emPLANThy: Exploring Interactive Plants for Neurodiverse Empathic Experiences

Diana Pimentel[1,*], Isabel Neto[1] and Tiago Guerreiro[1]

[1]LASIGE, Faculdade de Ciências, Universidade de Lisboa, Portugal

Abstract

Autistic individuals are often stereotyped as lacking empathy, a misconception that contributes to harmful stigma and social challenges between autistic and neurotypical individuals. The Double Empathy Problem reframes those challenges as resulting from mutual misunderstanding, rather than a unilateral deficit. Supporting mutual understanding from childhood may reduce communication gaps within neurodiverse communities. Interactive technologies have shown promise in fostering emotional skills and inclusion among neurodiverse children, and integrating living elements, such as plants, with responsive technologies offers a unique opportunity to create low-pressure, emotionally resonant experiences that support connection and awareness. Here, we present emPLANThy, an exploration of interactive plants designed to promote empathy and emotional connection in neurodiverse contexts. Through an initial brainstorming activity, we identified four initial design dimensions (sensory feedback, interaction, expressive plant behaviour, and social mediation) that will be further refined through participatory design. We also outline two interaction scenarios to explore how plant-based interaction can foster empathy, thereby supporting inclusion, enhanced emotional well-being, and a deeper understanding of neurodiverse communication. This work offers a novel design perspective grounded in living elements for interactive designs in empathy research.

Keywords

Empathy, Interactive Plants, Human-Nature Interaction, Inclusion, Autism

1. Introduction and Motivation

Autistic people often face challenges in social engagement and emotional understanding [1, 2], and are frequently stereotyped as "lacking empathy". This view is highly contested and perpetuates a negative stigma [3]. The **Double Empathy Problem** reframes communication breakdowns between autistic and neurotypical individuals as reciprocal rather than a unilateral deficit, arising from differences in emotional interpretation and expression [4]. **This shifts design goals toward creating inclusive environments that support mutual understanding rather than enforcing neurotypical norms.**

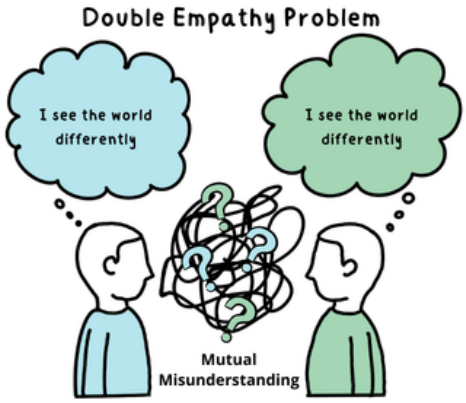

Figure 1: Illustration of the Double Empathy Problem.

Existing interventions, including social stories [5], theory of mind training [6], and social-emotional learning programs [7], often encourage autistic people to adapt to neurotypical expectations, risking "masking" and emotional distress [8]. **This highlights the need for alternative approaches that foster emotional connection without imposing normative behaviour.**

Robots have shown promise in supporting emotional skills among neurodiverse children [9]. At

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*Corresponding author.

dmpimentel@fc.ul.pt (D. Pimentel); aineto@fc.ul.pt (I. Neto); tjguerreiro@ciencias.ulisboa.pt (T. Guerreiro)

0000-0002-8191-0916 (D. Pimentel); 0000-0003-2515-0446 (I. Neto); 0000-0002-0333-5792 (T. Guerreiro)

the same time, Human–Plant Interaction (HPI) research explores augmented plants as responsive, touch-sensitive interfaces that foster attachment, care, and empathy [10, 11, 12]. Nature-based interactions benefit well-being and mental health [13, 14], and plant-based systems have been shown to promote relaxation, attention, and sensory engagement among autistic children [15, 16, 17].

Plants offer unique qualities as interaction partners: they are static, familiar, non-verbal, and alive. They can create low-pressure spaces with reduced sensory overload, often a challenge for neurodivergent children, that can be explored to support diverse ways of interacting and expressing emotions [16]. Despite promising work in HPI, little is known about how interactive plants might support mutual empathy between autistic and neurotypical children. Most existing systems focus on individual interactions rather than shared environments that support emotional connection and mutual understanding.

To address this gap, we introduce **emPLANThy**, an exploration of **interactive, touch-responsive plants designed to support social interaction and emotional connection in neurodiverse contexts**. By leveraging non-verbal, nature-inspired interaction, the system aims to create low-pressure, inclusive social environments that reduce communication breakdowns and foster empathic connections. By using living plants, this work introduces a new design approach to empathy research, providing an alternative to conventional digital and robotic interaction designs.

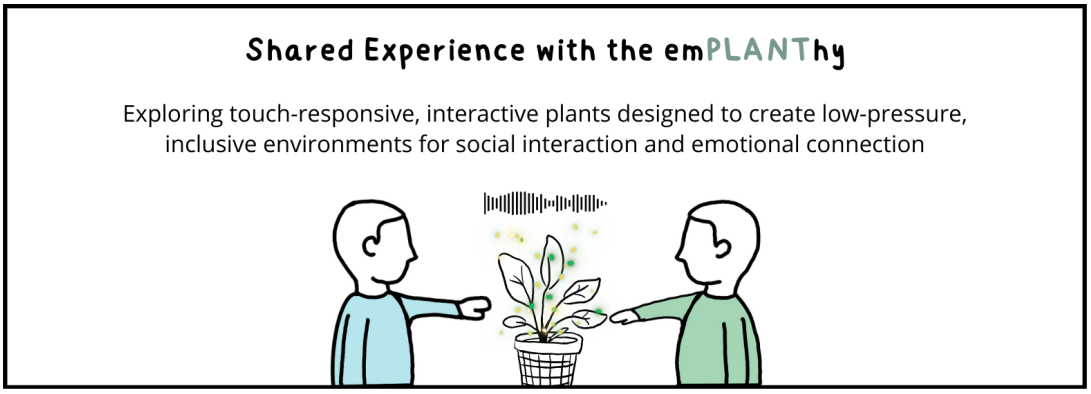
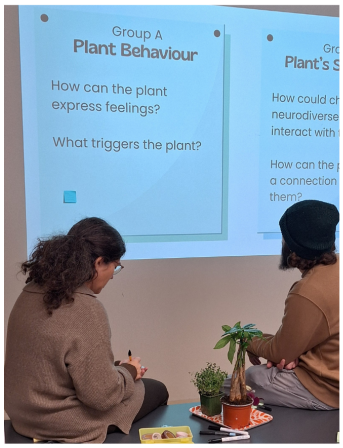


Figure 2: Illustration of the emPLANThy, a touch-responsive, interactive plant-based system design to create a low-pressure, inclusive environment in neurodiverse contexts.

2. Concept

emPLANThy explores how interactive plant-based systems can create a low-pressure, inclusive space for group interaction and emotional connection among neurodiverse children. By augmenting a living plant with multisensory feedback, the system aims to support both individual emotional grounding and shared emotional experiences in neurodiverse contexts.

To shape and expand this concept, we conducted a brainstorming session with four HCI and HRI researchers with experience in neurodiversity, social robotics, and research with children (Figure 3). The session was structured into three moments: warm-up, main activity, and wrap-up. During the warm-up, participants were invited to touch the plants in the room and write down an emotion, sensation, or memory, helping set the tone for envisioning plants as interactive elements. During the main activity, participants were divided into two groups. The first group explored 'Plant Behaviour', imagining how a plant might express emotion and what kinds of interactions could trigger a response. The second group focused on the 'Plant's Social Role', considering how the plant might support interaction between children, particularly in neurodiverse dyads. At the end of the session, the group collectively reflected on the most relevant ideas. Their sketches and contributions revealed diverse possibilities for plant behaviour, sensory expression, and plant-mediated social interaction. Together, these early insights provided the foundation for identifying the initial dimensions of **emPLANThy**'s design space.



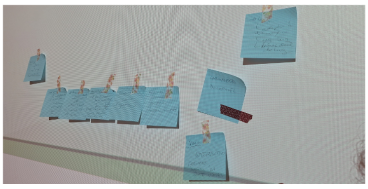
Plant Behaviour

How can the plant express feelings?

Participants imagined the plant expressing feelings through light changes, movement, vibration, sound adapted to emotion, scent, AR/VR projections showing possible future states of the plant, perceptible growth, and an interactive pot responses.

What triggers the plant?

Participants suggested triggers such as touch, proximity, voice, child behaviour or emotion, silence, watering, and programed reactions



Plant's Social Role

How could children in neurodiverse dyads interact with the plant?
How can the plant foster a connection between them?

Participants sketched possible scenarios supporting both individual and shared interaction. The interactive plant was envisioned as an emotional regulator/mediator: guiding breathing through light, approaching the child to offer calm, or moving its leaves to support regulation and co-presence. For shared interactions, ideas included a plant that points or moves to mediate conversations, balancing introversion and extroversion, scent-based responses to evoke emotions, and a "microphone plant" that supports emotional expression between children.

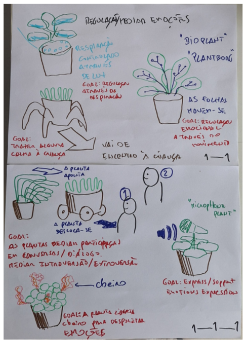


Figure 3: Brainstroming activity.

2.1. Initial Design Space

From the brainstorming session, four initial dimensions emerged describing how an interactive plant might support emotional awareness, low-pressure social interaction, and empathy. These dimensions include **(1)** sensory feedback, **(2)** interaction, **(3)** expressive plant behaviour, and **(4)** social mediation. This initial design space will later be expanded through participatory design involving professionals, autistic and neurotypical adults, and members of autistic support networks, as well as co-design sessions with children.

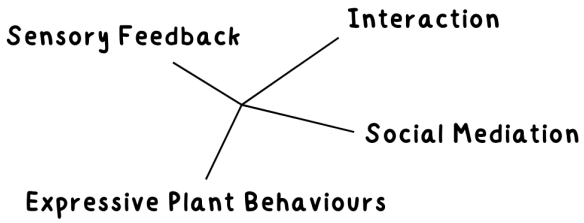


Figure 4: Initial dimensions of the design space.

The **Sensory Feedback** dimension explores how an enhanced plant expresses itself during interaction. Participants envisioned responses such as changes in light intensity or colour, gentle movement or rotations, subtle vibration, emotion-adapted sounds or intentional silence, scent cues, responses through the pot, and AR/VR projections to visualize possible future states. These modalities can be explored individually or combined to create soft but interpretable feedback.

The **Interaction** dimension focuses on what triggers a plant's response. Participants proposed a variety of possibilities, including direct user actions (e.g., touch [e.g., stroking, tapping, pinching]), proximity, or voice), changes in child emotional states, contextual cues such as ambient sound or silence, and programmed behavior.

The **Expressive Plant Behaviour** dimension considers how the plant might express or reflect

emotional states, such as gentle movement toward the child, breathing-like pulses, and light shifts.

Finally, the **Social Mediation** dimension explores how the interactive plant might support dyadic interactions. Participants envisioned the plant guiding shared moments and mediating emotional regulation.

3. Interaction Scenarios

We envision two interaction scenarios for the **emPLANThy**: individual interaction and shared sessions, which will be explored after system development.

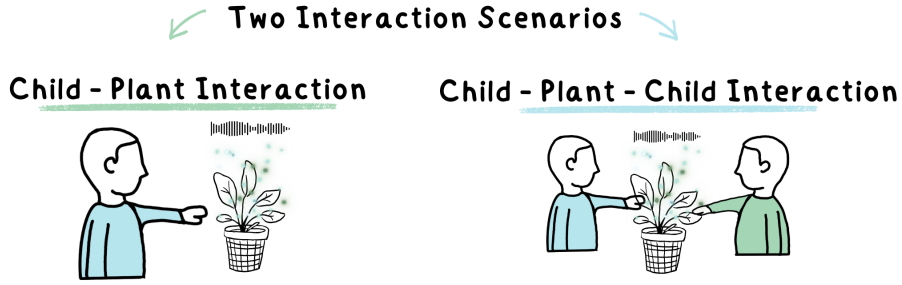


Figure 5: Interaction Scenarios.

In the **child-plant interaction** scenario, we will explore the system's potential to foster empathetic responses and emotional attachment during individual engagement. A child (autistic or neurotypical) will interact with the plant through touch-based storytelling activities, with the plant acting as an interactive storyteller. Through gentle multisensory feedback, the plant will invite the child to explore emotions in a calm, low-pressure environment. These sessions will be designed to help the child familiarise themselves with the plant and establish an emotional connection to the narrative.

In the **child-plant-child interaction** scenario, we will investigate how the interactive plant can enhance mutual understanding and support empathy in shared interactions. The plant will mediate their engagement, creating moments of shared attention and co-regulation. Through storytelling activities, the plant serves as a mediator, reducing social pressure and enabling children to explore emotional understanding together.

4. Outlook

Here, we introduce **emPLANThy**, an exploration of how interactive, touch-responsive plants may support emotional awareness and empathy in a neurodiverse context. Through a brainstorming activity, we identified four initial design dimensions, namely sensory feedback, interaction, expressive plant behaviour, and social mediation, that will guide the next stages. This design space will be further refined through participatory design and co-design sessions. Future work will investigate how plant-mediated interactions foster empathy and connection in both individual and shared interaction scenarios.

emPLANThy offers an opportunity to explore how living materials might create inclusive and empathic experiences, bringing a new perspective on empathy-oriented interaction design to the workshop (Re-)thinking Empathy's Materiality in HCI. Given the project's early stage, this workshop provides an ideal venue to discuss these ideas and to strengthen theoretical and methodological understandings of empathy in HCI.

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Declaration on Generative AI

During the preparation of this work, the authors used generative AI for linguistic enhancements. Human figures were hand-drawn on top of an initial AI-generated image and further edited with Canva elements. After using these tools, the authors reviewed and edited all content as needed and take full responsibility for the publication's content. No scientific content was generated by AI.

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