions 1 and 2 form the basis of Chapter 3, where the eventual design of the dialogue and **Contextualised Value Model** are described. Questions 3 and 4, on the other hand, focus more on the experiment conducted during this study to evaluate the effects of the **Contextualised Value Model**, detailed in Chapter 4, and measure the accuracy and effectiveness of the **Contextualised Value Model**.



## Related Work & Novelty

Answering the research questions requires combining knowledge from various disciplines, including psychology, didactics, human-robot interaction, and memory design. Each area contributes to the overall prototype used in this research, drawing on expertise in conversation strategies [24], value discussion [25], supporting reflection [8], and the construction of memory systems for ongoing conversation [5, 6, 26]. These areas combined form the basis for the **Contextualised Value Model** and dialogue proposed in this thesis.

### 2.1. Conversational Agents for a Healthy Lifestyle

Conversational agents, such as virtual assistants and chatbots, are currently used in various ways to assist humans in their daily lives. Conversational agents are used as, for instance, virtual assistants [27] (such as Siri [28]), customer support [29], and health-related assistance [30–32]. Examples of their applications include aiding individuals with Alzheimer’s disease [33], providing support for metabolic conditions [34], educating on sexual health [35], assisting in quitting smoking [36], or facilitating stress management [37, 38]. These agents demonstrate outcomes comparable to therapist-delivered interventions [39–41], contributing to increased accessibility to therapy [42]. In the context of this research, the dialogue strategy focuses on identifying daily life events and exploring the consequences of actions to enhance overall well-being, contributing to overall personal well-being [43, 44].

#### 2.1.1. Conversations for Behaviour Change

This subsection delves into the important role of conversational strategies in effecting behaviour change, aligning closely with the overarching goal of this thesis mentioned in Section 1.1, providing personalised behaviour change. The dialogue described in this thesis aims to elicit values and foster user reflection for enhanced value awareness and to promote behaviour change [14, 45]. To do this, the dialogue takes influence from *Cognitive Behaviour Therapy* (CBT), a psychological conversational technique known for promoting behaviour change through elicitation and reflection [46, 47]. The dialogue explores the interplay between thoughts, emotions, and behaviour to address mental health [39, 48] and is rooted in the idea that perceptions influence actions. CBT empowers users to independently alter behavioural patterns [49, 50] through components like Perspective Taking [51, 52] and Socratic Questions, such as seeking clarification and challenging assumptions, fostering thoughtful and reflective conversations [53–55].

#### Guided Discovery

Guided discovery, a fusion of Perspective Taking and Socratic Questions in CBT, encourages exploration beyond immediate challenges [52, 56, 57], it uncovers motives and values, aiding informed decision-making and fostering empathy [58, 59]. Stress management chatbots highlight the value of guided discovery in embracing diverse perspectives for effective problem-solving [38, 60]. This approach blends viewpoints through perspective-taking, fostering an understanding of broader impacts [61, 62], exploring alternatives, supported by Socratic questions [53, 63] through open-ended questions that encourage alternative perspectives, knowledge acquisition and user engagement [54,

59, 63, 64]. In psychotherapy, it plays a pivotal role in encouraging patient disclosure and addressing issues like stress, depression, and substance abuse [58, 65, 66].

### Reflective Conversations

Reflection is essential in CBT and behaviour change, aiding opinion building and behavioural adjustments [8, 54, 63, 64, 67]. One way to entice reflection is by focussing on the meaningfulness of the goals and reflecting on the achievements [8, 12, 13]. Another way to use reflection for behaviour change is to understand that individuals may hold different values, beliefs, desires, intentions, and perspectives. This type of reflection, similar to *Theory of Mind* in CBT, is vital for resolving conflicts in stressful situations [68–70] since it forces the learner to think about the consequences of their actions.

### 2.1.2. Value Conversations

As mentioned in the introduction (Section 1) this thesis focuses on storing and utilising values in conversations for personalised reflective behaviour change. Values play a crucial role in decision-making, relationship building, personal well-being, and stress management [45, 71–74], further proving their significance in our lives [18, 45]. The interplay of different values shapes attitudes and behaviours, highlighting their pivotal role in understanding human behaviour [14, 20, 75–77]. Value awareness involves understanding one's values, recognising the diversity of others' values, navigating potential clashes, and fostering empathy [78–80]. Acquiring value awareness contributes to informed decision-making aligned with personal priorities and fosters empathy towards others by acknowledging their fundamental life values.

### Values for Personalisation

In psychology, different conceptualisations of values exist [82, 83]. Two prominent definitions are proposed by Schwartz [14] and Rokeach [20]. Rokeach [20] introduced Terminal and Instrumental values, while Schwartz [14] outlined the *Schwartz basic human values* [14, 18], which are grouped into various categories within a circular framework, as depicted in Figure 2.1.

Utilising the values described in Schwartz [14] offers multiple advantages, they are extensively explored in diverse contexts [18, 84] and with various target audiences [85]. This approach has also been employed in studies using dictionaries to categorise values extracted from open dialogues and texts [86]. Considering the eventual target audience of the *ePartners* project, establishing a connection between Schwartz's values and those relevant to children is crucial.



Figure 2.1: Schwartz Basic Human Values; adapted from [14, 18, 81]

### Value Elicitation & Classification

Value elicitation involves obtaining values through questionnaires, like the Value Survey by Rokeach [20], and various conversation strategies. These include using images [21], a dictionary of keywords with open dialogue [86, 87], and scenario-based discussions [22, 23], often utilised in therapy sessions [88]. This thesis focuses on eliciting values through guided discovery, since it provides a good basis to construct conversations to uncover and discuss values and behaviour [58, 59]. Guided discovery also encourages the use of scenarios and perspectives, making the values less abstract, which improves clarity and makes it easier to discuss with the learner [22, 86, 87]. An example of elicitation and how it can be used for reflection is as follows:

Imagine a stressed student worried about exams. The agent, using guided discovery, discusses the values of *Achievement* and *Hedonism*. By exploring the importance of success

and fun, the agent suggests strategies aligned with these values, like effective time management for academic success and enjoyable activities to reduce stress.

By doing this the agent ensures that the student can reduce the stress they are feeling by encouraging the student to have fun and understand the importance of achievement.

### 2.1.3. Novelty & Contribution of Value-related Dialogue

While CBT methods using conversational agents have proven effective, due to the improved accessibility, consistency, personalised interventions, and motivation [42, 89], there's a notable research gap in addressing value awareness for overall well-being. Limited studies explore eliciting values in human-robot interaction through methods like perspective-taking, Socratic questions, or CBT.

To continue on the elicitation of values this work introduces a dialogue framework that leverages the **Contextualised Value Model**, proposed in Section 1, to create, refine, and use value-based memories. Through scenarios and perspective-taking, the dialogue not only personalises reflection but also extends memory to understand participants' personalities through their values, enabling adaptive conversations based on individual values.

## 2.2. Memory for Continuous Conversations

Memory is crucial for daily life, influencing relationship building [90, 91], information retention, and learning from shared experiences [92–95]. For conversational agents, well-designed memory is essential, enhancing user interactions in relationships [26, 96, 97], information retrieval [11, 98], and educational contexts [6, 9]. Memory-enabled agents play diverse roles, guiding users in learning [96, 99], fostering relatability [5, 26, 100], and motivating through past events [6, 7, 101], drawing inspiration from human memory to support the conversation.

### 2.2.1. Episodic Memory

*Episodic Memory* in conversational agents enables recalling significant events based on time, repetition, and emotional significance [5, 102–104]. This structure allows agents to refer back to specific user-related events for feedback and reminiscence through contextual references [10, 96, 105–108], showing the importance of contexts for episode retrieval.

Various methods, including remembering quiz questions, goals, and emotionally charged events, contribute to the creation of episodic memories [5, 10, 105, 106, 109]. The 5W1H (When, Where, Who, Why, What, and How) principle serves as a structured format for storing these memories, facilitating discussions with users [5, 7, 110]. This principle underlies diverse storage methods, such as the timeline model, which arranges events chronologically with 5W1H points [105], and question-and-answer pairs [111]. Additionally, memory designs based on the Belief-Desire-Intent (BDI) framework track context and outcomes, enabling emotional feedback and supporting tutoring [10, 96, 112]. For this research, the 5W1H storage method was chosen for its ease of use and readability, enabling efficient retrieval and discussion of episodes for conversations involving *perspective taking* and *Socratic questioning*.

#### Conversational Memory

*Conversational Memory* often encompasses elements of episodic memory, enabling recall of specific events in a temporal context. In conversational agents, this facilitates referencing past interactions for contextually relevant responses, enhancing overall engagement. Conversational memory is often learner-centric, it accumulates information gradually, such as dietary goals for motivational adaptation of conversation trajectories [6, 10]. Stored in a database with distinct keys, it categorises details like goal progress or questions posed by the user to enrich ongoing conversations [6, 98, 113].

### 2.2.2. Semantic Memory

*Semantic Memory* in conversational agents shapes beliefs through generalisation and abstraction of events and facts [11]. It enables the recognition of various concepts and facts, such as recognising colours, objects, and capital cities [114]. This allows for versatile discussions that require less reliance on contextual settings than *Episodic Memory* [115, 116].

For instance, the agent's semantic knowledge of a pig includes details such as four short legs, hooves, a stout body, and a curly tail, forming beliefs for recognising pigs [102, 103, 117]. However, understanding specific events, like a pink piglet at a petting zoo yesterday, requires closer alignment with *Episodic Memory*. Developing *Semantic Memory* involves questioning techniques, consulting the semantic web, or integrating predefined datasets [11, 118]. The information within the semantic memory is often organised in a graph or table-like format [11, 102, 103, 117], and could provide a method to store contextualised values to support dialogue based on *perspective taking* and *Socratic questioning*.

### 2.2.3. Novelty & Contribution of Proposed Memory Model

Despite extensive research on dialogue and memory models, a critical gap remains in understanding how these memory models can be adapted to model the context dependency of value preferences, with the eventual goal of personalising the conversation to said values and teaching value awareness. Current approaches do not sufficiently personalise the conversation to the personality and values of the participant but rather focus on the goals the participant is trying to achieve [5, 6] or factual (episodic) information [26, 119]. Most importantly, there is currently no memory implementation that allows for the storage of semantic value information based on the values of the participant to personalise the reflection and behaviour change on the participant's personality.

To facilitate this type of reflection, this research designs a dynamic memory model, called the ***Contextualised Value Model***. This semantic memory implementation weighs values within specific contexts, and, when combined with episodic memory in 5W1H format, facilitates the construction of reflective dialogue based on learners' values. In terms of contextualised values Episodic memory contains the instantiations of the different contexts and actions, while Semantic memory keeps track of the abstract value weights for each value within each context, to learn about the personality of the user and provide a method for reflection through the differences in weights.



# 3

## Design of the Contextualised Value Conversations

This work addresses existing research gaps, such as storing and discussing values for improving well-being, by introducing the **Contextualised Value Model** to store the value preferences of the learner within a given context. This memory model is designed to reason over how these values change over time and between different contexts. To further explain the design of the value conversations this chapter delves into the design of value conversations, describing the process of value elicitation and storage within the robotic memory. Furthermore, it explores how the **Contextualised Value Model** can be utilised to support reflection based on values.

### 3.1. Model Creation

For the agent to support and personalise the conversation the values should be stored in a manner that they can easily be used throughout the conversation. Personalisation is achieved by building a list of value preferences, based on the behaviour of the learner, as well as their reasons, and the interrelationships between values.

#### 3.1.1. Behaviour Choices

As mentioned in Section 2.1.2 a learner's behaviour is heavily influenced by their values [14, 20, 75–77]. This means that the agent can elicit the values of the learner by discussing various behaviour choices in various situations. Discussing these scenarios allows the agent to make the behaviour choices, and values, less abstract and easier to discuss and understand [25, 120, 121], the robot uses various scenarios representing specific events [25]. Each scenario offers at least two behavioural choices, which are actions that the participant can take based on the scenario, ensuring relevance and concreteness [17]. Participants select their preferred behaviour, addressing the dilemmas in the process. The dialogue follows a pattern (see Figure 3.1): presenting the scenario and choices, eliciting the learner's decision, requesting reasons, and responding accordingly.

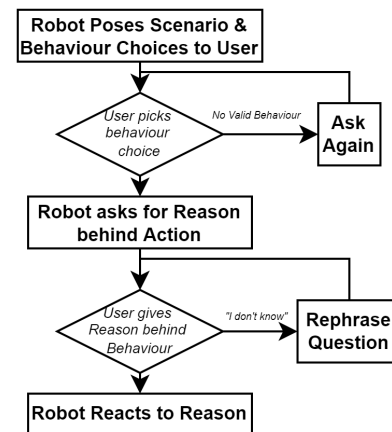


Figure 3.1: Scenario dialogue flow for eliciting values using guided discovery by discussing scenarios and behaviour choices.

When presented with the following scenario (more in Appendix A.2.1): **You have a test tomorrow, but your friends are going to a party.** Would you **study for the test**, or **go to the party with your friends**, if the learner chooses to “*learn for the test*”, the agent infers a prioritisation of **Achievement** over **Hedonism**.

in that context. Simultaneously, the agent delves deeper into the learner's behaviour by posing open-ended questions about their behavioural choices, connecting responses with values using a dictionary of value-related keywords designed by Ponizovskiy *et al.* [86] and Fischer *et al.* [87], they analysed 180.000 texts and derived a dictionary with keywords related to Schwartz values with a small but consistent correlation ( $r_s = .1-.4$ ) [86]. For instance, “helping” indicates a focus on **Benevolence**, while “award” suggests a priority on **Achievement** [86].

### 3.1.2. Relations between Values

To enhance the value preferences, the model considers relationships between values as described by Schwartz [122] (see Figure 2.1), to examine how values interact. Examples of these relations include **Personal Focus**, which contains values such as: *Hedonism*, *Self-Direction*, and *Achievement*, and **Social Focus**, which contains *Benevolence*, *Security*, and *Conformity*. For example, valuing *Benevolence* reflects the learner's prioritisation of socially oriented values in that context, since *Benevolence* is associated with *Social Focus*.

### 3.1.3. Weight Formula

The methods described earlier together form the weight for each **Contextualised Value** using the calculation shown in Equation 3.1.

$$\text{Weight} = \frac{\sum \text{Choices} + 0.25 * \sum \text{Related}}{\sum \text{Discussed Scenarios}} \quad (3.1) \quad \text{Weight Tie} = \text{Weight} + \frac{0.1 * \sum \text{Keywords}}{\sum \text{Discussed Scenarios}} \quad (3.2)$$

**Choices** indicate the Behaviour choices described in Section 3.1.1, **Related** indicate the relations of values as described in Section 3.1.2, and **Keywords** signify the keyword matches described in Section 3.1.1.

The choices made by the participants provide the important values in a certain scenario, these values are counted, with a 0.25 increase for each related value chosen, preventing ties and inaccuracies. This adjustment, validated through pilot testing, facilitates timely updates of value weights during the conversation, ensuring tailored responses to significant values. In the case of ties, matched keywords contribute to the weight with a 0.1 factor (Equation 3.2), allowing the agent to discern preferred values through open conversation. The consideration of keywords in ties (Equation 3.1) is due to the unverified effectiveness of the dictionary in open conversation, since it was designed based on text data [86]. Both formulas are normalised based on the number of discussed scenarios, preventing bias towards frequently mentioned values. In case of a tie after using Equation 3.2, the robot picks randomly what value is most important to continue the conversation with.

### Example

Table 3.1 shows an example of the belief a robot might have over the learner within the *Home* context. Plugging this information into Equation 3.1 both **Benevolence & Conformity** weigh  $1 + 0.25 * 1 = 1.25$ , the values with a *Social* focus have a weight of  $0 + 0.25 * 2 = 0.5$ , and the values with a *Personal* focus have a weight of  $0 + 0.25 * 0 = 0$ .

Scenario	Value	Reason
1	Benevolence	Because I like to help people.
2	Conformity	I don't know.

Table 3.1: Example belief of 2 scenarios within a *Home* context.

Since the weight of both **Benevolence & Conformity** are exactly the same, the information from Table 3.1 is plugged into Equation 3.2, resulting in a weight of  $1 + 0.25 * 1 + 0.1 * 1 = 1.35$  for **Benevolence**, while **Conformity** has a weight of  $1 + 0.25 * 1 + 0.1 * 0 = 1.25$ . Therefore, according to the learner's responses, the most important value in a *Home* context is **Benevolence**.

## 3.2. Robotic Memory Model

The project's memory combines **Contextualised Value Model** and **Episodic Memory** to form a cohesive knowledge base. The **Contextualised Value Model** captures various values and their importance within different contexts. Meanwhile, the **Episodic Memory** stores the learner's choices and responses, enabling reflection on shared experiences. The memory model, depicted in Figure 3.2, enables the agent to guide value-aware dialogues and reflective interactions effectively.

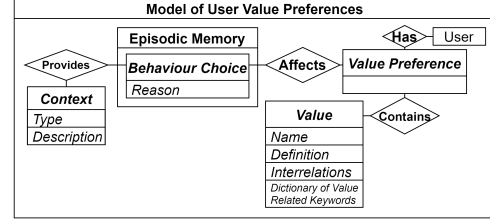


Figure 3.2: The Entity Relation Diagram describing the different aspects of the memory and how they relate to the conversation.

### 3.2.1. Episodic Memory

The episodic memory keeps track of the various scenarios and questions discussed during the dialogue, to support the reflection based on personalised shared episodes. Referring to the model in Figure 3.2, the Episodic Memory includes the recorded **Behaviour Choices** and the **reasons** behind the behaviour choices. Table 3.2 demonstrates the comprehensive model in the agent's memory, facilitating revisiting scenarios and reflecting on specific questions. The **contexts** are stored in the *DialogueID* column, the **behaviour choices** are stored in the *ChosenValue*, and the reasons behind the behaviour are stored in the **reason** column.

Session	DialogueID	Reason	ChosenValue*
1	s1	I like making others happy.	1
2	CsQ1	I think my parents would help them.	

Table 3.2: Example of the episodic memory, containing all relevant information on the questions and answers discussed. \* = optional, s1 = Scenario 1, CsQ1 = Context Specific Question 1.

### 3.2.2. Contextualised Value Model

The **Contextualised Value Model** abstracts the episodic information described in Section 3.2.1. While the episodic memory contains the values related to the instantiated **contexts**, the **Contextualised Value Model** contains the value weights for each context and value pair, forming a list of value preferences. This abstraction is updated dynamically during the conversation, by updating the weights of each value whenever new items are added to the episodic memory using the formulas described in Section 3.1. An example of this model is in Figure 3.3, allowing the agent to support reflection across different contexts. Initially, the agent only knows the names, definitions, relations between the values, and the keywords related to the values (all weights are set to 0, the **Value** attribute from Figure 3.2). But throughout the conversation, as the episodic memory fills up, the weights are updated using Formulas 3.1 & 3.2, enabling the agent to converse on the differences in weights and argue what value is most important within a certain context.

Context	Value	Behaviour Count	Related Count	Dialogue Count	Weight	Weight Tie
0	0	0	3	2	0.75	0.95
	1	3	0	2	3.0	3.2
	2	2	0	2	2.0	2.2
1	0	1	2	2	1.5	1.7
	1	2	1	0	2.25	2.25
	2	2	0	0	2.0	2.0

Table 3.3: Example of the **Contextualised Value Model** containing the weights of each contextualised value. The *Behaviour*, *Related*, and *Dialogue Count* columns each keep track of the different variables as described in Section 3.1, the *Weight* and *Weight Tie* columns show the results from Formulas 3.1 & 3.2 respectively. This model is updated throughout the conversation, whenever new information is stored in the Episodic memory.

## 3.3. Usage

The **Contextualised Value Model** has the eventual goal of supporting and personalising the reflection of the learner, to do this various principles were designed that allow for a cohesive usage of the memories within the robot. First, the reflective principles are described, after which the various personalisation

principles are discussed.

### 3.3.1. Value-Based Reflection

After constructing the memory, the agent should reuse the information for reflection. This involves examining the consistency of values within and outside a context and posing reflective or Socratic questions based on the learner's values. Table 3.4 outlines the reflection principles (RP) employed to design a section of the robot's dialogue. These principles guide the types of questions asked by the agent and provide clear guidelines for the design of the agent to have said questions, making the conversation more related to a human-human conversation, where the conversation and discussion is often personalised because of what we learn about each other. For each RP the agent has multiple pre-made questions and scenarios, examples of these are shown in Table 3.4, which can be selected and personalised to the participant based on their value preferences, as discussed in Section 3.3.2.

#	Reflection Principle (RP)	Reflection Strategy used by Robot	Example
1	Being aware of your own values.	Find consistency of the user within the <b>Contextualised Value Model</b> , inquire about this.	"You seem to find <b>Benevolence</b> very important in all contexts. Why would you think that is?"
2	Being aware of the values of others.	Asking relevant questions about the values of others given important values for the learner.	"What do you think your <b>parents</b> would do in this scenario?"
3	Being aware of differences between contexts.	Discuss the various contexts in a bit more detail	"Why do you think you find <b>Hedonism</b> important when with friends."

Table 3.4: Reflective Strategies used by the Robot to reflect on the values of the learners, allowing them to gain more insight into their values and the opinions of others.

#### Empathy

RP<sub>1</sub> and RP<sub>2</sub> introduce the concept of *empathy* [123] to the learner, which means that the learner should be able to reason over their values, as well as how they influence other people. Understanding differences in people's values is crucial for managing conflicts [69], which often underlie stressful situations [68]. Acknowledging individual value differences can be challenging but offers substantial benefits in daily life [69, 70]. Reflecting on both personal values and those of others is a vital step toward gaining *value awareness*. This is achieved by discussing relevant scenarios based on the learner's values and revisiting previously discussed scenarios from different perspectives. To initiate this conversation, the agent first determines the learner's values stored in the *Contextualised Value Model*, after which it can use these values to pick relevant scenarios for the user from a pre-made pool of scenarios, based on their important values within a certain context, exploring opposing viewpoints. Additionally, the agent can revisit previously discussed scenarios and conflicts from the *episodic memory* to examine diverse perspectives (other than their own) within scenarios that have already been discussed before. The agent does this by randomly picking a scenario and a viewpoint that is not related to the behaviour of the learner.

For example, a user has a strong preference for **Achievement**, which means that they would be willing to do anything to get recognition for their actions, so they are less inclined to be aware of more social values such as *Conformity* or *Benevolence* (as shown in their *Value Preferences* within the *Contextualised Value Model*). The agent might ask them what they would think their parents would do, to gauge whether their preference for **Achievement** is something that they have learned from their parents. Or the agent might ask what they would think of people who would choose more socially oriented values within a certain situation, or what others might think of their values, trying to get the user to see the scenario from a different perspective.

#### Consistency

RP<sub>3</sub> delves into the consistency of the values of the learners, fostering an understanding of varying values' significance across different contexts. Exploring consistency aids in value awareness, questioning why a specific value is chosen in one scenario but not in another [17, 124–126]. Recognising value differences in diverse contexts is crucial for understanding each value's specific weight. The agent discusses different contexts and reasons behind varying value weights, each of which is selected based on the learner's value preferences (the most important value within a context) from a pool of pre-made

scenarios. Reflecting on consistency within and between contexts, the learner gains insights into their values and behaviours, contributing to a more nuanced understanding.

For example, if the participant has a strong preference for **Hedonism** in one context, but **Benevolence** in another, it might be interesting for the agent to inquire about the difference and why the participant believes this discrepancy to be there, by asking questions about the different contexts and why the participant believes they would act differently in both situations. Doing this ensures the participant learns more about their values, and how they might change between different scenarios, allowing for more insight into their behaviour overall [17, 124–126].

### 3.3.2. Value-Based Personalisation

The robot employs Personalisation Strategies (PP) to personalise the conversation to the learner, including picking relevant conflicts (PP<sub>1</sub>) and personalising reflection principles (PP<sub>2</sub>), shown in Table 3.5. The agent uses the PPs in conjunction with a pre-made dialogue and, pre-made questions to pick a relevant situation to discuss according to the most important values of the participant (PP<sub>1</sub>) or to pick interesting questions and fill in open spots in sentences according to the preferred values of the participants (PP<sub>2</sub>).

#	Personalisation Principle	Personalisation Method used by Robot
1	Pick relevant conflicts	For each context find important values and inquire about relevant conflicts
2	Personalise RP	For each RP discussed in Table 3.4 pick relevant contexts, values and scenarios to reflect upon.

Table 3.5: Personalisation Strategies used by the Robot to personalise the conversation to the values of the learners, ensuring the conversation is relevant to them.

In PP<sub>1</sub>, the agent selects conflicts and questions from a pre-made pool, shown in Appendix A, based on the most important values within the **Contextualised Value Model**, ensuring a relevant and engaging dialogue for the learner based on the values of the participant. For instance, conflicts associated with the value of **Achievement** at **School** are detailed in Table 3.6, so if the agent knows the participant finds **Achievement** important when at **School** the agent can randomly pick a scenario or conflict that is related to this value. This principle is used to further refine the **Contextualised Value Model** based on the initial model. In PP<sub>2</sub>, the agent enhances the reflective experience by leveraging the **Contextualised Value Model** as a dynamic guide to personalise the Reflective Principles shown in Table 3.4, an example of the various personalisation strategies is shown in Table 3.7. Based on the context, and the most important values within said context different scenarios are picked to reflect upon. This approach allows for personalised reflection tailored to the learner's unique episodes and values, fostering a more meaningful and impactful dialogue.

Achievement at School		
Value 1	Value 2	Scenario Example
Achievement	Conformity	You have a difficult assignment due tomorrow, but your friends are already done. Would you <i>ask for the answers</i> or <i>make it yourself</i> ?
	Hedonism	You have an exam tomorrow, but your friends are going out tonight and are asking if you'd go with them. Would you <i>learn</i> or <i>party</i> ?
	Self-Direction	You have a difficult course, and your parents offer to get you a tutor, but you don't like the tutor. Would you <i>accept the help</i> or <i>learn for yourself</i> ?
	Benevolence	You have a difficult exam tomorrow, so you have to learn a lot. But your friends don't understand it and ask for your help. Would you <i>learn for the exam</i> or <i>help your friends</i> ?

Table 3.6: Example of the different conflicts based on the contextualised value of **Achievement** at **School**.

Note: The conversation is translated from Dutch to English for this report.

### 3.3.3. Dialogue

Both the personalisation and reflective principles use the robotic memory model, described in Section 3.2, to adapt the dialogue by selecting scenarios and questions based on their value preferences, with the eventual goal of providing a personalised conversation for reflecting on the learner's actions.

<i>RP<sub>1</sub></i> Being aware of your own values.	
Context	Social
Values	Benevolence & Self Direction
Scenario	Your friends are suggesting plans for the weekend. They want to explore a new museum, while you would much rather do something else. What option aligns more with your preferences?
<i>RP<sub>2</sub></i> Being aware of the values of others.	
Context	Home
Values	Security & Stimulation
Scenario	Your family has different opinions on how to spend the weekend. What do you think your <b>parents</b> would prefer – a relaxing day at home or an outdoor adventure?
<i>RP<sub>3</sub></i> Being aware of differences between contexts.	
Context	Social
Values	Hedonism
Scenario	You are planning an outing with friends. Why do you think you find <b>Hedonism</b> important in this context, compared to when you're alone?

Table 3.7: Example of the personalisation done on the different reflection principles.

### Building the initial *Contextualised Value Model*

To establish the initial model, the agent discusses various scenarios with a lot of varying behaviour choices, an example of which is shown in Table 3.8. This approach allows the agent to swiftly construct an initial *Contextualised Value Model* of the participant by discussing multiple scenarios from multiple contexts with varying behavioural choices.

<i>Your parents ask for your help.</i>	
Value	Behaviour Choice
<i>Conformity</i>	You'd listen to your parents and help them immediately because they are your parents.
<i>Achievement</i>	You'd help your parents, but only if you know you'll get something in return.
<i>Hedonism</i>	You wouldn't help your parents, because you want to have fun with friends.
<i>Self-Direction</i>	You'd decide for yourself when or if you would help your parents, you want to make your own decisions.
<i>Benevolence</i>	You love helping others, so of course you would help your parents.

Table 3.8: Example of a scenario and the different behaviour choices given by the agent.

Note: The conversation is translated from Dutch to English for this report.

### Refining and Checking the *Contextualised Value Model*

Subsequently, the agent refines and checks the *Contextualised Value Model* using *PP<sub>1</sub>* from Section 3.3.2. *PP<sub>1</sub>* dictates the selection of conflicts for discussion, with the robot having numerous conflicts for each context. By assessing weights in the *Contextualised Value Model*, the agent identifies the most relevant conflicts, focusing on the importance of certain values within a context. For instance, if the learner highly values *Benevolence* at *Home*, the robot selects conflicts involving *Benevolence*, presenting dilemmas like “*Your roommate asks you to keep quiet since he has a test the next day. Would you stay quiet or keep making noise?*” Through these discussions, the agent iteratively refines the model by updating weights based on the learner's choices, ensuring a personalised and adaptive learning process aligned with the individual's evolving ethical considerations. Since *RP<sub>3</sub>* relies on the consistency of the values of the participant, this dialogue can also be used to check whether the participant would always pick certain values over others, so for the example given earlier the agent would check whether *Benevolence* is the only value that is important to the participant, or whether certain other values may be important as well.

### Reflecting using the *Contextualised Value Model*

After the previous two conversations, the agent no longer updates the *Contextualised Value Model*. After those conversations, the model, along with the RPs (personalised using *PP<sub>2</sub>*), can be used to offer personalised reflection based on the learner's value preferences. The robot has several dialogue options based on the different values stored within memory, from this, the robot can pick the relevant dialogue based on the important values as well as the composition of the value model. The dialogue

trees are based on the reflective principles,  $RP_1$ ,  $RP_2$ , and  $RP_3$ , which allow for reflection based on empathy and the consistency of values within and between contexts.

Discussing  $RP_1$  and  $RP_2$  requires the agent to have an understanding of both the values that are important to the participant within a certain context, according to the *Contextualised Value Model*. These values can then be discussed using different scenarios, both previously discussed and new ones, that are relevant to said values and contexts, to discuss their views and relate them to the views of others.  $RP_3$  requires the agent to know the different ranked lists stored in the *Contextualised Value Model*, from this information the agent can obtain what values are important between the contexts, for instance, “Why do you find Benevolence important when with friends, but Achievement at school?” The robot also inquires why the participant might choose different values within a similar context, for instance, “It seems that at school you find both Benevolence and Achievement equally important, why might that be?” Ensuring that the participants understand their values, as well as reflecting on how others perceive their values.

### 3.4. Hypotheses

This study aims to design a memory model supporting value-based dialogue by storing and retrieving contextualised values. Two conditions are evaluated: one involving a robot without the *Contextualised Value Model*, solely focused on a conversation without any personalisation, and another involving an agent that does create, refine, and use the *Contextualised Value Model* for personalisation purposes. By having these conditions this study can look at whether the *Contextualised Value Model* can improve the personalisation of the conversation compared to a conversation solely based on an *Episodic* model.

#### 3.4.1. Quality of the Model (RQ3)

The study assesses the quality of the *Contextualised Value Model*. The hypotheses are:

$H_{3.0}$ : Personalising the conversation to the values of the participant the accuracy of the *Contextualised Value Model* is improved.

$H_{3.1}$ : The *Contextualised Value Model* enhances the **relevancy** of the conversation.

$H_{3.2}$ : The *Contextualised Value Model* improves the **likeability** of the robot [127, 128].

$H_{3.3}$ : The *Contextualised Value Model* increases the **intelligence** of the robot [127, 128].

For the overarching research question (**RQ3: Does the value model created from the dialogue accurately represent the values of the user?**), the hypothesis suggests that using a higher quality model during the conversation leads to a more relevant dialogue ( $H_{3.1}$ ), where relevant means the level at which the conversation is personalised to the values of the participant. This increased relevancy is expected to enhance the likeability ( $H_{3.2}$ ) and perceived intelligence ( $H_{3.3}$ ) of the robot, making it appear more attentive and responsive to the learner’s input [127, 128].

#### 3.4.2. Value Awareness of User (RQ4)

The study explores how personalisation influences a participant’s value awareness. The hypotheses are:

$H_{4.0}$ : Personalising the conversation enhances the **Value Awareness** of the participant.

$H_{4.1}$ : Personalising the conversation enhances **self-reflection** by tailoring the discussion to the individual’s values [46, 47].

$H_{4.2}$ : Personalising the conversation leads to better **reasoning** as participants engage in discussions closely aligned with their values [129].

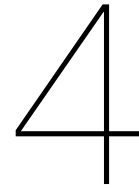
$H_{4.3}$ : Personalising the conversation results in more **remembrance**, making the dialogue more memorable over time.

$H_{4.4}$ : Personalising the conversation improves **conflict resolution** skills, addressing conflicts relevant to the user’s life by leveraging the *Contextualised Value Model* [129].

For the overarching research question (**RQ4: Does adapting the conversation to a user’s values improve the user’s value awareness?**), the hypothesis suggests that tailoring the conversation to one’s

values should enhance self-reflection ( $H_{4.1}$ ). This adaptation aligns with guided discovery in Cognitive Behavioural Therapy (CBT), emphasising personalised dialogue to foster self-reflection [46, 47]. Moreover, the personalised approach is anticipated to make the conversation more memorable ( $H_{4.3}$ ) and lead to stronger participant arguments ( $H_{4.2}$ ) due to discussions closely aligned with the learner's values [129]. Lastly, the adaptation is expected to improve conflict resolution skills ( $H_{4.4}$ ), as the agent leverages semantic memory to personalise the conversation, addressing conflicts relevant to the user's life [129].





# Method

After designing the memory model based on contextualised values for robotic conversations, it is important to evaluate the design. This chapter outlines the study designed to test the effect of using a **Contextualised Value Model** during value-based conversations. It covers the experiment's design, participant recruitment, hardware and software used, evaluation metrics, experimental conditions, experimental setup, and the procedures employed to ensure a smooth experiment.

## 4.1. Participants

For this study, participants, both students and non-students, were recruited through WhatsApp messages and word-of-mouth, assuming they met the researcher's requirements. Participants were expected to be over 18 years old, fluent in Dutch (though not necessarily as their first language), since the eventual target audience of the ePartners project is Dutch, primary school aged, children, and available for three sessions within the next three weeks, with consistent time intervals between each session and at the same location. Upon confirmation of eligibility, participants completed an Informed Consent form, providing consent to share and use the collected data. Exclusion criteria include failure to follow instructions on the consent form, failure to complete all three sessions, failure to demonstrate a sufficient level of Dutch language proficiency, or withdrawal from the research during or after the experiment.

## 4.2. Materials

For the experiment to proceed, various materials are required. Firstly, specific hardware and software are necessary for designing the robot. Additionally, the robot should be controlled by the researcher to ensure the smooth running of the experiment.

### 4.2.1. NAO Robot

This research uses the NAO robot by SoftBank Robotics<sup>1</sup>, since embodied agents improve participant attention and foster companionship, leading to better learning outcomes [9, 130–134]. The reason for picking the NAO robot over other available embodied agents are the fact that the NAO is readily available at Delft University of Technology and they have been successfully used in educational programs like NAO@School<sup>2</sup> and Robotsindeklas<sup>3</sup>. Furthermore, Python 3.10 and the Robotsindeklas platform were used for dialogue design, streamlining the process with state machines for fast prototyping and easy integration of memory components through Python.

### 4.2.2. Value Definitions & Translated Dictionary

As mentioned previously the eventual target audience of the project is Dutch primary school children. This means that some design has to be adapted to better fit this target audience, meaning that both the

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<sup>1</sup><https://www.softbankrobotics.com/emea/en/nao>

<sup>2</sup><https://www.aldebaran.com/en/nao-at-school-project>

<sup>3</sup><https://robotsindeklas.nl/>

value information and the dictionary, described in Section 3.1.1, have to be translated and simplified to fit the language and complexity understandable for Dutch primary school children.

The value information started with Schwartz [75], but since this information was in English it had to be translated and simplified. This was done by taking value definitions and explanations from children's literature, such as [25, 135, 136]. The dictionary for keyword value pairs was translated to Dutch using DeepL<sup>4</sup>, and verified by the researcher.

### 4.2.3. Python Robot Programming

The Robotsindeklas platform served as the framework for controlling the NAO robot, with additional libraries facilitating value elicitation and memory storage during conversations. For dictionary-based value extraction, this research utilised spaCy [137], a Natural Language Processing tool, for lemmatising words, and a Python implementation of Kraaij-Pohlmann for stemming in the Dutch language [138, 139]. The combination of spaCy and Kraaij-Pohlmann yielded optimal results during pilot tests, leading to their joint usage. In terms of memory structure, two CSV files were utilised: one for the Semantic portion and another for the Episodic part. To manage and write this memory to CSV, this research utilised the Pandas [140] library, a widely used data analysis tool in Python, and NumPy [141] for array and table calculations.

### 4.2.4. Robot Control

Initially, the dialogue, memory, and robotic agent were designed to operate autonomously, without needing any interference from the researcher. However, due to issues with speech recognition and speech-to-text during pilot testing, a *Wizard of Oz* setup was chosen for the experiment. This setup allowed the researcher, located in the same room as the participant, as shown in Figure 4.4, to input answers given by the participants, ensuring accurate answers and a smooth conversational flow.

The conversation involved both open and closed questions, with the researcher using a simple HTML and JavaScript webpage as the robot control interface for efficient input, as depicted in Figures 4.1 and 4.2 for multiple-choice and open questions, respectively.

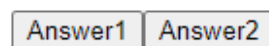


Figure 4.1: Multiple Choice Wizard of Oz, during a multiple choice question the answers are automatically put on the buttons, allowing the researcher to pick the answer given by the participant.



Figure 4.2: Open Question Wizard of Oz, during the open questions the researcher types the answer given by the participant, ensuring the agent can properly understand and handle the input.

## 4.3. Evaluation Metrics

To address the research questions posed in this study (see Section 1.1), the quality of both the value model and the dialogue needs to be determined. The evaluation metrics are divided into three categories: *Accuracy of the Model*, *Likeability & Intelligence*, and *Value Awareness*. *Accuracy of the Model* includes the relevancy of the conversation, since a more accurate model should result in a more relevant conversation. These categories are supported by questionnaires, interviews after sessions 2 and 3, and text analysis. This section elaborates on how this data is utilised to assess the model and address the various research questions.

### 4.3.1. Godspeed Questionnaire (Likeability & Intelligence)

The Godspeed questionnaire is a questionnaire often used in Human-Robot Interaction to assess robot and dialogue quality. It measures users' perceptions of aspects such as Anthropomorphism, Animacy, Likeability, Perceived Intelligence, and Perceived Safety [142]. This experiment focuses on *Likeability* and *Perceived Intelligence*. The likeability questionnaire (Table 4.1) compares preferences for the

<sup>4</sup>[www.deepl.com](http://www.deepl.com)

robot with the **Contextualised Value Model** against the non-adaptive version. The study hypothesises that intelligence positively influences robot likeability [143]. The perceived intelligence questionnaire (Table 4.2) assesses whether participants perceive the **Contextualised Value Model** robot as more intelligent than the non-adaptive robot, assuming errors from the latter may lead to a perception of lower intelligence.

Dislike	1	2	3	4	5	Like	Incompetent	1	2	3	4	5	Competent
Unfriendly	1	2	3	4	5	Friendly	Ignorant	1	2	3	4	5	Knowledgeable
Unkind	1	2	3	4	5	Kind	Irresponsible	1	2	3	4	5	Responsible
Unpleasant	1	2	3	4	5	Pleasant	Unintelligent	1	2	3	4	5	Intelligent
Awful	1	2	3	4	5	Nice	Foolish	1	2	3	4	5	Sensible

Table 4.1: The Godspeed questionnaire for *Likeability*. Table 4.2: The Godspeed questionnaire for *Perceived Intelligence*.

### 4.3.2. Self-Efficacy Questionnaire (GSES)

Self-efficacy refers to an individual's belief in their capacity to achieve specific goals [144–147], it implies confidence in controlling their behaviour. The General Self-Efficacy Scale (GSES) was used to measure self-efficacy levels at the beginning and after the final session, as it is closely related to the individual's values and can reflect improvements in value awareness [148]. The GSES, available in official Dutch translations, is a 10-question survey using a Likert scale, assessing conflict resolution abilities, the full version is included in Appendix B.

### 4.3.3. Structured Interview After Session 2

Because the second session relies heavily on the **Contextualised Value Model**, since it decides what conflicts to discuss and thus personalise the conversation, it is important to, after this session, evaluate the effects of the **Contextualised Value Model** on the conversation. This was done through a series of questions, shown in Table 4.3, with the goal of gauging the conversation's quality and the impact of the value model. The Likert scale questions indicate the quality of the model and conversation, while the open-ended questions provide feedback and insights into participants' perspectives on the conversation and potential shortcomings based on the **Contextualised Value Model**.

$s_{2.1}$	Did you feel like the agent discussed relevant values during the conversation?	7-Point Likert Scale
$s_{2.2}$	Did you feel the agent learned something about you during the conversation?	7-Point Likert Scale
$s_{2.3}$	What do you not agree with during this conversation?	Open Question
$s_{2.4}$	What do you think the agent got wrong during the conversation?	Open Question
$s_{2.5}$	How relevant were the questions at the end of the conversation to your values?	7-Point Likert Scale

Table 4.3: The questions for the interview after the second session. *Note:* Questions were translated from Dutch to English for this thesis.

### 4.3.4. Structured Interview After Session 3

Since the third session is also the final sessions the researcher can conduct a structured interview with the participant based on their experience with the robot. During this interview the researcher starts by reviewing the robotic memory and evaluating the alignment of this memory with the perception of the participant about their own values. The researcher started this interview by showing the memory data in a human-readable format, using a Radar Chart (Figure 4.3). The interview involves comparing this chart with two models: one of the models is randomly generated, while the other model contains the robotic belief according to the conversation. Participants are asked to pick the model that best reflects their values, followed by a discussion using questions from Table 4.4. Similarly to the interview after session 2 the Likert scale questions indicate the quality of the model and conversation, while the open questions ensure the participants give feedback on the conversation or shortcomings of the robotic memory model.

### 4.3.5. Evaluation

As mentioned previously in Section 4.3 the evaluation of this research is categorised as follows: *Accuracy of the Model*, *Likeability & Intelligence*, and *Value Awareness*. In order to properly evaluate each of the categories each questionnaire and interview question is associated with one category.

$s_{3.1}$	Do you agree with this model?	7-Point Likert Scale
$s_{3.2}$	Did you feel like the agent discussed relevant values during the conversation?	7-Point Likert Scale
$s_{3.3}$	Did you feel the agent learned something about you during the conversation?	7-Point Likert Scale
$s_{3.4}$	What do you not agree with when seeing this model?	Open Question
$s_{3.5}$	What did you learn from the conversation?	Open Question
$s_{3.6}$	What did you learn from seeing the memory models?	Open Question
$s_{3.7}$	What did this model get wrong about you?	Open Question
$s_{3.8}$	How much do you remember from the conversation?	7-Point Likert Scale
$s_{3.9}$	What do you remember from the conversation?	Open Question
$s_{3.10}$	How much did the robot help you to self-reflect?	7-Point Likert Scale
$s_{3.11}$	Did you talk to a smart or dumb robot?	Binary Question

Table 4.4: The questions for the interview after the third session. *Note:* Questions were translated from Dutch to English for this thesis.

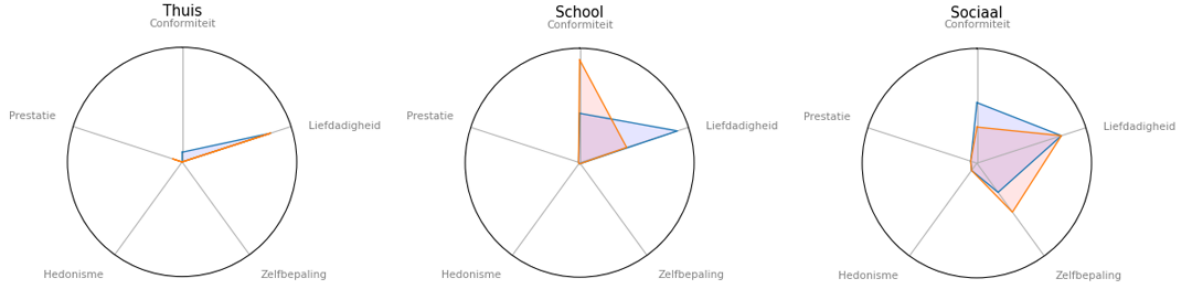


Figure 4.3: Example of the Human Readable Memory Format: for each context a separate radar chart is shown, this radar chart shows the distribution of the different values for the participant. During the experiment, one of the colours is the memory designed by the robot, while the other colour shows a randomised shuffled version of said memory. The participant has to choose which colour fits them best to discuss them during the interview.

### Accuracy of the Model

The accuracy of the model is assessed by examining both the model itself and its alignment with participants' values, as described in Section 4.3.4. Participants were shown an image (shown in Figure 4.3). They select the most agreeable colour for each context and overall, then rate their agreement on a scale of 1 to 7 ( $s_{3.1}$ ). Additionally, participants are asked about the relevance of the conversation, focusing on whether the robot selected scenarios and questions aligned with their values ( $s_{2.1}$ ,  $s_{2.5}$ , and  $s_{3.2}$ ).

### Likeability & Intelligence

The main metric related to the *Likeability & Intelligence* of the robot was the Godspeed questionnaire [142], as described in Section 4.3.1. The score for each category of the Godspeed questionnaire are calculated by averaging the individual scores. Another method for determining the intelligence of the agent is through examining the learning rate of the robot during sessions 2 and 3 ( $s_{2.2}$  and  $s_{3.3}$ ). As the final question of the interview after session 3 the participants were informed about the fact that there were two conditions, an adaptive robot, and a non-adaptive, randomised, robot. They then had to identify the type they believe they interacted with ( $s_{3.11}$ ).

### Value Awareness

The participants' value awareness is mainly focused on **Self-Efficacy**, which is scored on a scale of 10-40 using the GSES, as described in Section 4.3.2. By doing this questionnaire before the first session and after the last session the improvement of **Self-Efficacy** and, in turn, value awareness can be measured [148]. Further insights are obtained through **Argument Quality**, since the robot prompts the participant to provide reasons behind their behaviour and actions the quality of said reasons can be scored according to Table 4.5. Lastly, **Remembrance Analysis** involves the participants' recollection of the conversation ( $s_{3.8}$  and  $s_{3.9}$ ), and can be used to evaluate the level of reflection, since a more relevant conversation would be more memorable, which is important for long-term reflection [149], similarly to **Argument Quality** the **Remembrance Quality** is scored using the criteria in Table 4.6 on the answers given to question  $s_{3.9}$ .

<b>Label</b>	<b>Points</b>	<b>Argument Description</b>
No Answer	0	<i>"I don't know"</i>
Irrelevant	1	<i>Rephrase the action without giving a reason</i>
Fact	2	<i>"I have tried it many times and this worked" or any other (personal) facts</i>
Implicit Values	3	<i>The participant mentions the importance of certain actions or consequences in their reasons</i>
Explicit Values	4	<i>The participant explicitly mentions values in their arguments</i>

Table 4.5: Argument quality for measuring the value awareness of the participants using self-disclosure.

<b>Label</b>	<b>Points</b>	<b>Argument Description</b>
Low	0	<i>The participant remembers nothing about the conversation, only about the robot.</i>
Medium	1	<i>The participant remembers a scenario, but not the specifics.</i>
High	2	<i>The participant remembers a scenario, and specifics about what they picked themselves.</i>

Table 4.6: Argument quality for measuring the value awareness of the participants using self-disclosure.

### General Feedback & Trends

During the different interviews the participants share feedback through open questions ( $s_{2.3}$ ,  $s_{2.4}$ ,  $s_{3.4}$ ,  $s_{3.5}$ ,  $s_{3.6}$ , and  $s_{3.7}$ ). The goal of these questions is to obtain feedback on the robot's performance, especially the conversation and model design. The data obtained from these questions do not impact the evaluation, but it does give insight into areas of improvement and serves as a foundation for future enhancements. Further discussion on these insights is available in Section 6.

## 4.4. Study Design

This study uses a between-subjects design. The participants are divided into two groups, with the key distinction being the utilisation of the **Contextualised Value Model** to personalise the conversation. This approach allows for exploring the impact of contextualised value-based memory on both conversation quality and the resulting memory model. Despite the demonstrated advantages of episodic memory for conversational agents' intelligence and usability [10, 96], the influence of the **Contextualised Value Model** remains unexplored. To keep this experiment short and focused, several compromises had to be made, including decisions on the number and duration of sessions, the values discussed, and the contexts used during the dialogue.

### 4.4.1. Separate Sessions

This study uses three different sessions, as mentioned previously, since it enhances participant motivation, reduces fatigue, offers scheduling flexibility, and minimises disruptions to routines. Each of which are important for obtaining the highest quality of responses as possible. Between each session is a certain interval (minimal of 1 day), this allows for reflection and memory consolidation, demonstrating consistent system reliability, and fostering trust.

### 4.4.2. Values

Given the extensive requirements for personalisation, including scenarios, conflicts, and questions, it was decided, due to time constraints in this thesis and participant interactions, to focus on five values most important and relevant to the intended audience: children in primary school. These values, Conformity, Achievement, Hedonism, Self-Direction, and Benevolence, are identified through research as pivotal for children's development [25, 125, 135, 136, 150]. Conformity stresses discipline [151, 152], Achievement spans sports and academics [153, 154], Hedonism underscores enjoying life [155, 156], Self-Direction teaches early independence [157, 158], and Benevolence promotes values like honesty and friendship [159, 160]. These values also represent a big part of the Schwartz Basic Human Value circle, illustrated in Figure 2.1. *Conformity* and *Benevolence* are part of the social focus, while *Hedonism*, *Self-Direction*, and *Achievement* are centred around personal development.

### 4.4.3. Contexts

While values can stay consistent between contexts, they are, as mentioned in Section 1, not rigid, meaning that their importance and meaning might change based on the context. Some people behave differently when they are surrounded by friends than when they are at home with their parents, this is why it is important to discuss values within a certain context.

To keep the experiment as simple as possible as a proof of concept for the **Contextualised Value Model** a fixed subset of contexts was chosen based on the eventual target audience of this research, primary school children. Research identifies three different key contexts for children: **Home**, where interactions with parents and siblings introduce value conflicts that demand understanding and discussion [161]; **Social**, emphasising the importance of friendships and relationships across school and neighbourhoods, fostering social awareness [162–164]; and **School**, mirroring home in time spent, encompassing academic and social learning, with potential conflicts necessitating comprehension [165, 166].

## 4.5. Experiment Setup

During the experiment, participants are seated facing the robot at a table, with a monitor and camera placed between them for gaze detection. The researcher is positioned behind the participant to minimise distractions from the robot. The setup was standardised across multiple locations to ensure consistency between each participant. Figure 4.4 illustrates the experimental setup.

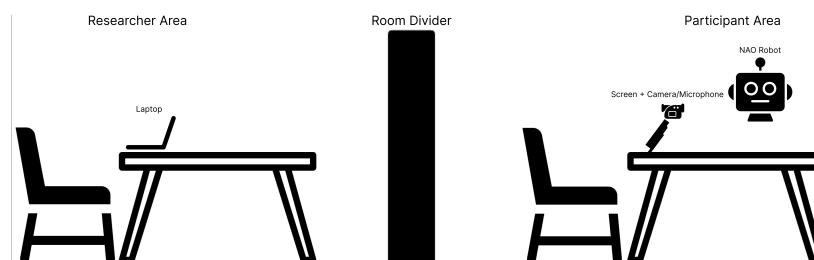


Figure 4.4: The experimental setup.

### 4.5.1. Gaze Detection Setup

Gaze data collection was requested for future research, requiring suitable cameras and an engaging setup to encourage participants to focus on either the screen or the robot. Images displaying various perspectives and scenarios were used, created via StoryboardThat<sup>5</sup>. The inclusion of emoticons in the images helped convey the intended meaning of each value or action consistently without causing distraction. An example of these images is illustrated in Figure 4.5, with all images available in Appendix C.



Figure 4.5: Example of the images used to entice gaze; This image shows the conflict between choosing family or achievement.

## 4.6. Protocol

To ensure everything related to the experiment could go over smoothly various protocols were implemented.

### 4.6.1. Before and During Experiment

Participants were asked to schedule three sessions using Calendly<sup>6</sup>, a scheduling application that streamlined appointments. Between each session a buffer of 10 minutes was scheduled, which was used for preparation of the upcoming session and handling unexpected delays.

Before each session the researcher greeted them, engaged in casual conversation, calibrated the camera, and activated the voice recording microphone before initiating the robot. The experiment primarily operated autonomously, with minimal intervention.

<sup>5</sup><https://www.storyboardthat.com/>

<sup>6</sup><https://calendly.com/>

After each session the questionnaires and interviews were transcribed to an Excel file and, if necessary, the robot's memory model could be updated to ensure that the subsequent sessions had the correct data to work with.

#### **4.6.2. Post-Experiment**

After the experiment was done all of the results were combined into a single Excel sheet for visual analysis, including trends, conditions, and demographic information. This excel file was later used for analysis using SPSS 28 and R. The analysis started with a Shapiro-Wilk test for normality, determining the appropriate tests to use (parametric or non-parametric). For binary choices a Chi-Square tests was chosen, while T-tests, Mann-Whitney U tests, or ANOVA were used for score or ratio questions. A significance level ( $\alpha$ ) of .05 was used for all tests.

The open questions from the interviews were later examined for recurring patterns or trends, providing insights into perceived conversation shortcomings and guiding future experiments.





# 5

## Results

In this chapter, the *Partial* robot refers to the robot that does not update and utilise the **Contextualised Value Model** throughout the conversation, whereas the *Complete* robot employs the **Contextualised Value Model** to personalise the conversation according to the participant's values.

This chapter presents the results obtained during the experiment. First the demographic information of the participants are outlined, followed by an examination of the normality tests that determine the appropriate analyses. After which each of the findings are presented through graphs, charts, and tables. A discussion of each result is provided in Chapter 6.

### 5.1. Participants

During this study, a total of 57 participants were recruited to engage in conversations with the robot regarding their values. Among these 57 participants, 3 had to be excluded due to an inability to complete the study within the required time frame or failure to adhere to the researcher's guidelines. As a result, data from 54 participants were analysed for the experiment. A summarised version of the demographic information of the participants is presented in Table 5.1. The participants had an average age of 38.3, with a standard deviation of 18.8 (minimum age 18, maximum age 81).

<b>Category</b>	<b>Subcategory</b>	<b>Frequency</b>	<b>Proportion</b>
<i>Total</i>	<i>Usable</i>	54	94.74%
	<i>Not Usable</i>	3	5.25%
<i>Gender</i>	<i>Male</i>	28	51.85%
	<i>Female</i>	26	48.15%
<i>Condition</i>	<i>Complete</i>	28	51.85%
	<i>Partial</i>	26	48.15%
<i>Age</i>	<i>18-25</i>	22	40.74%
	<i>26-40</i>	11	20.37%
	<i>41-60</i>	13	24.07%
	<i>&gt;60</i>	8	14.81%

Table 5.1: Demographic information of the participants.

Of all participants 28 (51.8%) were male, and 26 participants (48.2%) were female. While this distribution is not expected to significantly influence the analysis, the nearly equal representation of genders minimises potential gender-related discrepancies. Both genders were also evenly distributed across the conditions, ensuring that there was no notable disparity between male and female participants within each condition ( $\chi^2(1, N = 54) = .08, p = .777$ ). Thus, this study can examine the various conditions and results without considering gender as a variable.

## 5.2. Normality Testing

To determine the appropriate statistical tests, the data distribution was examined, using the Shapiro-Wilk test due to the sample size being less than 2000 participants. A summary of the normality tests is provided in Table 5.2, while several variables showed a normal distribution ( $p > .05$ ), most did not ( $p < .05$ ). This leads to the use of non-parametric tests for the analysis of all results.

<i>Variable</i>	<i>Shapiro-Wilk</i>		
	<i>Statistic</i>	<i>df</i>	<i>Sig.</i>
<i>Pre GSES</i>	.968	54	.159
<i>Post GSES</i>	.963	54	.098
<i>Likeability</i>	.904	54	< .001
<i>Perceived Intelligence</i>	.930	54	.004
<i>Final Choice</i>	.561	54	< .001
<i>Session 3 Agree</i>	.866	54	< .001
<i>Session 3 Remember</i>	.903	54	< .001
<i>Session 3 Reflection</i>	.939	54	.008
<i>Condition Guess</i>	.494	54	< .001
<i>Relevancy Score</i>	.967	54	.149
<i>Learning Rate</i>	.942	54	.011
<i>Argument Score Pre</i>	.915	54	.006
<i>Argument Score Post</i>	.913	54	.005
<i>Remember Score</i>	.810	54	< .001
<i>Joy Pre</i>	.833	13	.017
<i>Confusion Pre</i>	.673	13	< .001
<i>Joy Post</i>	.860	13	.038
<i>Confusion Post</i>	.699	13	< .001

Table 5.2: Tests of Normality, due to the lower quality of video data the Joy and Confusion metrics only had 13 degrees of freedom.

## 5.3. Accuracy of the Model

To assess the quality of the value model and address **RQ5**, two metrics were used, as explained in Section 4.3.5. First, the participants were asked which of the two models (random or robotic belief) best fits their own beliefs, without knowing which one is which, as well as the accuracy of this model by providing a score of 1-7 to each context within the model, as well as a score for the model overall. Finally, insights from the interviews were used to evaluate the conversational relevance from the participants' perspectives.

### 5.3.1. Value Model Choices

Table 5.3 shows the different choices that the participants made. Participants engaging with the complete robot were more inclined to choose the robot's belief, whereas those interacting with the partial robot appeared to make more random selections, this trend is also shown in the bar graph in Figure 5.1. To show whether this trend is a significant difference between both conditions a chi-square test of independence was performed. The relationship between the condition and the model the participants most agreed with was significant,  $\chi^2(1, N = 54) = 27.93$ ,  $p = < .001$ . Participants who had the complete robot were more likely to pick the robot's belief than those who conversed with the partial robot.

Participants were asked about the quality of the model based on the choices they made, rating the model on its alignment with their values. A summarised representation of this data is shown in Table 5.3. This shows that the mean for the *Complete\*Robotic Belief* agreement is higher than the other conditions ( $\mu = 5.5$ ,  $\sigma = .8$ ), while for the *Partial* condition, it seems that the Random model was closer to the values of the participants ( $\mu = 5.1$ ,  $\sigma = .9$ ). A two-way ANOVA was conducted to examine the main effects of Condition and Choice Final, as well as their interaction effects. The results indicate that

Condition	Final Choice	Count	Mean	Std. Dev
Partial	Random	14	5.1	.9
	Robotic Belief	12	4.3	1.0
Complete	Random	1	3.0	.0
	Robotic Belief	27	5.5	.8

Table 5.3: Frequency table of the choices made by the participants, also contains summarising data of the scores given on how close the chosen memory model follows the values of the participants, as answered by the participants on a 7-Point Likert Scale,  $p = .002$  based on the condition and final choice.

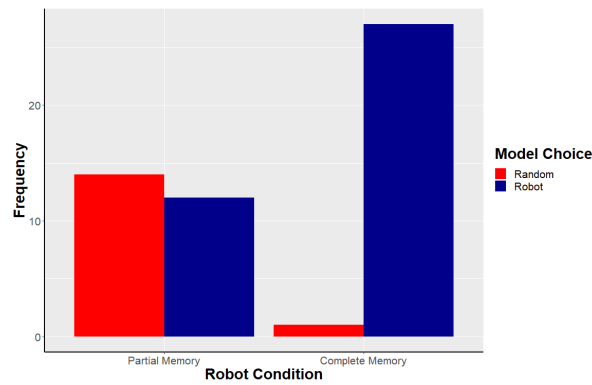


Figure 5.1: Bar chart showing the frequencies of the choices made by the participant on whether the random model (red) or robotic belief (blue) best fits their values,  $p = .001$ .

there was no significant main effect on the score given based on the Condition,  $F(1, 50) = .9$ ,  $p = .4$ ,  $\eta^2 = .7$ . Similarly, there was no significant effect on the score related to the chosen memory model,  $F(1, 50) = 2.5$ ,  $p = .1$ ,  $\eta^2 = 2.1$ .

### 5.3.2. Relevancy of Conversation

During interviews, participants gave scores based on the robot's understanding of their values and the adaptability of the conversation. Table 5.4 presents a composite measure based on mean responses to three relevancy-related questions ( $s_{2.1}$ ,  $s_{2.5}$ , and  $s_{3.2}$ ), showing a satisfactory Cronbach Alpha of .76, indicating the reliability of the measure. The mean values for the complete robot ( $\mu = 5.2$ ,  $\sigma = .9$ ) is higher than those for the partial robot ( $\mu = 4.7$ ,  $\sigma = .7$ ), the distinctive 95% confidence intervals in the box plots shown in Figure 5.2 suggested a probable significant difference. A Mann-Whitney U test confirmed the significance, indicating a notable difference in conversation relevancy based on the condition of the participants ( $U = 176.5$ ,  $p = .001$ ).

Metric	Condition	Mean	Std. Dev
Relevancy	Partial	4.7	.9
	Complete	5.2	.7

Table 5.4: Summarising data of the level of adaption to the values of the participant throughout the conversation, self-reported by the participant on a 7-point Likert Scale.

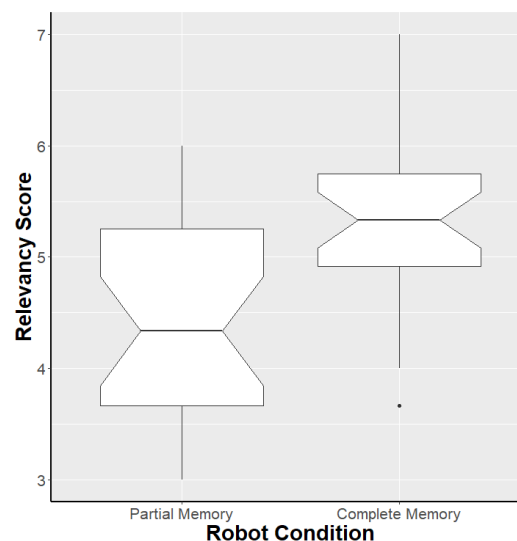


Figure 5.2: Notched Boxplot showing the level of adaption to the values of the participant based on their condition,  $p = .001$ .

## 5.4. Likeability & Intelligence

This section presents the outcomes of the Godspeed questionnaire, together with the responses to interview questions regarding the perceived learning rate of the robot, and finally the participants' guess

of whether their robot used the **Contextualised Value Model** or not. These results shed light on whether the complete robot is perceived as more intelligent and potentially more likeable, since it seems to be listening more and actively processing the information during the conversation.

### 5.4.1. Godspeed Questionnaire

Table 5.5 presents the summarised data from the Godspeed questionnaire, which shows the level of likeability and perceived intelligence the participants felt towards the robot. The data indicates similar ratings for likeability ( $\mu = 4.2$ ,  $\sigma = .7$  for the partial condition,  $\mu = 4.3$ ,  $\sigma = .5$  for the complete condition) and perceived intelligence ( $\mu = 3.6$ ,  $\sigma = 1.0$  for the partial condition,  $\mu = 4.0$ ,  $\sigma = .7$  for the complete condition). The box plots depicted in Figure 5.3 demonstrate overlapping 95% confidence intervals, suggesting no significant distinction between the conditions.

To validate these findings, a Mann-Whitney U test was conducted to assess potential differences in Likeability and Perceived Intelligence based on the condition. The results indicated that there was no significant difference in the robot's likeability ( $U = 349$ ,  $p = .793$ ) or perceived intelligence ( $U = 300.5$ ,  $p = .269$ ) between the complete and partial robot conditions.

<i>Metric</i>	<i>Condition</i>	<i>Mean</i>	<i>Std. Dev</i>
Likeability	Partial	4.2	.7
	Complete	4.3	.5
Intelligence	Partial	3.6	1.0
	Complete	4.0	.7

Table 5.5: Summarising values for the likeability and intelligence of the robot according to the Godspeed questionnaire, on a 5-Point Likert Scale.

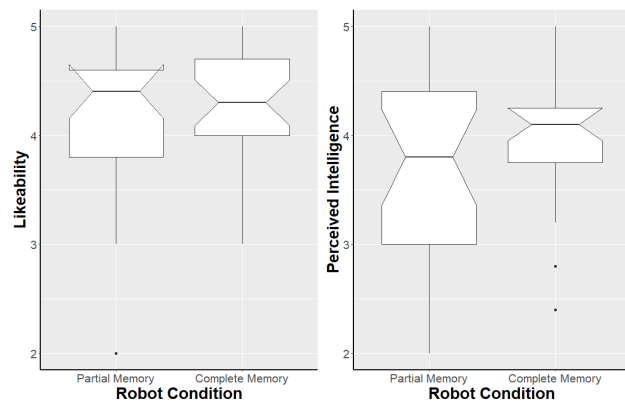


Figure 5.3: Notched Boxplot showing the level of likeability and perceived intelligence the participants have towards the robot,  $p = .793$  and  $p = .269$  respectively.

### 5.4.2. Learning Rate

During the interviews the participants were asked to report how much the participants felt the robot learned about their values based on a 7-Point Likert Scale ( $s_{2.2}$  &  $s_{3.3}$ ), a summarised view of the data can be seen in Table 5.6. From this table, it is clear that the participants felt that the complete robot ( $\mu = 5.4$ ,  $\sigma = 1.0$ ) learned more about the values of the participants than the partial robot ( $\mu = 4.5$ ,  $\sigma = 1.0$ ), as also depicted in the notched box plot in Figure 5.4. The distinct 95% confidence intervals shown in the box plots suggest a likely significant result.

To confirm this finding a Mann-Whitney U test was performed to evaluate whether the learning rate of the robot differed by the condition. The results indicated that the complete robot learned more than the robot that did not adapt to the values of the participants ( $U = 198$ ,  $p = .004$ ).

<i><b>Metric</b></i>	<i><b>Condition</b></i>	<i><b>Mean</b></i>	<i><b>Std. Dev</b></i>
<i><b>Learning Rate</b></i>	<i><b>Partial</b></i>	4.5	1.0
	<i><b>Complete</b></i>	5.4	1.1

Table 5.6: Summarising values for the level of learning the participants thought the robot had to their values according to a self-report question, on a 7-Point Likert Scale.

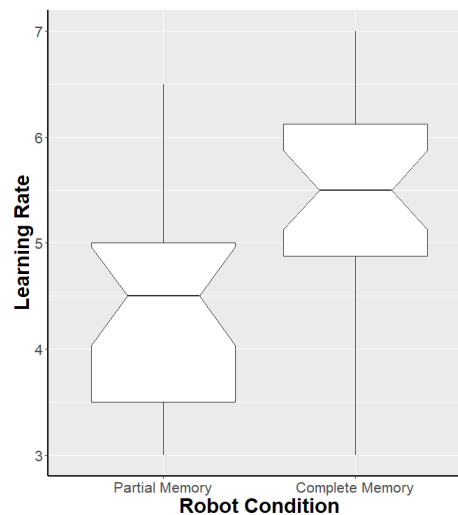


Figure 5.4: Notched Boxplot showing the level of learning the participants believe the robot has,  $p = .004$ .

### 5.4.3. Condition Guess

As the final question of the experiment, the participants were asked whether they believed the robot they talked with was intelligent or unintelligent after it was explained to them that there were two different conditions. Table 5.7 shows a summary of the frequencies of the choices made by the participants for the partial condition, the participants are less clear whether the robot is intelligent or not (10 random, 16 intelligent), while for the complete condition, the robot is almost always seen as intelligent (1 random, 27 intelligent), this trend is also shown in the bar graph in Figure 5.5.

To show whether this trend is a significant difference between both conditions a chi-square test of independence was performed to evaluate the relationship between the condition (whether the participant spoke to the complete or partial robot) and what condition the participants believed they had. The relationship between these variables was significant,  $\chi^2(1, N = 54) = 10.12, p = .001$ . Participants who talked with the complete robot were more likely to correctly guess that the robot was complete, while participants who talked with the partial robot more often chose that they talked with the partial robot.

<i><b>Condition</b></i>	<i><b>Final Choice</b></i>	<i><b>Count</b></i>
<i><b>Partial</b></i>	<i><b>Random</b></i>	10
	<i><b>Intelligent</b></i>	16
<i><b>Complete</b></i>	<i><b>Random</b></i>	1
	<i><b>Intelligent</b></i>	27

Table 5.7: Frequency table of the guesses made by the participants after they were told that there were multiple robots.

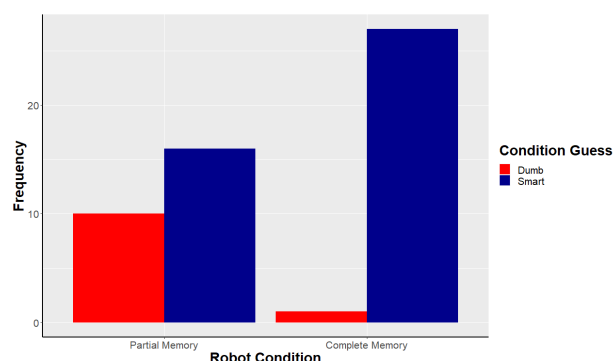


Figure 5.5: Bar chart showing the frequencies of the choices made by the participant on whether the robot they had a conversation with was intelligent (blue) or dumb (red),  $p = .001$ .

## 5.5. Value Awareness

This section describes the possible improvement of value awareness of the participants based on whether they spoke to the complete or partial robot. According to Section 4.3.5, the GSES, Self-Disclosure, and Self-Reflection Score are important to evaluate the difference in value awareness.

### 5.5.1. General Self Efficacy Scale

Before and after the conversations the participants had to fill in the GSES [167], to show whether their self-efficacy and conflict resolution scores improved due to the conversations. A summary of this data is shown in Table 5.8, which shows that the means do not change a lot before and after the conversation, this trend can also be seen in the box plots shown in Figure 5.6. Since the box plots show overlapping 95% confidence intervals, a non-significant distinction between the GSES scores is suggested based on the time and condition.

Since the data is independent, spherical, and normally distributed, this significance can be proven or disproven using a repeated-measures ANOVA test to assess the relationship between the condition and the pre- / post-test results. Examining the interaction between the Condition and the GSES, the GSES scores do not significantly differ between each condition,  $p = .567$ . Participants who conversed with the complete robot did not significantly improve their GSES scores compared to the participants who interacted with the partial robot.

<i>Metric</i>	<i>Condition</i>	<i>Mean</i>	<i>Std. Dev</i>
Pre GSES	Partial	31.1	3.6
	Complete	32.7	3.8
Post GSES	Partial	31.4	3.2
	Complete	32.0	3.8

Table 5.8: Summarising data of the GSES scores before and after the experiment, each GSES score is derived as the sum of 10 4-Point Likert Scale questions.

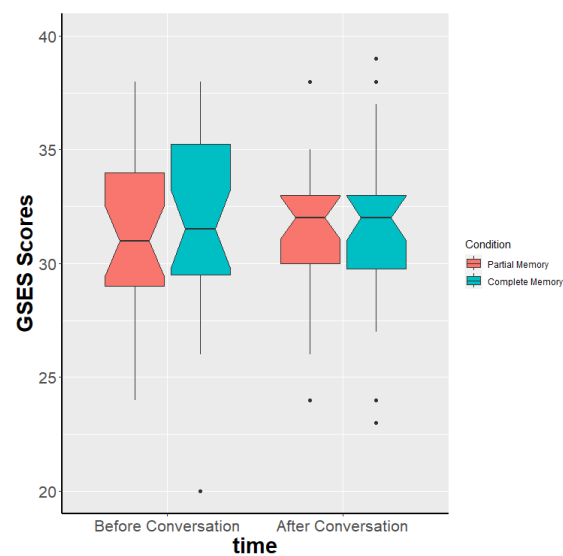


Figure 5.6: Notched Boxplot showing the level of self-efficacy the participants believed they had before and after the conversation,  $p = .567$ .

### 5.5.2. Self-Disclosure Analysis

During the conversation, the robot prompts participants to explain their reasons for certain actions, which are then evaluated using the schema presented in Table 4.5, validated as moderately reliable according to the kappa coefficient  $\kappa = .5$  which means a moderate agreement between the raters. The assigned grades aim to discern any significant enhancements in argument quality attributed to the robot's memory usage. A summary of the data in Table 5.9 reveals minimal disparities in the overall means (2.4), a trend further supported by the overlapping 95% confidence intervals displayed in Figure 5.6. As such, the data implies no significant discrepancy in the GSES scores based on time and condition.

To validate these findings, a repeated-measures ANOVA test was conducted, considering the relationship between the condition and the argument quality. The analysis of the interaction between the Condition and argument quality suggests that the quality of arguments does not significantly differ across the conditions ( $p = .512$ ). Participants engaging with the complete robot did not notably enhance their argument quality when discussing relevant conflicts compared to those conversing with the partial robot, which only discussed random conflicts.

Metric	Condition	Mean	Std. Dev
Argument Score Base	Partial	2.2	.3
	Complete	2.3	.4
Argument Score	Partial	2.2	.3
	Complete	2.2	.2

Table 5.9: Summarising data of the argument scores during the first session (base), and during the second and third session (after usage of memory), each argument given for their actions is scored on 0-4 according to the scoring table shown in Table 4.5

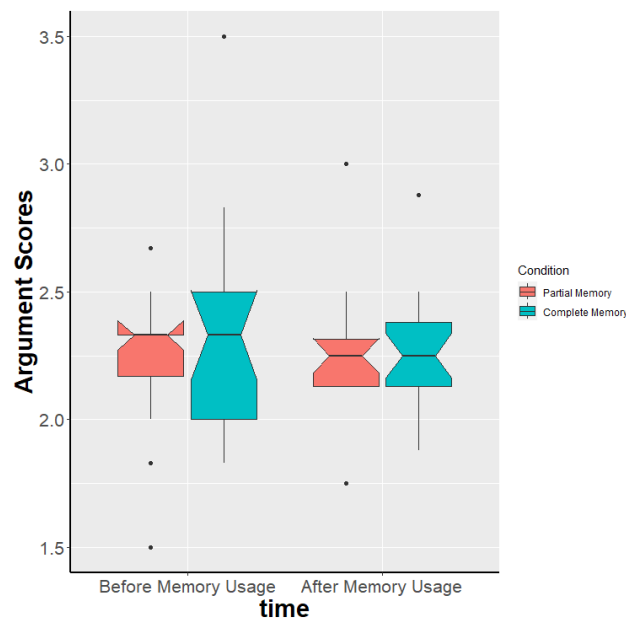


Figure 5.7: Notched Boxplot showing the argument scores given to the reasons behind the actions the participants would choose in certain scenarios,  $p = .512$ .

### 5.5.3. Remembrance Analysis

During the interviews the participants were asked to self-report the level of recollection the participants thought they would have after the conversation was finished, this was done to try to gauge whether the participants were able to retain more information and learn more from the robot that adapts to their value compared to the robot that does not, Table 5.10 shows the summarising values for this 7-Point Likert Scale question, both means are the same ( $\mu = 4.3$ ) with a small difference in standard deviation, but overall the data was very similar, this similarity is also shown in the box plots shown in Figure 5.8. The overlapping 95% confidence intervals in the box plots convey a similar relatedness of the data. As such, the data implies no significant discrepancy in the self-reported remembrance score and condition.

To validate these findings, a Mann-Whitney U test was performed to evaluate whether the remembrance of the conversation differed by the condition. The results indicated that the conversation with the complete robot was not significantly more memorable than a conversation with the partial robot,  $U = 304$ ,  $p = .283$ .

Metric	Condition	Mean	Std. Dev
Remembrance Self-Report	Partial	4.3	1.1
	Complete	4.3	1.4

Table 5.10: Summarising data of the level of self-reported recollection the participants have towards the conversation on a 7-Point Likert Scale.

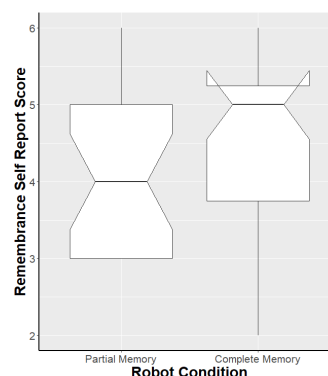


Figure 5.8: Notched Boxplot showing the self-reported remembrance score given to the conversation the participants had with the robot based on its condition,  $p = .283$ .

To further look into this the participants were asked to name one thing that they could remember from the conversation, these arguments were scored according to Table 4.6 and counted up. A summary of this data can be found in Table 5.11, which shows that the scores for the *Complete* robot were a little higher ( $\mu = 1.1$ ,  $\sigma = .8$ ) compared to the scores given to the remembrance of the participants that spoke with the *Partial* robot ( $\mu = .9$ ,  $\sigma = .7$ ). This similarity is also shown in the box plot shown in Figure 5.9, the overlapping 95% confidence intervals in the box plots convey a similar relatedness of the data. As such, the data implies no significant discrepancy in the self-reported remembrance score and condition.

To validate these findings, a Mann-Whitney U test was performed to evaluate whether the remembrance scores differ based on the condition. The results indicated that the conversation with the *Complete* robot was not significantly better remembered by the participants compared to the robot without the usage of the **Contextualised Value Model**, since  $U = 172.5$ ,  $p = .432$ .

<i>Metric</i>	<i>Condition</i>	<i>Mean</i>	<i>Std. Dev</i>
<i>Remembrance Score</i>	<i>Partial</i>	.9	.8
	<i>Complete</i>	1.1	.7

Table 5.11: Summarising values for the argument quality of the remembrance question in the interview after session 3.

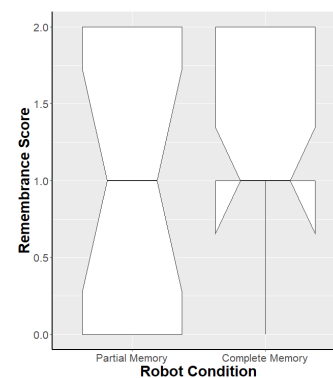


Figure 5.9: Notched Boxplot showing the remembrance score based on the open answer the participants give to question ( $s_{3.9}$ ), scored according to Table 4.6 based on the condition of the robot,  $p = .432$ .

#### 5.5.4. Self-Reflection Score

During the final interview, the participants were asked how much the robot supported them with reflecting on their values using a 7-point Likert Scale. The summarising values of this question can be found in Table 5.12. From this table, it shows that both means are relatively similar ( $\mu = 4.7$  for partial and  $\mu = 5.0$  for complete), but the spread for the complete condition ( $\sigma = 1.5$ ) is a bit higher than for the partial condition ( $\sigma = 1.0$ ). This trend is also visible in the box plots shown in Figure 5.10, where the overlapping 95% confidence intervals convey a similar relatedness of the data. As such, the data implies no significant discrepancy in the self-reported remembrance score and condition.

To validate these findings, a Mann-Whitney U test was performed to evaluate whether the reflective effect of the conversation differed by the condition. The results indicated that the complete robot was not significantly better at enticing self-reflection than the partial robot,  $U = 361$ ,  $p = .957$ .



<i>Metric</i>	<i>Condition</i>	<i>Mean</i>	<i>Std. Dev</i>
<i>Self-Reflection Score</i>	<i>Partial</i>	4.7	1.0
	<i>Complete</i>	5.0	1.5

Table 5.12: Summarising data of the self-reported reflection score on a 7-Point Likert Scale, according to question ( $s_{3.10}$ ).

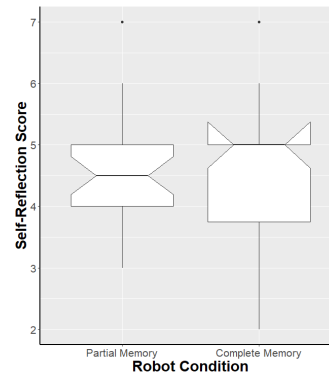


Figure 5.10: Notched Boxplot showing the self-reflection score based on the condition of the robot,  $p = .957$ .

## 5.6. Additional Results

Throughout the experiment, several incidental findings emerged that, although not directly relevant to the study's primary research questions, offer valuable insights for discussion. This section presents the results obtained during the experiment that do not directly contribute to addressing the research questions.

### 5.6.1. Video Analysis

During the conversation, the robot draws conclusions and makes assumptions based on its value model, prompting varied participant responses (most importantly, confusion). Video analysis of the experiment utilised OpenFace<sup>1</sup>, employing the Facial Action Coding System (FACS) [168] to categorise emotions. Notably, confusion is indicated by a combination of Action Units 4 and 7, while Joy is often represented by Action Units 6 and 12 [169–173]. A summary of this data is shown in Table 5.13, which shows that the means are all over the place, most likely due to the low-quality data.

Given the data's independence, sphericity, and (approximately) normal distribution, a repeated-measures ANOVA test was conducted to assess the relationship between the condition and the pre- / post-emotion results. The analysis revealed that, concerning the interaction between the Condition and the joy/confusion, the joy significantly varied between the different conditions ( $F(1, 11) = 4.898$ ,  $p = .049$ ), whereas the confusion score did not show a significant difference ( $F(1, 11) = .003$ ,  $p = .955$ ). However, as only 13 out of the 54 participants had videos that were amenable to analysis using OpenFace, these results were not integrated into the final analysis.

<i>Facial Feature</i>	<i>Context</i>	<i>Mean</i>	<i>Std. Dev</i>
<i>Joy Base</i>	<i>Partial</i>	4.5	10.2
	<i>Complete</i>	23.4	15.5
<i>Confusion Base</i>	<i>Partial</i>	6.1	11.6
	<i>Complete</i>	9.7	12.9
<i>Joy Session 2 &amp; 3</i>	<i>Partial</i>	4.0	5.6
	<i>Complete</i>	9.2	8.2
<i>Confusion Session 2 &amp; 3</i>	<i>Partial</i>	11.7	13.4
	<i>Complete</i>	8.9	19.1

Table 5.13: Summarising data of the Joy and Confusion shown by the participant. Joy is the combination of AU 6 & 12, while Confusion is the combination of AU 4 & 7 according to OpenFace.

### 5.6.2. Differences Between Contexts

During the conversation the robot builds a memory model based on the values of the participants, looking at the differences in ranks of the values between each context can give some insight into the quality

<sup>1</sup><https://github.com/TadasBaltrusaitis/OpenFace>

of the model, since the differences can be compared with existing literature on values. A summary of this data is shown in Table 5.14, which shows that the means are all over the place. There are some differences between some contextualised values, such as *Achievement*, which is mostly important in School scenarios, similarly for conformity, while self-direction is mostly prominent in Social situations.

To test these theories a series of Friedman tests were conducted on the ranks of each value within each context, the results of these are shown in Table 5.15. When looking at *Conformity* the Friedman test reveals a statistically significant difference between the contexts ( $\chi^2(2) = 11.007$ ,  $P = 0.0041$ ). However, the subsequent Wilcoxon signed-rank tests indicate no significant differences between Home and Social situations ( $Z = 671.5$ ,  $P = 0.1096$ ), but a significant difference between Home and School situations ( $Z = 541$ ,  $P = 0.006$ ) and between Social and School contexts ( $Z = 1061.5$ ,  $P = 0.035$ ). Similarly, *Self Direction* exhibits a highly significant difference among contexts ( $\chi^2(2) = 37.574$ ,  $P = < .001$ ), with significant differences observed in all pairwise comparisons. Both *Hedonism* and *Achievement* follow a similar pattern, both were significantly different between the contexts ( $\chi^2(2) = 6.049$ ,  $P = 0.049$  and  $\chi^2(2) = 11.971$ ,  $P = 0.0025$  respectively) with the Post-Hoc only showing non-significant results only between Home and School scenarios ( $Z = 811$ ,  $P = 0.776$  and  $Z = 987$ ,  $P = 0.161$  respectively). However, *Benevolence* shows no significant differences across contexts according to the Friedman test ( $\chi^2(2) = 5.084$ ,  $P = 0.0787$ ).

Value	Context	Mean	Std. Dev
<i>Conformity</i>	0	2.8	1.4
	1	3.3	1.3
	2	2.2	1.2
<i>Benevolence</i>	0	2.1	1.3
	1	2.5	1.1
	2	2.0	1.1
<i>Self Direction</i>	0	2.6	1.3
	1	1.8	1.1
	2	3.8	1.0
<i>Hedonism</i>	0	4.0	.8
	1	3.4	1.2
	2	4.0	1.0
<i>Achievement</i>	0	3.1	1.1
	1	3.8	1.3
	2	2.8	1.2

Table 5.14: Summarising data of the weight of each value within each context. 0 = Home, 1 = Social, 2 = School. **Note:** higher rank/mean means less important.

Value	Friedman ( $P$ , $\chi^2$ )	Wilcoxon (Context, $P$ , $Z$ )
<i>Conformity</i>	0.0041(11.007)	Home-Social: 0.1096(671.5) Social-School: 0.0351(1061.5) Home-School: 0.0056(541)
<i>Benevolence</i>	0.0787(5.084)	Home-Social: 0.1098(675.5) Social-School: 0.0390(1055) Home-School: 0.9251(830.5)
<i>Self Direction</i>	< .001(37.574)	Home-Social: 0.0034(1142.5) Social-School: < .001(189.5) Home-School: < .001(436.5)
<i>Hedonism</i>	0.0486(6.049)	Home-Social: 0.0244(1070) Social-School: 0.0225(603.5) Home-School: 0.7761(811)
<i>Achievement</i>	0.0025(11.971)	Home-Social: 0.0169(589.5) Social-School: 0.0008(1195.5) Home-School: 0.1614(987)

Table 5.15: Friedman-test results and Wilcoxon signed-rank test for Post-Hoc analysis

# 6

## Discussion

The purpose of this study was to evaluate the newly discussed *Contextualised Value Model*, as well as the effects it has on the conversation and what the learner learns during the conversation. Several hypotheses were examined throughout the study, their validation, or refutation, along with their implications, are all discussed in this section. Following the analysis of the results and their implications, the study delves into the contributions, in addition to appraising the validity of the experiment and outlining its limitations and prospects for future research.

As previously mentioned, this research sought to evaluate the role of memory concerning three distinct hypotheses: *Accuracy*, *Likeability* & *Intelligence*, and the influence on *Value Awareness*.

### 6.1. Accuracy of the Model

The evaluation of the quality of the *Contextualised Value Model* involved testing the hypothesis denoted as  $H_5$  (Section 3.4), which suggested that using the memory model during conversations would result in a higher quality memory model that closely fits the values of the participant. The data obtained during the experiment suggested that the dialogue conducted with the agent utilising the *complete* memory model, was more relevant and more closely follows the values of the participant during the conversation. Consequently, the results indicate that the conversation was customised and adapted to the participant's values through the utilisation of the *Contextualised Value Model* ( $H_{5.1}$ , Section 5.3.2), resembling the use of an “episodic memory” for personalisation as observed in the study by Lighthart *et al.* [26] and Ahmad *et al.* [109]. Moreover, while semantic knowledge, such as the *Contextualised Value Model*, has demonstrated effectiveness in various personalisation approaches, such as recommender systems [174, 175] or reasoning in Human-Robot collaboration [176], this particular implementation stands as one of the pioneering endeavours to incorporate semantic knowledge for personalisation based on the appreciation of different values within the domain of Human-Robot interaction.

The notably heightened relevance of the conversation, coupled with the results presented in Section 5.3, provides substantial backing for the hypothesis that employing the “complete” memory model during the interaction leads to the development of a more refined memory representation ( $H_5$ ), wherein “higher quality” denotes a stronger resonance with the values of the participants.

Consequently, it can be inferred that the robot employing the complete memory model, which integrates the *Contextualised Value Model*, maintains a more precise memory, enabling it to model the participants' values across various contexts more effectively. Additionally, the robot can dynamically adjust the conversation to the participants' values, ensuring that the conversation remains relevant and personalised for each participant. The *Contextualised Value Model* differs from “episodic memory”, but combining both provides a solid foundation for value-based Human-Robot conversations. The episodic memory can be used to personalise the conversation and support reflection based on *what was discussed* in previous sessions, and the *Contextualised Value Model* can be used to personalise the conversation based on *what is interesting to discuss* based on the values of the participant.

## 6.2. Likeability & Intelligence

To examine the impact of the *Contextualised Value Model* on the perceived intelligence and likeability of the robot, both aspects were evaluated using the Godspeed questionnaire [142] ( $H_{5.2}$ ,  $H_{5.3}$ , Section 3.4). However, the data collected during the experiment did not yield significant results to disprove either of the hypotheses.

The results revealed that the use of the complete memory model in the robot did not necessarily lead to it being perceived as more likeable ( $H_{5.2}$ ). This finding can be contextualised within the existing literature, as conflicting evidence exists regarding the likeability of personalised robots. Notably, studies conducted by Gao *et al.* [177] and Kennedy *et al.* [178] observed that a non-personalised robot often yielded superior learning outcomes ( $H_4$ ) and was preferred by students. However, studies by Mayer *et al.* [179] and Churamani *et al.* [180] demonstrated that personalisation had a positive impact on the likeability of the robot. This study's results align more closely with the findings of Saravanan *et al.* [7], which indicated that personalising the robot to the participant did not lead to an enhanced user experience. Another plausible explanation for this trend could be the novelty effect. Specifically, within the context of this experiment, only 4 participants (constituting 7.5% of the sample) had prior experience interacting with a robot. Consequently, the novelty effect might have influenced the participants' responses during the brief 3-session interaction. Research has shown that the novelty effect typically generates heightened enthusiasm among participants during initial interactions with a robot, primarily because the novelty of the experience inherently makes it intriguing [131, 181].

Likewise, the observation that the robot using the complete memory model was not perceived as more intelligent ( $H_{5.3}$ ) can be attributed to similar factors that influence the perception of likeability. Notably, the study conducted by Churamani *et al.* [180] suggested that a personalised robot was perceived as more intelligent, potentially influenced by their experimental setup, where participants had two 15-minute sessions with only a 10-minute break in between, in contrast to the day(s) provided as breaks in this study. Additionally, the novelty effect might have played a role, considering that most participants had limited prior experience with robots. The robot's ability to move, walk, and engage in conversation is often perceived as more intelligent than initially anticipated. It is worth noting that participants correctly discerned the "more intelligent" robot only after being informed that two different robots were involved, particularly recognising the one with the complete memory as more intelligent, as demonstrated in Section 5.4.3. Similarly, although participants perceived the personalised robot to have a greater learning capacity, indicating a higher level of intelligence (as observed in Section 5.4.2), this aspect was not reflected in the results of the Godspeed Questionnaire. Consequently, there is insufficient evidence to definitively confirm the assertion proposed by  $H_{5.3}$ .

Consequently, the observations suggest that the selection of the memory model utilised by the robot did not significantly influence its perceived likeability and intelligence. This lack of impact could potentially be attributed to the presence of the novelty effect, as indicated by earlier research [131, 181], and the influence of personalisation remains a contentious hypothesis in the domain of Human-Robot interaction [7, 177–180]. Therefore, conducting an extended observation period is crucial to allow for the dissipation of the novelty effect before embarking on a more comprehensive exploration of the robot's intelligence and likeability. Notably, the participant's ability to accurately distinguish the more intelligent robot and the observed increase in learning rate indicates the potential for differences in perceived intelligence over an extended period of interaction.

## 6.3. Value Awareness

The study aimed to investigate the impact of the *Contextualised Value Model* on participants' understanding of their values. This investigation involved testing the hypothesis labelled as  $H_4$ , which proposed that the use of the memory model during conversations would enhance the learners' awareness of values. However, the data gathered during the experiment failed to provide sufficient evidence to support this hypothesis. Consequently, the influence of the Contextualised Value Model on the participants' awareness of values remains inconclusive. Specifically, the participant's ability to recall their interactions with the robot was not notably affected by whether the robot had a complete or incomplete memory model ( $H_{4.3}$ , Section 3.4). Additionally, the presence of a complete memory model did not

seem to influence the participants' reflective processes ( $H_{4.1}$ , Section 3.4). Furthermore, the analysis of the participants' arguments during the conversation did not exhibit significant improvement based on the type of robot they engaged with ( $H_{4.2}$ , Section 3.4). Lastly, the participants did not demonstrate enhanced conflict resolution abilities following their conversations with either robot ( $H_{4.4}$ , Section 3.4).

This suggests that the impact of the *Contextualised Value Model* on participants' awareness of their values has not yet become apparent. This lack of influence could be attributed to the relatively brief duration of the conversation. Typically, cognitive behavioural therapy (CBT) conversations require weekly sessions lasting 30 to 60 minutes, spread over a period of 12 to 20 weeks [49]. This aligns with previous research, such as the study by Berg [8], which observed no noticeable improvement in the achievement of learning objectives over a short experimental period. In contrast, the study conducted by Neerincx *et al.* [34] noted significant improvement over the entire duration of their more extended research, highlighting the importance of prolonged engagement to discern substantial impacts in similar studies.

### 6.3.1. Age Differences

During the experiment, although not originally designed for multiple age groups, it inadvertently included participants from various age ranges, thereby introducing age as a variable in the analysis. Consequently, distinct age-related trends emerged, including the observation that older participants tended to seek more information to make informed decisions about their values. This finding underscores the importance of investigating differences in value awareness based on participants' ages. Utilising the data from Table 5.9, the incorporation of participants' ages as a variable yielded no noteworthy insights. Performing a linear regression on the Argument Scores, no significant differences were found ( $p = .959$ ) between the argument qualities based on the ages of the participants. Thus, while older participants required more information than the robot was able to provide, their answers did not demonstrate higher levels of value awareness compared to the younger participants.

## 6.4. Additional Results

During the study, various results came up that either have little to do with the research questions posed for this study, or that cannot be fully analysed due to the nature and/or quality of the answers. These results are discussed in more detail in this section and what their current trends mean for the contributions made during this research.

### 6.4.1. Video Analysis

As outlined in Section 4, the recording of each participant's facial expressions was intended for subsequent analysis. However, owing to limitations in video quality and excessive noise, these recordings were deemed unsuitable for direct processing using OpenFace. Consequently, due to the time constraints of this thesis, these results were not integrated into the examination of the research questions. Nevertheless, certain discernible trends within the data could potentially be ascertained upon careful analysis of the patterns, the detailed outcomes of which are explicated in Section 5.6.1.

It is currently apparent that there might exist a discernible difference in the expression of the emotion of "joy" when participants engaged with the robot utilising the complete memory. This finding could be attributed to the participants' positive response, perhaps reflecting their satisfaction that the robot was able to recall their previous statements. Conversely, there was no notable difference in the expression of the emotion of "confusion". This could potentially be due to the challenges posed by the low quality of the data or the possibility that participants did not experience a sense of confusion as a result of any incorrect assumptions made by the robot.

### 6.4.2. Feedback Trends

During the interviews, several pieces of feedback were collected, revealing discernible trends upon analysis. Some participants expressed the sentiment that the robot lacked subtlety, often focusing on a single value deemed important, neglecting the potential complexities of multifaceted human values. Another recurrent trend was the perception that the robot directed the conversation towards the participant's values too quickly, leaving some participants desiring a more comprehensive exploration of

all values. Additionally, some participants felt that the interaction resembled more of an interview than an open conversation, with the robot responding inadequately to their queries and primarily driving the conversation with its own questions. These valuable insights from the feedback provide crucial guidance for future research on the development and application of **Contextualised Value Models** in the domain of Human-Robot Interaction, emphasising the need for nuanced understanding, interactive adaptability, and open-ended conversational dynamics to enhance user engagement and satisfaction.

### 6.4.3. Differences between Contexts

During the conversation the agent was building the **Contextualised Value Model**, comparing the different values for each participant the following differences between the contexts can be noticed: all values are significantly different except for Benevolence, which means that each participant is on average equally benevolent. The different contexts often require different values to take front, at school conforming to the rules is often more important compared to social outings. Similarly, the significance of self-direction during social interactions was highlighted, suggesting a shift in priorities based on the particular context, whether at school, at home, or in social settings. The differences in values between contexts support the findings of various other studies, such as McCracken and Yang [182], Steg *et al.* [183], and McNichols and Zimmerer [184].

Moreover, the absence of significant differences shown during the post hoc analysis in certain values warrants attention. Notably, the lack of variance in **Conformity** between *Home* and *Social* contexts implied that the adult participants perceived their relationships with their parents as more equal, a finding supported by the earlier study conducted by De Goede *et al.* [185]. Similarly, the absence of substantial disparities in **Hedonism** between *Home* and *School* contexts could be attributed to the non-hedonistic nature of the tasks involved in these settings. Responsibilities such as household chores at *Home* and academic obligations at *School* tend to prioritise duties over personal gratification, aligning with the concept that a hedonistic lifestyle involves selecting activities based on present moods, as discussed by Taquet *et al.* [186]. Furthermore, the lack of significant distinctions in **Achievement** between *Social* situations and situations at *School* or *Home* may be linked to the participants' reduced need for approval from their peers, viewing them as equals in their adult relationships compared to teachers or parents, as highlighted by De Goede *et al.* [185], another point of view is that the relationship with your friends and family is different towards your teachers, where your friends and family more often support the decisions you make yourself [187], even though you, most often, seek more approval from your family [187]. Lastly, the significant difference for **Benevolence** between *Social* and *School* seems to disagree with current literature and the expected outcome according to the means in Table 5.14. This table shows that **Benevolence** is less important within a *Social* situation than at *School* or *Home*, but the Post-Hoc results in Table 5.15 only show a significant difference between *Social* and *School*. From previous literature, it would have been expected that none of the results would be significant, since they show the significance of displaying benevolent behaviour in all aspects of an individual's daily lives [188].

## 6.5. Validity of Study

To ensure consistency in the experiment, several protocols were implemented and adhered to, with the discussions and potential areas for improvement highlighted in this section for future research considerations.

It was preferred to have one location for the entire experiment. However, due to logistical constraints, not every participant could access the same location. Consequently, three different locations were utilised, each equipped with identical setups as outlined in Section 4.5. While there were differences in the room environment, this variable was disregarded within the experiment since each participant was assigned to only one location.

While participants were instructed to select three days with a similar time interval between sessions, the actual time gap varied among participants. Some individuals had a two-day interval, while others completed the three sessions within three consecutive days. This discrepancy might have influenced participants' responses due to varying levels of memory retention between sessions. To minimise this

impact, efforts were made to maintain consistent time intervals for each participant, despite the lack of uniformity among different participants owing to time constraints.

All participants followed a standardised dialogue structure. In session 1, the dialogue remained consistent across all participants, while sessions 2 and 3 allowed for a more personalised conversation. Although the robot tailored the dialogue based on individual responses, the scenarios and questions were drawn from the same pool for every participant. Notably, peer review and consultation with supervisors were conducted for each scenario, although no formal analysis was conducted to ascertain the uniformity of scenario quality.

While certain technical issues, such as Wi-Fi disconnections and overheating of the robot due to warm weather, were encountered during specific conversations, these incidents were isolated and quickly resolved. Their impact on the overall results appeared negligible, and the participants were minimally inconvenienced.

## 6.6. Limitations & Future Work

For this experiment to work in a timely manner various limitations had to be made to the eventual design. Firstly, the examination was confined to *only* three 15-minute sessions. Given the time constraints, truly understanding an individual within a mere 45 minutes of conversation is challenging. Participants were explicitly informed that the model was based solely on the discussions and not a definitive representation of their values, as constructing a comprehensive representation from mere conversations would require a significantly longer duration. Exploring the effects of the **Contextualised Value Model** during prolonged human-robot interaction over an extended period would be both interesting and important.

Additionally, only 5 out of 10 Schwartz values were discussed during the conversations due to the significant time investment required for discussing all combinations of values. Limiting the discussion to the 5 most prominent values for primary school children (who are the eventual target audience) was a pragmatic choice to ensure the experiment could be completed within a feasible timeframe. Examining the influence of the other 5 values and their potential impact on the model when participants have more options would be a valuable avenue for future research.

Similarly, the discussion was restricted to only 3 broad contexts (Home, Social, School). While these contexts are pertinent for children, they are also abstract and comprehensive. Utilising more detailed contexts could enhance the clarity of the conversation and minimise potential participant assumptions. However, the choice of “only” three contexts was essential for comparing values across different contexts and ensuring the conversation fit within the allocated 15-minute slots for each session.

Further, the experiment involved adults as participants, chosen for ethical considerations, recognising that the ultimate model is intended for children. The decision to conduct the study with adults was practical, due to the ethical difficulties while laying the groundwork for future studies involving the target audience of primary school children. To adapt this work to Dutch primary school children the dialogue has to be changed to provide scenarios tailored to children, as well as lowering the complexity of the conversation and reflection. Although the dialogue was ultimately tailored for students within this demographic, adults were also included as participants. This required them to envision themselves as students during the dialogue.

The most significant limitation lies in the binary nature of the robot's memory model, which considers only the most important values and accounts for only a single choice, which means that when the value preferences give two values as equally important a random choice is made by the robot on which one to discuss. In reality, many scenarios require a combination of multiple values for the best resolution. During this experiment, the robot solely considered each of the 5 values independently, without adequately accounting for combinations of values, to enhance the conversation's clarity and validate the model's functionality. Incorporating the capacity for the agent to comprehend combinations of values and the grey area between them would make the model more realistic.





# Conclusion

This research conducted a comprehensive evaluation of the *Contextualised Value Model*, specifically tailored to Dutch children's values (**Achievement**, **Hedonism**, **Self-Direction**, **Conformity**, and **Benevolence**) and contexts (**Home**, **Social**, and **School**). The model is designed to discern the significance of each value in diverse contexts through *learner choices*, *responses to value-related questions*, and *interrelationships between values* [122]. Three key dimensions were considered: assessing the *Accuracy* of the model, gauging its impact on *Likeability & Intelligence*, and evaluating its influence on participants' *Value Awareness*.

The integration of the memory model in conversations facilitated a personalised and relevant interaction experience, leading to a closer alignment with participants' values (**RQ3**). This study demonstrated the potential of diverse memory implementations to enhance conversation personalisation. Results from the Godspeed questionnaire did not reveal significant differences in participants' perception of the robot's likeability and intelligence based on the choice of the memory model (**RQ3**). The novelty effect during the participants' interactions might have influenced these outcomes, emphasising the need for extended observation to thoroughly evaluate the long-term impact on likeability and intelligence.

The study did not provide substantial evidence to support the hypothesis regarding the impact of the *Contextualised Value Model* on participants' understanding of their values (**RQ4**). Further research is essential to evaluate the long-term impact and develop effective strategies for improving participants' value awareness.

## 7.1. Additional Insights

Supplementary insights included notable trends in facial expression data, age-related differences, and valuable participant feedback. These findings highlight the significance of nuanced context, extended engagement periods, and a comprehensive approach to understanding human values in Human-Robot Interaction.

## 7.2. Future Directions

The study's limitations suggest areas for future research, such as extending the study duration, exploring the complete range of values, incorporating nuanced contextual scenarios, and developing a more sophisticated memory model. The findings lay a robust foundation for investigating the dynamics of human-robot interactions and the cultivation of participants' value awareness.

In conclusion, the *Contextualised Value Model* presents a promising framework for enhancing personalised interactions, holding significant potential in various real-world applications, but the study's findings also underscore the importance of further research in this area. Furthermore, within the broader context of the *ePartners4all* project, this experiment lays the foundation for discussing the values with children, aligning with the project's aim to develop robotic partners that enhance children's health and well-being through engaging conversations on personal well-being.



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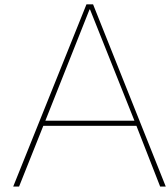
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# **Appendices**







# Dialogue

This Appendix contains both an example script of the dialogue the agent and the child might have, as well as raw data on the different types of scenarios, conflicts, questions, etc. The implementation of the dialogue can be found on GitHub<sup>1</sup>.

## A.1. Session 1

### Introduction

Robot: Hallo, ik ben NAO, wat goed je te ontmoeten. Wat is jouw naam?  
Kind: Hallo NAO, ik ben **Tom**.  
Robot: **Tom** is echt een mooie naam. En, Tom, wat vind jij het leukst om te doen?  
Kind: Ik hou van **Judo**.  
Robot: **Judo** vind ik ook heel leuk. Ik hou zelf heel erg van dansen.  
Robot: Weet jij al een beetje waar wij vandaag over gaan praten?  
Kind: **Nee**, dat weet ik nog niet.  
Robot: Ah, dan heeft iedereen het goed geheim gehouden, ook wel spannend en leuk af en toe. We gaan vandaag wat situaties bespreken die jij waarschijnlijk al wel eerder heb meegemaakt, en dan wil ik graag weten wat je zou doen, want ik weet het altijd niet zo goed. Kan je mij daarmee helpen?  
Kind: **Ja**.  
Robot: Top, ik wist wel dat je mij daarmee zou kunnen helpen.  
Robot: Ik ga jou zo meteen wat dingen vertellen die bij mij allemaal gebeurd zijn vorige week. Dan geef ik voorbeelden van wat je kan doen in die situatie, ik zou graag willen horen welke van die keuzes jij zou doen. Daarna bespreken we de situaties nog wat meer. Zo komen we samen te weten wat jij belangrijk vindt, dit heten ook wel waarden. Volgende keer gaan we samen meer bespreken over waarden.

### Core

Robot: Laten we beginnen met het eerste scenario, beeld je in dat je in een scenario zit over: "**Je heb morgen een tentamen.**"  
Robot: Wat past het meeste bij jou?  
Je heb veel discipline, dus leert, zelfs als je het vak niet leuk vindt.  
Je wilt graag hoge cijfers halen dus gaat zo goed mogelijk leren.  
Je hebt helemaal geen zin om te leren, dus leert zo min mogelijk.  
Je bepaalt het liefst zelf of je leert of niet, dus leert alleen voor leuke vakken.

---

<sup>1</sup>[https://github.com/Tomaati/ePartners\\_Dialogue\\_Design](https://github.com/Tomaati/ePartners_Dialogue_Design)

Je gaat zoveel mogelijk mensen helpen met vragen die ze hebben voor het tentamen, en heb dus minder tijd om te leren.

Robot: Welke keuze lijkt het meest op wat jij zou doen in het scenario over **voorbereiden van een tentamen**.

De eerste: **Discipline**

De tweede: **Zo goed mogelijk leren**

De derde: **Niet leren**

De vierde: **Zelf bepalen**

De vijfde: **Andere helpen**

Kind: Ik zou **Zo goed mogelijk leren**.

Robot: En waarom zou jij ervoor kiezen om **zo goed mogelijk te leren**?

Kind: Omdat **mijn ouders graag willen dat ik goede cijfers haal** en ik vind het belangrijk **om te doen wat mijn ouders zeggen**.

Robot: Wat goed dat je al een idee heb wat je zou doen in dit scenario, laten we snel wat korte vragen beantwoorden.

Robot: **Is dit een scenario waar je veel over kan denken?**

Kind: **Nee**, de keuze is voor mij makkelijk om te maken.

Robot: **Wat goed dat de keuze makkelijk is voor jou, heb jij dit scenario al een keer eerder meegemaakt?**

Kind: **Ja** Robot: Wat een goede antwoorden, ik ga nog eens goed nadenken over wat je zei. Laten we doorgaan naar de volgende. Robot: ***Repeat until all scenarios have been discussed, the scenarios and perspective can be found in Appendix A.1.1***

## Outro

Robot: Zo dat is alles wat ik vandaag met je wilde bespreken. Laten we even kort herhalen wat we vandaag allemaal besproken hebben.

Robot: Wij hebben vandaag wat scenario's besproken, en jij heb mij verteld wat jij zou doen in deze scenario's. Laten we kort nog een scenario herhalen van vandaag.

Robot: In het scenario over: **voorbereiden van een tentamen**. Had je mij verteld dat jij zou kiezen voor **zo goed mogelijk leren**, klopt dit?

Kind: **Ja**.

Robot: Oké top, dan heb ik het goed onthouden. Zou je mij nog kort kunnen vertellen waarom je zou kiezen voor **zo goed mogelijk leren**?

Kind: Omdat **mijn ouders graag willen dat ik goede cijfers haal** en ik vind het belangrijk **om te doen wat mijn ouders zeggen**.

Robot: Bedankt dat je het nog een keer kon uitleggen voor mij, ik denk dat ik nu een goed beeld heb van wat jij belangrijk vind om te doen in bepaalde scenario's. Volgende keer gaan we verder bespreken wat dit betekent, en hoe het je kan helpen met conflicten oplossen.

Robot: Tot volgende keer, **Tom**. Ik vond het leuk met je gesproken te hebben. Ik hoop jij ook en dat je er wat van heb geleerd over jezelf.

### A.1.1. Scenarios & Perspectives

```

1  [
2      {
3          "scenario_id": 1,
4          "scenario_name": "je ouders vragen om hulp",
5          "scenario_text": "Je ouders vragen of je ze met iets kan helpen.",
6          "scenario_context": "thuis",
7          "perspectives": {
8              "Conformiteit": {
9                  "value": "Conformiteit",

```

```

10     "name": "luisteren",
11     "text": "Je luistert naar je ouders en helpt ze metten, het
           zijn ouders."
12 },
13 "Prestatie": {
14     "value": "Prestatie",
15     "name": "helpen met tegenprestatie",
16     "text": "Je helpt je ouders, want misschien krijg je dan wat
           terug."
17 },
18 "Hedonisme": {
19     "value": "Hedonisme",
20     "name": "plezier maken",
21     "text": "Je helpt ze niet, want je heb daar helemaal geen zin in
           . Er zijn veel leukere dingen om te doen."
22 },
23 "Zelfbepaling": {
24     "value": "Zelfbepaling",
25     "name": "zelf bepalen wanneer",
26     "text": "Je bepaalt zelf of je ze wilt helpen of niet, je wil
           graag je eigen plan maken."
27 },
28 "Liefdadigheid": {
29     "value": "Liefdadigheid",
30     "name": "helpen",
31     "text": "Je helpt graag, dus je helpt ook je ouders."
32 }
33 }
34 },
35 {
36     "scenario_id": 2,
37     "scenario_name": "de keuken schoon maken",
38     "scenario_text": "Je huisgenoot vraagt of je eindelijk eens de
           keuken wil schoon maken.",
39     "scenario_context": "thuis",
40     "perspectives": {
41         "Conformiteit": {
42             "value": "Conformiteit",
43             "name": "snel schoon maken",
44             "text": "Je wil niet dat iemand boos wordt, dus maakt het snel
                   schoon."
45         },
46         "Prestatie": {
47             "value": "Prestatie",
48             "name": "grondig schoon maken",
49             "text": "Je wilt dat je huisgenoot trots is dus maakt het zo
                   grondig mogelijk schoon."
50         },
51         "Hedonisme": {
52             "value": "Hedonisme",
53             "name": "niet schoonmaken",
54             "text": "Je heb daar helemaal geen zin in, je maakt het niet
                   schoon of doet het heel snel."
55         },
56         "Zelfbepaling": {
57             "value": "Zelfbepaling",

```

```

58         "name": "zelf bepalen",
59         "text": "Je vind het vervelend dat je iets opgelegd wordt, je
           bepaalt liever zelf wanneer je schoonmaakt."
60     },
61     "Liefdadigheid": {
62         "value": "Liefdadigheid",
63         "name": "verontschuldigen en schoon maken",
64         "text": "Je zegt sorry dat je er eerder geen tijd voor had en
           gaat gelijk aan de slag."
65     }
66 }
67 },
68 {
69     "scenario_id": 3,
70     "scenario_name": "voorbereiden van een tentamen",
71     "scenario_text": "Je heb morgen een tentamen.",
72     "scenario_context": "school",
73     "perspectives": {
74         "Conformiteit": {
75             "value": "Conformiteit",
76             "name": "discipline",
77             "text": "Je heb veel discipline, dus leert, zelfs als je het vak
           niet leuk vind."
78         },
79         "Prestatie": {
80             "value": "Prestatie",
81             "name": "zo goed mogelijk leren",
82             "text": "Je wilt graag hoge cijfers halen dus gaat zo goed
           mogelijk leren."
83         },
84         "Hedonisme": {
85             "value": "Hedonisme",
86             "name": "niet leren",
87             "text": "Je hebt helemaal geen zin om te leren, dus leert zo min
           mogelijk."
88         },
89         "Zelfbepaling": {
90             "value": "Zelfbepaling",
91             "name": "zelf bepalen",
92             "text": "Je leert alleen goed als je dat zelf wil, bijvoorbeeld
           bij leuke vakken."
93         },
94         "Liefdadigheid": {
95             "value": "Liefdadigheid",
96             "name": "andere helpen",
97             "text": "Je gaat zoveel mogelijk mensen helpen met vragen die ze
           hebben over het tentamen."
98         }
99     }
100 },
101 {
102     "scenario_id": 4,
103     "scenario_name": "een deadline",
104     "scenario_text": "Je heb een grote deadline met een groep over een
           maand.",
105     "scenario_context": "school",

```

```

106     "perspectives": {
107         "Conformiteit": {
108             "value": "Conformiteit",
109             "name": "doen wat groep wilt",
110             "text": "Je luistert naar wat de groep wil dat je doet, en doet
                  alleen dat."
111         },
112         "Prestatie": {
113             "value": "Prestatie",
114             "name": "zo snel mogelijk beginnen",
115             "text": "Je wilt graag een hoog cijfer, dus je begint zo snel
                  mogelijk aan het project."
116         },
117         "Hedonisme": {
118             "value": "Hedonisme",
119             "name": "uitstellen",
120             "text": "Je stelt het allemaal zo lang mogelijk uit, want je heb
                  er geen zin in."
121         },
122         "Zelfbepaling": {
123             "value": "Zelfbepaling",
124             "name": "zelf bepalen",
125             "text": "Je kiest zelf wat je wil doen en wanneer je daaraan
                  begint, je werkt eigenlijk liever alleen."
126         },
127         "Liefdadigheid": {
128             "value": "Liefdadigheid",
129             "name": "andere helpen",
130             "text": "Je doet je eigen taken, en helpt alle andere uit je
                  groep met hun taken als het niet lukt."
131         }
132     }
133 },
134 {
135     "scenario_id": 5,
136     "scenario_name": "uitgaan",
137     "scenario_text": "Je vrienden vragen of je mee uitgaat.",
138     "scenario_context": "sociaal",
139     "perspectives": {
140         "Conformiteit": {
141             "value": "Conformiteit",
142             "name": "meegaan met de groep",
143             "text": "Je wilt graag bij de groep horen, dus gaat mee, ook als
                  je eigenlijk geen zin heb."
144         },
145         "Prestatie": {
146             "value": "Prestatie",
147             "name": "huiswerk en sporten",
148             "text": "Je heb eigenlijk altijd wel huiswerk te doen of een
                  sportwedstrijd waar je mee moet doen dus je blijft thuis."
149         },
150         "Hedonisme": {
151             "value": "Hedonisme",
152             "name": "meegaan",
153             "text": "Je heb altijd zin om uit te gaan, dus natuurlijk ga je
                  mee."

```

```

154     },
155     "Zelfbepaling": {
156         "value": "Zelfbepaling",
157         "name": "zelf bepalen",
158         "text": "Je kijkt eerst of je nog andere dingen moet doen, en zo
                niet bepaal je zelf of je zin heb of liever thuis blijft."
159     },
160     "Liefdadigheid": {
161         "value": "Liefdadigheid",
162         "name": "verantwoordelijkheden nakomen",
163         "text": "Je kijkt eerst of je morgen ochtend wat te doen heb, zo
                niet ga je mee. Maar je wil niet werk missen omdat je
                uitgaat."
164     }
165 }
166 },
167 {
168     "scenario_id": 6,
169     "scenario_name": "bij een student vereniging",
170     "scenario_text": "Je vrienden sluiten zich aan bij een student
                vereniging.",
171     "scenario_context": "sociaal",
172     "perspectives": {
173         "Conformiteit": {
174             "value": "Conformiteit",
175             "name": "erbij horen",
176             "text": "Je wilt graag bij je vrienden blijven, dus gaat bij
                dezelfde vereniging."
177         },
178         "Prestatie": {
179             "value": "Prestatie",
180             "name": "liever studeren",
181             "text": "Je wilt graag goede cijfers halen, en wilt niet
                afgeleid raken door een vereniging."
182         },
183         "Hedonisme": {
184             "value": "Hedonisme",
185             "name": "bij een vereniging",
186             "text": "Je wilt graag plezier maken en wilde al bij een
                vereniging, dat je vrienden erbij zitten is een bonus."
187         },
188         "Zelfbepaling": {
189             "value": "Zelfbepaling",
190             "name": "zelf bepalen",
191             "text": "Je kiest zelf of je bij die vereniging wilt, een andere
                of geen, dat je vrienden erbij gaan is niet een reden."
192         },
193         "Liefdadigheid": {
194             "value": "Liefdadigheid",
195             "name": "verantwoordelijkheden bekijken",
196             "text": "Je heb nog veel andere verantwoordelijkheden en bent
                bang dat je die niet kan nakomen als je lid wordt, dus je
                gaat niet bij een vereniging."
197         }
198     }
199 }

```

## A.2. Session 2

### Introduction

Robot: Welkom terug, **Tom**, wat goed je weer te zien! Ik heb afgelopen week gedanst, heb jij nog **Judo** gedaan?

Kind: Hallo, NAO, **ja** ik heb nog judo gedaan.

Robot: Wat gaaf zeg! Laten we snel beginnen met ons gesprek, we hebben veel te bespreken.

Robot: Vorige keer hebben wij scenario's besproken over verschillende onderwerpen, heb jij hier thuis nog een keer over nagedacht?

Kind: **Nee.**

Robot: Dat geeft niet, misschien volgende keer, je kan er namelijk veel van leren.

Robot: Aan de hand van deze scenario's hadden we vorige keer gepraat over wat jij zou doen, en waarom.

Robot: Zou jij mij nog een keer kunnen vertellen wat je zou doen in ...?

Kind:

Robot: Top, dankjewel dat je het nog een keer kon uitleggen voor mij, laten we snel doorgaan met wat ik vandaag gepland had om te bespreken.

Robot: Na de scenario's van vorige keer heb ik een beetje een beeld van wat jij belangrijk vindt. Maar om dat nog wat aan te scherpen wil ik graag dat jij mij helpt met nog wat meer keuzes maken. Na het maken van deze keuzes praten we nog wat meer over wat jij belangrijk vindt, en hoe dat invloed heeft op bepaalde keuzes. Volgende keer gaan wij dan wat meer praten over waarom je de keuzes maakt, wat voor invloed waardes hebben op je gedrag, en hoe je de waardes van andere kan meenemen. In de hoop dat het voor jou makkelijker wordt om bepaalde keuzes te maken.

### Core

Robot: Je heb misschien zelf al gemerkt dat alle dingen die we vorige week besproken hebben een bepaald thema hebben, namelijk: School, thuis, en sociaal.

**Start Core Loop; loop through every context and discuss relevant conflicts.**

Robot: Als we het hebben over **school** blijkt het dat jij **liefdadigheid** het belangrijkste vindt, dit betekent dat jij **graag mensen helpt en voor andere mensen zal zorgen**. Klopt dit?

Kind: **Ja**, dat vind ik inderdaad belangrijk.

Robot: Maar dit kan niet altijd, soms moet je keuzes maken tussen wat je zelf belangrijk vindt en wat iemand anders belangrijk vindt. Dit noemen we ook wel conflicten tussen waarden. Laten we er eens een paar bespreken.

Robot: Een mogelijk conflict kan zijn kiezen tussen **zelf leren of helpen**. Stel je eens voor dat je in het volgende scenario zit: **Je heb een moeilijk tentamen morgen, dus je moet zelf veel leren, maar je vrienden snappen er niks van en vragen om hulp**. Dit beschrijft een mogelijk conflict tussen **Prestatie (zelf leren)** en **Liefdadigheid (andere helpen)**. Zou jij kiezen voor **zelf leren** of **andere helpen**?

Kind: Ik zou **andere helpen**.

Robot: Waarom zou jij kiezen voor **andere helpen**?

Kind: Omdat ik **ook wat leer als ik andere mensen dingen uitleg en dan halen mijn vrienden ook goede cijfers**.

Robot: Wat denk jij dat de persoon zou vinden die **zelf leren** belangrijk vindt?

Kind: Ik denk dat diegene alleen **om zijn eigen cijfers geeft**.

**Continue until all contexts & enough conflicts are discussed.**

Robot: Zo, we hebben nu een hoop conflicten besproken, en ik denk dat ik wel een goed beeld heb van wat jij belangrijk vind. Laten we hier nog wat meer over praten.

## Outro

Robot: Zo, dat was alles wat ik vandaag met jou wilde bespreken, laten we even kort alles herhalen wat we besproken hebben.

Robot: We zijn samen begonnen met wat dieper ingaan op de verschillende thema's en welke waardes daarbij belangrijk zijn voor jou. Daarna hebben we kort wat conflicten besproken zodat ik een beter beeld heb van wat jij allemaal belangrijk vind.

Robot: In een **thuis** bijvoorbeeld, vond jij **liefdadigheid** heel belangrijk. Klopt dat?

Kind: **Ja**, dat klopt.

Robot: **Gelukkig maar, dan heb ik het goed onthouden.** Hierna hadden we elke thema en waarde kort besproken.

Robot: Volgende keer gaan wij wat meer praten over wat deze waardes zijn, wat voor invloed waardes hebben op je gedrag, en hoe je kan bepalen of jouw keuze wel slim is voor de andere. In de hoop dat het voor jou makkelijker wordt om bepaalde keuzes te maken.

## A.2.1. Conflicts

```

1  "school": [
2      {
3          "conflict_id": 1,
4          "conflict_name": "Zelf maken of antwoorden vragen",
5          "conflict_context": "school",
6          "conflict_text": "Je snapt niks van de opdracht die morgen af moet
          voor een deel van je cijfer, maar je vrienden hebben het
          allemaal wel af.",
7          "conflict_values": [
8              "Conformiteit",
9              "Prestatie"
10         ]
11     },
12     {
13         "conflict_id": 2,
14         "conflict_name": "stil zijn of doorpraten",
15         "conflict_context": "school",
16         "conflict_text": "De docent vraagt om stilte tijdens de uitleg,
          maar jij bent gister bij een festival geweest en je vrienden
          willen erover weten.",
17         "conflict_values": [
18             "Conformiteit",
19             "Hedonisme"
20         ]
21     },
22     {
23         "conflict_id": 3,
24         "conflict_name": "doen wat team zegt of zelf bepalen",
25         "conflict_context": "school",
26         "conflict_text": "Je werkt samen in een team, en ze vragen of jij
          iets wil doen waar je geen zin in heb.",
27         "conflict_values": [
28             "Conformiteit",

```



```

29         "Zelfbepaling"
30     ]
31 },
32 {
33     "conflict_id": 4,
34     "conflict_name": "zelf laten maken of antwoorden geven",
35     "conflict_context": "school",
36     "conflict_text": "Je beste vriend vraagt tijdens een toets of je
        hem de antwoorden kan doorgeven.",
37     "conflict_values": [
38         "Conformiteit",
39         "Liefdadigheid"
40     ]
41 },
42 {
43     "conflict_id": 5,
44     "conflict_name": "leren of feesten",
45     "conflict_context": "school",
46     "conflict_text": "Je heb morgen een tentamen, maar al je vrienden
        gaan de avond ervoor uit.",
47     "conflict_values": [
48         "Prestatie",
49         "Hedonisme"
50     ]
51 },
52 {
53     "conflict_id": 6,
54     "conflict_name": "geholpen worden of zelf leren",
55     "conflict_context": "school",
56     "conflict_text": "Je heb een moeilijk vak maar iemand kan je
        bijles geven voor het tentamen.",
57     "conflict_values": [
58         "Prestatie",
59         "Zelfbepaling"
60     ]
61 },
62 {
63     "conflict_id": 7,
64     "conflict_name": "zelf leren of helpen",
65     "conflict_context": "school",
66     "conflict_text": "Je heb een moeilijk tentamen morgen, dus je moet
        zelf veel leren, maar je vrienden snappen er niks van en
        vragen om hulp.",
67     "conflict_values": [
68         "Prestatie",
69         "Liefdadigheid"
70     ]
71 },
72 {
73     "conflict_id": 9,
74     "conflict_name": "andere afleiden of stil blijven voor de groep",
75     "conflict_context": "school",
76     "conflict_text": "Je bent met je vrienden aan het leren voor een
        tentamen, maar je weet al zeker dat dit tentamen voor jou niet
        gaat lukken.",
77     "conflict_values": [

```

```

78         "Hedonsime",
79         "Liefdadigheid"
80     ]
81 },
82 {
83     "conflict_id": 10,
84     "conflict_name": "zelf leren of andere helpen met leren",
85     "conflict_context": "school",
86     "conflict_text": "Je vrienden vragen of je mee komt leren, maar je
                        kent alles al.",
87     "conflict_values": [
88         "Zelfbepaling",
89         "Liefdadigheid"
90     ]
91 }
92 ],
93 "thuis": [
94     {
95         "conflict_id": 1,
96         "conflict_name": "luisteren naar je ouders of universiteit",
97         "conflict_context": "thuis",
98         "conflict_text": "Jij wilt graag naar de universiteit toe, want je
                        wil zo slim mogelijk worden. Maar je ouders denken dat dat
                        niet zo slim is.",
99         "conflict_values": [
100             "Conformiteit",
101             "Prestatie"
102         ]
103     },
104     {
105         "conflict_id": 2,
106         "conflict_name": "stil blijven of geluid maken",
107         "conflict_context": "thuis",
108         "conflict_text": "Je huisgenoten vragen of het stil kan blijven
                        omdat ze een tentamen hebben de volgende dag.",
109         "conflict_values": [
110             "Conformiteit",
111             "Hedonisme"
112         ]
113     },
114     {
115         "conflict_id": 3,
116         "conflict_name": "huiseten of niet mee-eten",
117         "conflict_context": "thuis",
118         "conflict_text": "Je heb vandaag huiseten maar je heb totaal geen
                        zin.",
119         "conflict_values": [
120             "Conformiteit",
121             "Zelfbepaling"
122         ]
123     },
124     {
125         "conflict_id": 4,
126         "conflict_name": "luisteren naar ouders of vegan worden",
127         "conflict_context": "thuis",
128         "conflict_text": "Je ouders houden niet van vegans en maken altijd

```

```

        grappen over ze, maar jij wilt graag vegan worden omdat je het
        zielig vind voor de dieren.",
129     "conflict_values": [
130         "Conformiteit",
131         "Liefdadigheid"
132     ],
133 },
134 {
135     "conflict_id": 5,
136     "conflict_name": "leerzame boeken of verhaal boeken",
137     "conflict_context": "thuis",
138     "conflict_text": "Je moet van je ouders meer boeken lezen.",
139     "conflict_values": [
140         "Prestatie",
141         "Hedonisme"
142     ],
143 },
144 {
145     "conflict_id": 6,
146     "conflict_name": "uitgebreid koken zodat andere trots worden of
        zelf bepalen wat je maakt",
147     "conflict_context": "thuis",
148     "conflict_text": "Je moet het eten verzorgen thuis.",
149     "conflict_values": [
150         "Prestatie",
151         "Zelfbepaling"
152     ],
153 },
154 {
155     "conflict_id": 7,
156     "conflict_name": "normaal spelen of laten winnen",
157     "conflict_context": "thuis",
158     "conflict_text": "Je speelt een spelletje met je kleine broertje,
        hij is niet zo goed.",
159     "conflict_values": [
160         "Prestatie",
161         "Liefdadigheid"
162     ],
163 },
164 {
165     "conflict_id": 9,
166     "conflict_name": "helpen met opruimen of bier drinken",
167     "conflict_context": "thuis",
168     "conflict_text": "Je huisgenoot is bezig met de tafel opruimen,
        maar jij heb nog wat bier over.",
169     "conflict_values": [
170         "Hedonisme",
171         "Liefdadigheid"
172     ],
173 },
174 {
175     "conflict_id": 10,
176     "conflict_name": "film kijken of helpen",
177     "conflict_context": "thuis",
178     "conflict_text": "Je huisgenoot vraagt of jij even wil helpen met
        wat spullen verhuizen, maar je stond net op het punt een film

```

```

        te kijken.",
179     "conflict_values": [
180         "Zelfbepaling",
181         "Liefdadigheid"
182     ]
183 }
184 ],
185 "sociaal": [
186     {
187         "conflict_id": 1,
188         "conflict_name": "vakantie vieren of leren",
189         "conflict_context": "sociaal",
190         "conflict_text": "Je bent met je vrienden op vakantie, maar heb de
            dag nadat je terugkomt een toets.",
191         "conflict_values": [
192             "Conformiteit",
193             "Prestatie"
194         ]
195     },
196     {
197         "conflict_id": 2,
198         "conflict_name": "meedoen of klieren",
199         "conflict_context": "sociaal",
200         "conflict_text": "Je bent met je vrienden in een museum terwijl je
            dat eigenlijk niet leuk vind.",
201         "conflict_values": [
202             "Conformiteit",
203             "Hedonisme"
204         ]
205     },
206     {
207         "conflict_id": 3,
208         "conflict_name": "meegaan of zelf bepalen",
209         "conflict_context": "sociaal",
210         "conflict_text": "Je bent met je vrienden en zij zeggen dat jullie
            vandaag naar het strand gaan, maar je houdt niet van het strand
            .",
211         "conflict_values": [
212             "Conformiteit",
213             "Zelfbepaling"
214         ]
215     },
216     {
217         "conflict_id": 4,
218         "conflict_name": "doorgaan met vrienden of helpen",
219         "conflict_context": "sociaal",
220         "conflict_text": "Iemand vraagt op straat om je hulp, maar je
            vrienden lopen al door.",
221         "conflict_values": [
222             "Conformiteit",
223             "Liefdadigheid"
224         ]
225     },
226     {
227         "conflict_id": 5,
228         "conflict_name": "sporten of feesten",

```

```

229     "conflict_context": "sociaal",
230     "conflict_text": "Je heb een belangrijke sportwedstrijd, maar
        tegelijk is er ook een leuk feest in de stad.",
231     "conflict_values": [
232         "Prestatie",
233         "Hedonisme"
234     ]
235 },
236 {
237     "conflict_id": 6,
238     "conflict_name": "meer trainen of zelf bepalen",
239     "conflict_context": "sociaal",
240     "conflict_text": "Je trainer zegt dat om mee te blijven doen in de
        selectie je meer moet gaan trainen.",
241     "conflict_values": [
242         "Prestatie",
243         "Zelfbepaling"
244     ]
245 },
246 {
247     "conflict_id": 7,
248     "conflict_name": "sporten of diploma uitreiking",
249     "conflict_context": "sociaal",
250     "conflict_text": "Je heb een belangrijke sportwedstrijd, maar je
        zusje heeft tegelijk haar diploma uitreiking.",
251     "conflict_values": [
252         "Prestatie",
253         "Liefdadigheid"
254     ]
255 },
256 {
257     "conflict_id": 9,
258     "conflict_name": "feestje vriendin of verjaardag oma",
259     "conflict_context": "sociaal",
260     "conflict_text": "Je heb een feestje bij je beste vriendin maar
        tegelijk is je oma ook jarig.",
261     "conflict_values": [
262         "Hedonsime",
263         "Liefdadigheid"
264     ]
265 },
266 {
267     "conflict_id": 10,
268     "conflict_name": "geheim vertellen of geheimhouden",
269     "conflict_context": "sociaal",
270     "conflict_text": "Een vriend heeft een geheim verteld over iemand
        anders.",
271     "conflict_values": [
272         "Zelfbepaling",
273         "Liefdadidheid"
274     ]
275 }
276 ]

```

### A.2.2. Context Based Value Dialogue

```

1  "school": {
2      "conformiteit": [
3          "Je houd je graag aan de regels op school, waarom vind je dit
           belangrijk?",
4          "Vind je het vervelend als andere mensen zich niet aan de regels
           houden? Waarom?",
5          "Vind je dan ook lastig om zelf dingen te bepalen?"
6      ],
7      "prestatie": [
8          "Waarom vind je het belangrijk om goede cijfers te halen op school
           ?",
9          "En wat vinden je ouders van presteren op school? Is dat voor hun
           ook belangrijk?",
10         "Wat is jouw favoriete vak, en wat wil je later worden en waarom?"
11     ],
12     "hedonisme": [
13         "Op school vind jij het belangrijk om plezier te maken, wat vind
           je dan het leukst om te doen op school?",
14         "Waarom vind jij het belangrijk om plezier te maken op school?",
15         "Raken je klasgenoten weleens afgeleid van jou? Wat vind jij ervan
           en hoe denk je dat zij denken over jou?"
16     ],
17     "zelfbepaling": [
18         "Ik begrijp dat je het belangrijk vindt om dingen zelf te kunnen
           bepalen op school. Wat doe je het liefste op school?",
19         "En wat doe je dan als je alle leuke vakken al gedaan hebt en nog
           alleen maar de stomme vakken over hebt?",
20         "Wat vind je ervan als iemand tegen je zegt wat je moet doen?"
21     ],
22     "liefdadigheid": [
23         "Anderen helpen op school vind je belangrijk. Wat vind je het
           leukst aan het helpen van je klasgenoten?",
24         "Verwacht jij wat terug als je klasgenoten helpt met schoolwerk?",
25         "Wat denk jij dat andere mensen ervan vinden van dat jij ze helpt
           ?"
26     ]
27 },
28 "thuis": {
29     "conformiteit": [
30         "Ik begrijp dat jij het belangrijk vindt om te luisteren naar
           andere. Maar wat vind je er dan van als je iets moet doen wat
           je eigenlijk niet wil doen?",
31         "En als je echt iets niet wil en 'nee moet zeggen, hoe voelt dat
           voor jou?",
32         "Wat vind jij ervan als je zelf moet kiezen wat je doet?"
33     ],
34     "prestatie": [
35         "Goed presteren is belangrijk voor jou, ook thuis. Wat vind je
           ervan als je iets moet doen waar je niets voor terug krijgt?",
36         "Wat vind jij ervan als je je ouders moet helpen en dus niet kan
           leren voor je toets?",
37         "Wat vertel jij tegen je ouders als je een laag cijfer hebt gehad
           of iets niet goed ging? En hoe voel je je dan?"
38     ],
39     "hedonisme": [
40         "Jij vindt plezier maken erg belangrijk, maar wat vind je ervan

```

```

    als je thuis iets vervelends moet doen?",
41    "Waarom is plezier maken zo belangrijk voor je? Kies jij altijd
        voor leuke dingen doen?",
42    "Wat doe je als je huiswerk moet maken, maar eigenlijk liever wil
        chillen met je vrienden?"
43 ],
44 "zelfbepaling": [
45     "Als je het belangrijk vindt om zelf te kiezen wat je moet doen,
        wat vind jij ervan als je ouders zeggen dat je iets moet doen?"
46     ,
47     "Kies jij altijd voor leuke dingen doen? Wat vind jij het leukst
        om te doen thuis?",
48     "Ben jij het liefst alleen of met vrienden? Waarom?"
49 ],
50 "liefdadigheid": [
51     "Jij geeft aan het belangrijk te vinden om thuis te helpen.
        Verwacht je ook iets terug als je wat voor een ander doet?",
52     "Waarom vind je het zo belangrijk om thuis te helpen?",
53     "Wat vind je het stomste klusje om mee te helpen? En wat het
        leukste?"
54 ],
55 "sociaal": {
56     "conformiteit": [
57         "Jij geeft aan het belangrijk te vinden om mee te gaan in een
            groep. Wat doe jij als de groep iets wil doen wat jij niet wilt
            ?",
58         "Waarom is het voor jou zo belangrijk om te doen wat oudere mensen
            van je vragen?",
59         "Wat zou je doen als je zelf zou mogen bepalen wat je zou gaan
            doen?"
60     ],
61     "prestatie": [
62         "Ik begrijp dat je goed presteren belangrijk vindt, maar hoe is
            het dan voor jou als je beste vriend ergens beter in is dan jij
            ?",
63         "Wat vind je de leukste sport om te doen? Ben je daar ook goed in
            ?",
64         "Hoe reageer jij als je een sportwedstrijd verliest?"
65     ],
66     "hedonisme": [
67         "Plezier maken is belangrijk voor jou, maar wat als je vrienden
            geen zin hebben om wat leuk te doen? Wat doe je dan?",
68         "Wat vind je ervan als je minder leuke dingen moet doen, zoals
            samen met een vriend werken aan een deadline?",
69         "Wat vind jij het leukst om te doen samen met je vrienden?"
70     ],
71     "zelfbepaling": [
72         "Jij geeft aan het belangrijk te vinden om zelf te kunnen bepalen
            wat je gaat doen met je vrienden, maar wat als je ergens mee
            naartoe moet waar je eigenlijk geen zin in hebt?",
73         "Ben jij altijd degene die kiest wat je met je vrienden gaat doen?
            En wat kies je dan het liefst?",
74         "Wat vind je ervan als iemand tegen je zegt wat je moet doen?"
75     ],
76     "liefdadigheid": [

```

```

77      "Ik begrijp dat je het belangrijk vindt om dingen voor anderen te
        doen. Help je dan ook altijd met bijvoorbeeld het inruimen van
        de vaatwasser bij je vrienden?",
78      "Probeer je altijd anderen te helpen, ook als je iets eigenlijk
        niet wil doen?",
79      "Wat vind je het leukst aan mensen helpen? En wat het minst leukst
        ?"
80    ]
81  }

```

### A.3. Session 3

#### Introduction

Robot: Welkom terug, **Tom**, wat goed je weer te zien!

Kind: Hallo, NAO, **ja** ik heb nog judo gedaan.

Robot: Vorige keer hebben wij een hoop dingen besproken, verschillende situaties en conflicten zijn aan bod gekomen, en we hebben ook gekeken naar wat dat betekend voor je gedrag. Vandaag gaan wij meer praten over de waardes die jij belangrijk vind.

Robot: Door onze vorige gesprekken denk ik dat jij Liefdadigheid en conformiteit belangrijk vind, klopt dat?

Kind: **Ja**.

Robot: Gelukkig maar, dan heb ik het goed begrepen en onthouden.

Robot: Wat dit betekend gaan we vandaag bespreken, we gaan ook bespreken hoe deze waardes je gedrag beïnvloeden en hoe je waardes van andere mensen kan gebruiken om keuzes te maken.

Robot: Voor we beginnen, in een thuis context, blijkt het dat jij liefdadigheid belangrijk vind. Zou je mij kort kunnen uitleggen wat jij denkt dat liefdadigheid betekend?

Kind: Dat je graag mensen wilt helpen.

Robot: Wat een goed antwoord, liefdadigheid betekend dat je altijd andere mensen wilt helpen, zonder dat je daar iets voor terug krijgt. Je bent een goede vriend en altijd eerlijk naar andere.

#### Core

Robot: Zoals blijkt uit onze vorige gesprekken hebben verschillende mensen verschillende waardes in verschillende situaties of conflicten. Door deze verschillen in waardes zal iedereen dus andere dingen doen in bepaalde situaties. Hieruit kunnen we opmerken dat waardes beïnvloeden wat jij zou doen in bepaalde situaties, het beïnvloed je gedrag. Kan je mij eens kort uitleggen wat de waarde Conformiteit voor jou betekend?

Kind: Dat je je aanpast aan de situatie waarin je bent.

Robot: Wat goed dat je al een beetje een idee heb. Conformiteit betekend dat je meegaat met wat andere zeggen, en ervoor zorgt dat je je aanpast aan de groep of situatie waarin je je bevindt. Je belangrijkste waardes zijn nu besproken, laten we nog eens kijken naar de andere waardes die aan bod zijn gekomen: Prestatie betekend dat je graag dingen wilt bereiken in je leven en graag persoonlijk succes wilt, hedonisme betekend dat je graag zo veel mogelijk plezier hebt en graag van het leven geniet en zelfbepaling betekend dat je graag je eigen plan maakt en liever niet luistert naar wat andere mensen zeggen. Nu we een beetje een idee hebben van wat de waardes nou eigenlijk betekenen, wil ik wat meer kijken naar je belangrijkste waardes. Laten we beginnen met kijken naar hoe consistent je bent met je waardes tussen elke context.

Robot: In thuis en sociale situaties vind je liefdadigheid het belangrijkste, maar op school conformiteit. Klopt dat idee een beetje?



Kind: Jahoor.

Robot: Heeft dit te maken met de verschillende situaties?

Kind: Ja, op school luister ik altijd naar de docent, maar met vrienden en thuis wil ik altijd andere helpen.

Robot: Waarom denk jij dat de context voor jou zo belangrijk is?

Kind: Elke situatie vraagt een eigen inkijk, soms moet je je aan de regels houden en soms wil je aardig zijn voor andere.

Robot: Dank je wel voor het antwoorden van mijn vragen, laten we nu eens kijken naar je waardes binnen een context.

Robot: Binnen een school context vind je meerdere waardes belangrijk, namelijk conformiteit en prestatie. Waarom denk jij dat je binnen een school situatie kiest voor verschillende waardes?

Kind: Omdat ik graag een hoog cijfer wil halen maar me ook aan de regels wil houden.

Robot: Kan je in eigen woorden uitleggen wat jij het aller belangrijkste vind in een school situatie?

Kind: Ik wil graag hoge cijfers halen, maar ook vriendelijk zijn naar andere en de docenten.

Robot: Denk jij dat keuzes moeilijk zijn omdat je meerdere waardes belangrijk vind? En waarom?

Kind: Ik denk het niet, je maakt altijd een afweging tussen meerdere waardes.

Robot: Nu dat we een duidelijk beeld hebben van welke waardes jij belangrijk vind, en waarom. Laten we kijken naar wat andere misschien vinden van jouw waardes, en wat jij vind van de waardes van andere mensen. Dit noemen we ook wel 'Theory of Mind'. Het betekent dat jij begrijpt dat jou waardes anders zijn dan de waardes van andere mensen. Laten we beginnen met een voorbeeld van een conflict. Je huisgenoot vraagt of je kan helpen met de tafel afruimen, maar jij heb nog wat bier over. Zou jij eerst je bier opdrinken of eerst helpen met opruimen?

Kind: Ik zou helpen met opruimen.

Robot: Jij vind helpen opruimen belangrijk, maar wat zou er gebeuren als je bier opdrinken zou doen in zelfde situatie?

Kind: Dan zou mijn huisgenoot misschien boos worden.

Robot: Wat vind jij van mensen die zouden kiezen voor bier opdrinken?

Kind: Die vind ik lui.

Robot: Wat als jij eerst bier zou drinken, hoe zou jij het vinden als iemand zou helpen met opruimen?

Kind: Dat zou ik alleen maar goed vinden.

Robot: Bedankt voor het helpen met dit conflict. Laten we nog snel kijken naar een eerder besproken situatie. Beeld je de volgende situatie in, je heb morgen een tentamen. Jij had toen gekozen voor: zo goed mogelijk leren, met als waarde prestatie, en de volgende reden: ik wil graag hoge cijfers halen. Wat denk jij dat iemand zou doen die hedonisme belangrijk vind?

Kind: Die zou waarschijnlijk niet leren en gewoon wat leuks gaan doen.

Robot: En wat zou je vinden van iemand die eerst iedereen zou helpen en dan zelf leren?

Kind: Ik zou dat niet zo slim vinden, dan heb je misschien zelf te weinig tijd om te leren.

Robot: Wat denk je dat je oma zou doen?

Kind: Die vond school niet leuk, dus zou niet gaan leren.

Robot: We hebben nu wat conflicten en situaties besproken om te kijken wat andere mensen zouden doen in dezelfde situaties. Zo zie je dat iedereen verschillende dingen belangrijk vind, en dus verschillende waardes heeft. Dit betekend dus dat het handig is als je keuzes gaat maken om mee te nemen wat andere mensen belangrijk vinden.

## Outro

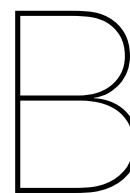
Robot: Zo, dat was alles wat ik vandaag met jou wilde bespreken, laten we het even kort afronden. Vandaag hebben wij besproken wat elke waarde betekent, hoe consistent jij bent, en hoe je de waarden van andere mensen mee kan nemen om keuzes te maken. Ik hoop dat jij na dit gesprek veel geleerd heb over jouw waarden en wat dat betekent voor je gedrag. Ik vond het leuk de laatste paar dagen met jou gesproken te hebben Tom, Hopelijk heb jij veel geleerd na ons gesprek. Hopelijk spreken we elkaar ooit weer. Tot ziens!

### A.3.1. Socratic Questions

```

1  "clarification": [
2      "Kan je eens een voorbeeld geven waarom je <PLACEHOLDER_VALUE>
        belangrijk vindt?",
3      "Zou je opnieuw kunnen vertellen waarom je <PLACEHOLDER_VALUE>
        belangrijk vindt?",
4      "Wat bedoel je precies als je denkt aan dat je <PLACEHOLDER_VALUE>
        belangrijk vindt?",
5      "Waarom denk jij dat dat zo is?"
6  ],
7  "assumption": [
8      "Begrijp ik goed dat <PLACEHOLDER_VALUE> een belangrijke waarde is
        voor jou?",
9      "Wat kunnen we ophalen uit het feit dat <PLACEHOLDER_VALUE> belangrijk
        is voor jou?",
10     "Waarom zou iemand <PLACEHOLDER_VALUE> belangrijk vinden?"
11 ],
12 "reason_evidence": [
13     "Geef eens een voorbeeld wat iemand die <PLACEHOLDER_VALUE> belangrijk
        vind zou doen?",
14     "Waarom vind jij <PLACEHOLDER_VALUE> belangrijk?",
15     "Twijfel jij weleens of je <PLACEHOLDER_VALUE> wel belangrijk vindt?
        Waarom?"
16 ],
17 "origin_source": [
18     "Vond jij <PLACEHOLDER_VALUE> altijd al belangrijk?",
19     "Heeft iets of iemand jouw mening over <PLACEHOLDER_VALUE> beïnvloed?"
20     ,
21     "Wie of wat heeft ervoor gezorgd dat jij <PLACEHOLDER_VALUE> zo
        belangrijk vindt? En waarom?"
22 ],
23 "implication_consequence": [
24     "Wat effect heeft het dat jij <PLACEHOLDER_VALUE> belangrijk vindt?",
25     "Wat zou een alternatief kunnen zijn om te doen in een <
        PLACEHOLDER_CONTEXT> context, als je <PLACEHOLDER_VALUE> niet
        belangrijk vindt?",
26     "Wat bedoel je precies als je <PLACEHOLDER_VALUE> belangrijk vindt?"
27 ],
28 "viewpoint": [
29     "Zou jij kunnen uitleggen wat <PLACEHOLDER_VALUE> voor jou betekend?",
30     "Wat denk je dat je ouders of broertje of zusje hiervan vinden?",
31     "Wat zou er gebeuren als iemand een andere value kiest zoals <
        PLACEHOLDER_OPPOSINGVALUE>?"
32 ]

```



# Self-Efficacy Questionnaire

## Dutch General Self-Efficacy Scale

### Toelichting

Hieronder volgen 10 stellingen over hoe u in het algemeen denkt en doet.

Zou u aan willen geven in hoeverre u het oneens of eens bent met deze stellingen.

Wilt u daartoe voor alle stellingen het antwoord aankruisen dat OP DIT MOMENT op u het meest van toepassing is.

		volledig onjuist	nauwelijks juist	enigszins juist	volledig juist
1	Het lukt me altijd moeilijke problemen op te lossen, als ik er genoeg moeite voor doe.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Als iemand mij tegenwerkt, vind ik toch manieren om te krijgen wat ik wil.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Het is voor mij makkelijk om vast te houden aan mijn plannen en mijn doel te bereiken.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Ik vertrouw erop dat ik onverwachte gebeurtenissen doeltreffend aanpak.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Dankzij mijn vindingrijkheid weet ik hoe ik in onvoorziene situaties moet handelen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Ik kan de meeste problemen oplossen als ik er de nodige moeite voor doe.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Ik blijf kalm als ik voor moeilijkheden kom te staan omdat ik vertrouw op mijn vermogen om problemen op te lossen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Als ik geconfronteerd word met een probleem, heb ik meestal meerdere oplossingen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Als ik in een benarde situatie zit, weet ik meestal wat ik moet doen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Wat er ook gebeurt, ik kom er wel uit.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



# C

## Images



Figure C.1: Images for all scenarios described in Appendix A.1.1

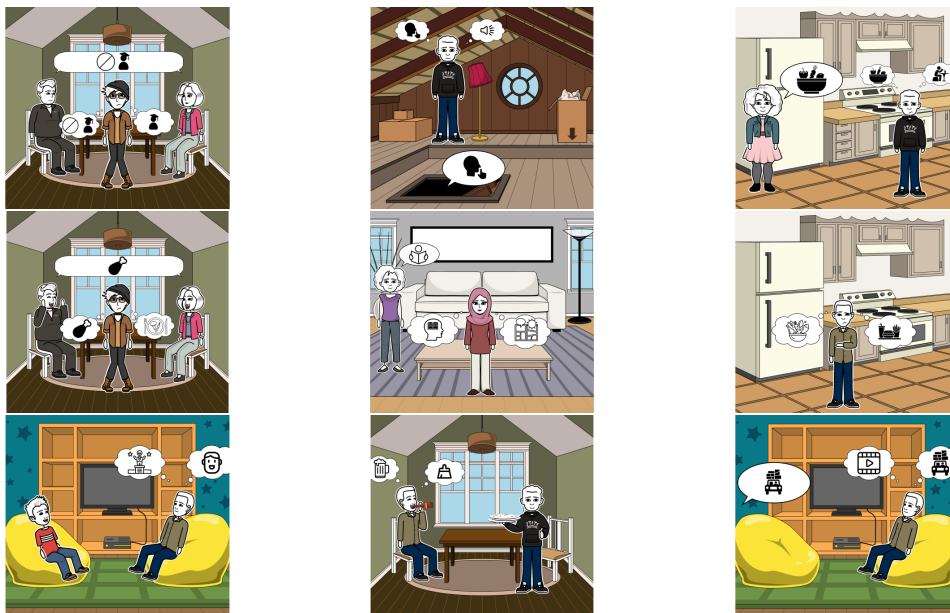


Figure C.2: Images for all conflicts, within a home context, described in Appendix A.2.1

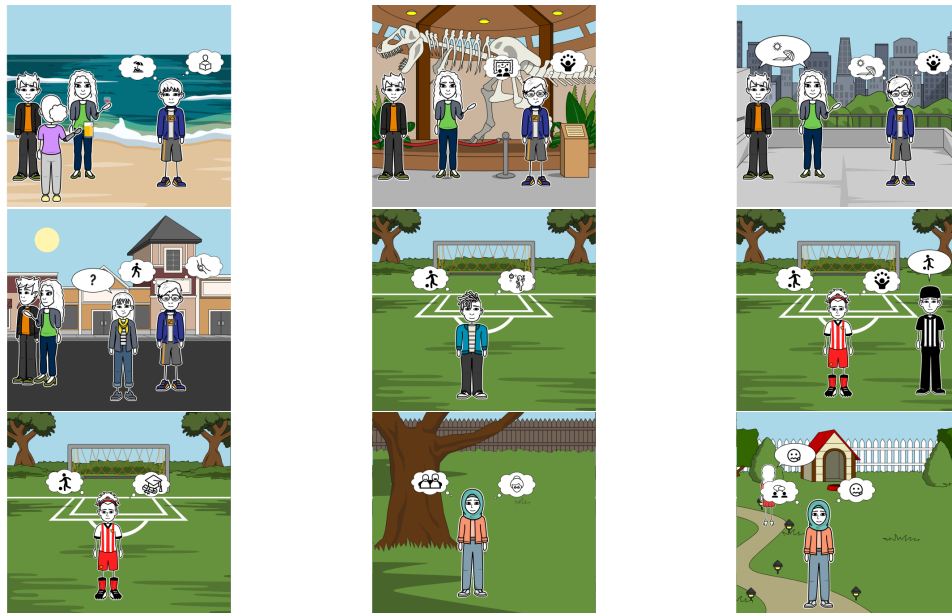


Figure C.3: Images for all conflicts, within a social context, described in Appendix A.2.1

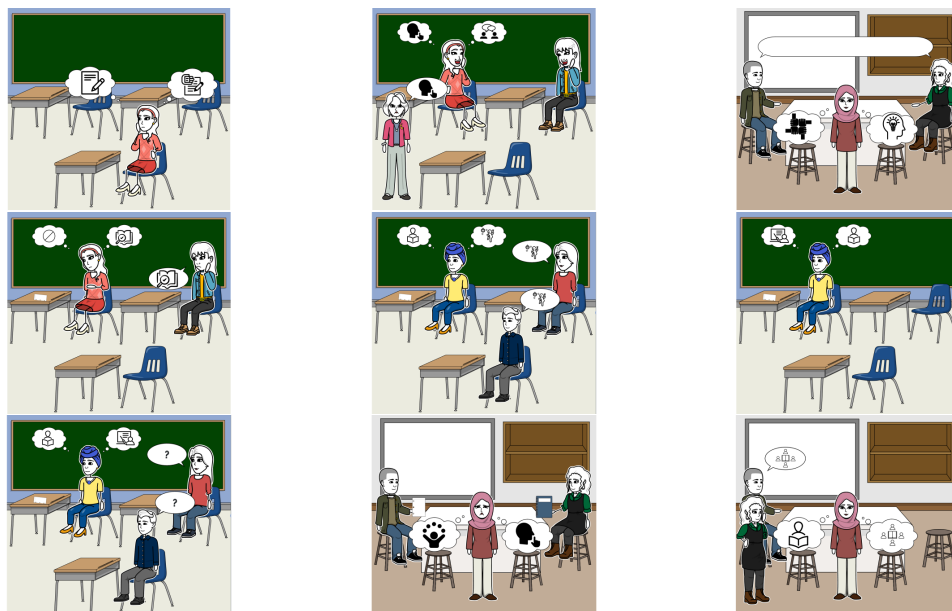


Figure C.4: Images for all conflicts, within a school context, described in Appendix A.2.1