



**UNITE**  
FOREST-HUMAN-MACHINE INTERPLAY

# Designing, Experiencing, and Imagining Robots for the Forest

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Tampere



Tämmönen otus tuli tänään vastaan Hervantajärven uimarannan tuntumassa.



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# What's happening in the Forests of Tampere!?



# Human - Robot - Forest

- Humans and forests are connected through evolution.
- The forest-human connection is intuitive.
- Interacting with forest has numerous positive benefits.
  
- But, what happens when we bring Robots into the mix?!
  - what roles can it play?
  - how would it influence the forest-human connection?
  - and, what does it mean for the human-robot connection?



# Why?



# Robots: From Labs to Homes to Wild?

- Robots are no longer futuristic; they're here and among us.
  - In homes (e.g., vacuum bots), hospitals (e.g., surgical robots), streets (e.g., delivery bots), and workplaces (e.g., industrial arms).
- What happens when we move beyond controlled settings?
- Robots in the wild challenge traditional HRI assumptions.
  - How should a robot behave?
  - What roles can it play?
  - What relationships might it build?





# Let's see some examples!



# Follow or Lead



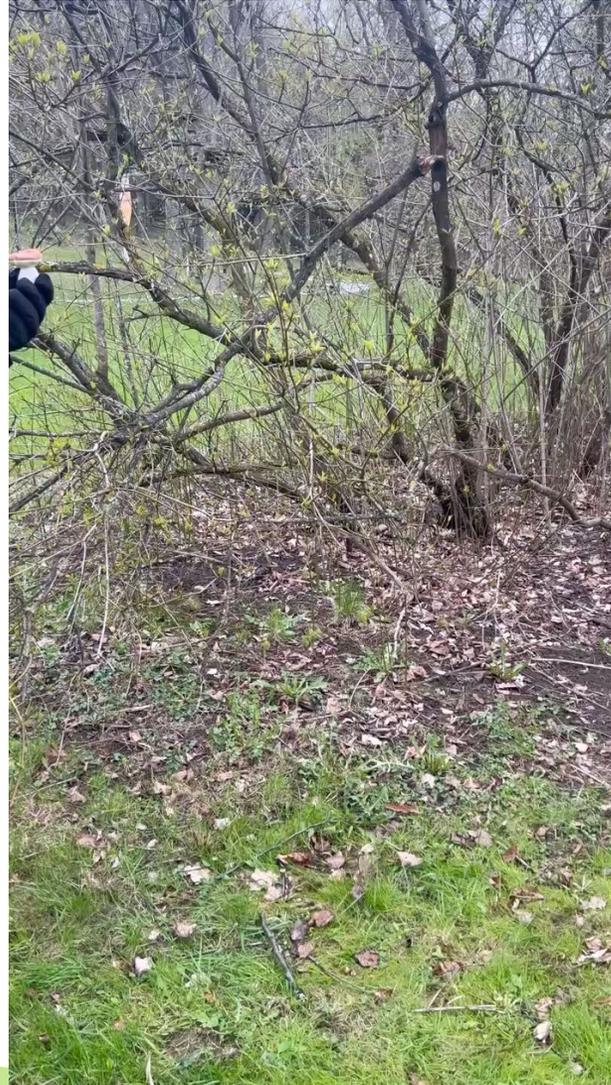


# Justice for Mushrooms





# Justice for Mushrooms - 2





# Robot as Community Driver





# Stretch Together?





# Engage Together with Forest





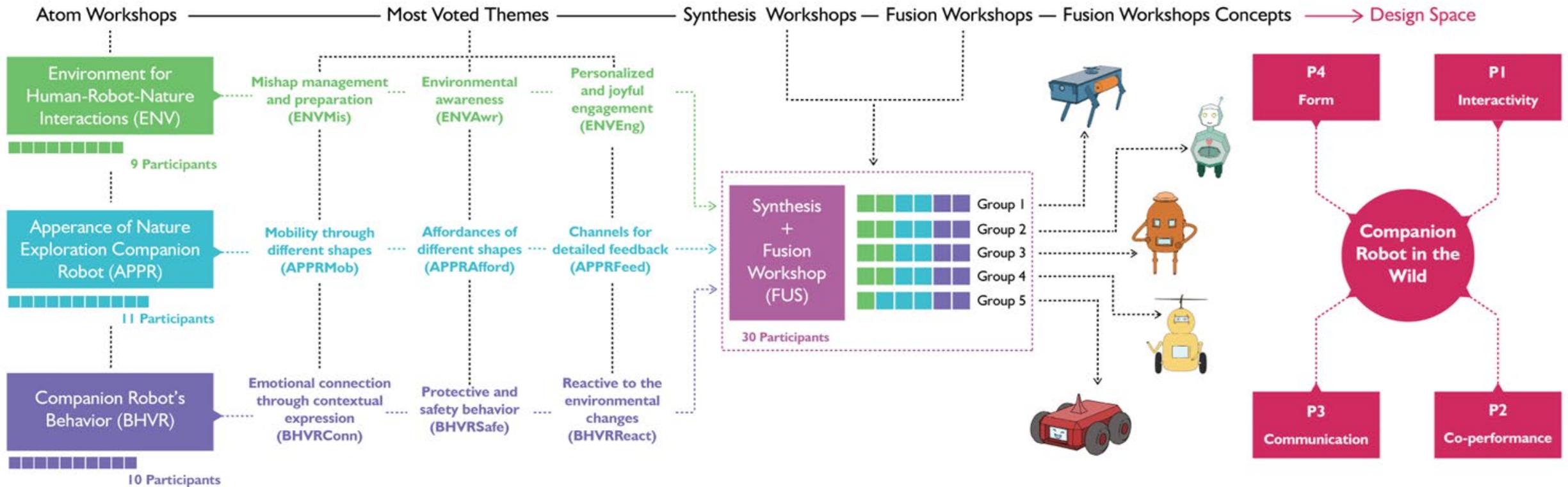
# But, How did we get here?

Research on:

- Human-Robot Companionship (HRC)
  - to understand the state of the art in HRC
- Co-design Workshops on Designing Robots for the Wild
  - to solidify the design space and considerations
- Walking Outdoors with a Companion Robot
  - to develop initial understanding of outdoor walking with a robot
- Walking with Robots in the Forest
  - to understand how the forest experience changes with robots.
  - Robots, not just tools or helpers, but co-explorers, playmates, storytellers, or ecological provocateurs.



# Participatory Design Workshop





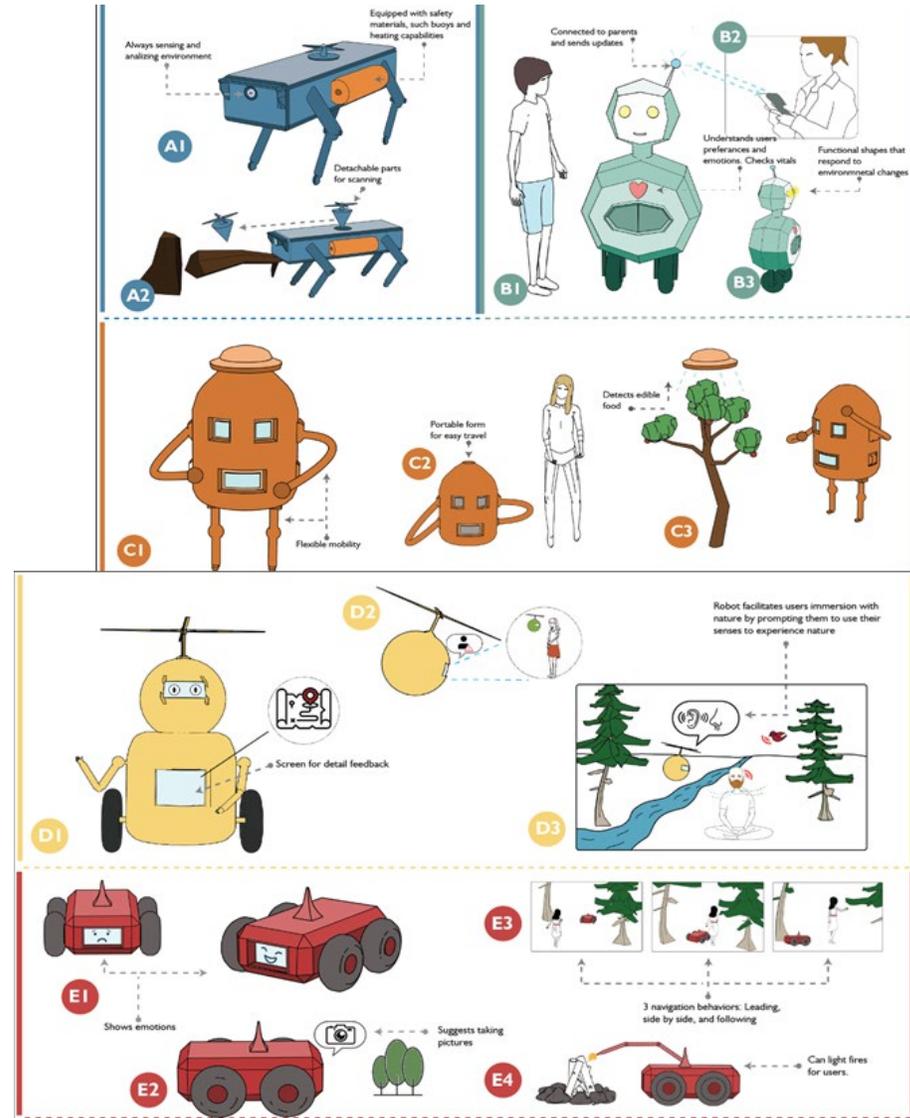
# Robot Concepts from PD Workshop

**SOS** Robot as emergency support

  Robot as social proxy

 Robot as the barrier between human and danger

 Robot as facilitator of active sensing and engagement in the forest





# The Design Space

## Interactivity Plane

Individual

Planetary



*With Robot  
(HR)*

*Through Robot  
(NtR)*

*Holistic  
(HRN)*

## Form Plane

Utilitarian

Affective



*Functional,  
affordance-driven*

*Companion*

*Anthropomorphic,  
appearance-driven*

## Communication Plane

Ambiguous

Straightforward



*Unpredictable,  
unknown,  
unclear,  
sarcastic*

*Implicit  
(contextualized)*

*Transparent,  
predictable,  
clear,  
serious*

## Co-performance Plane

Follower

Leader



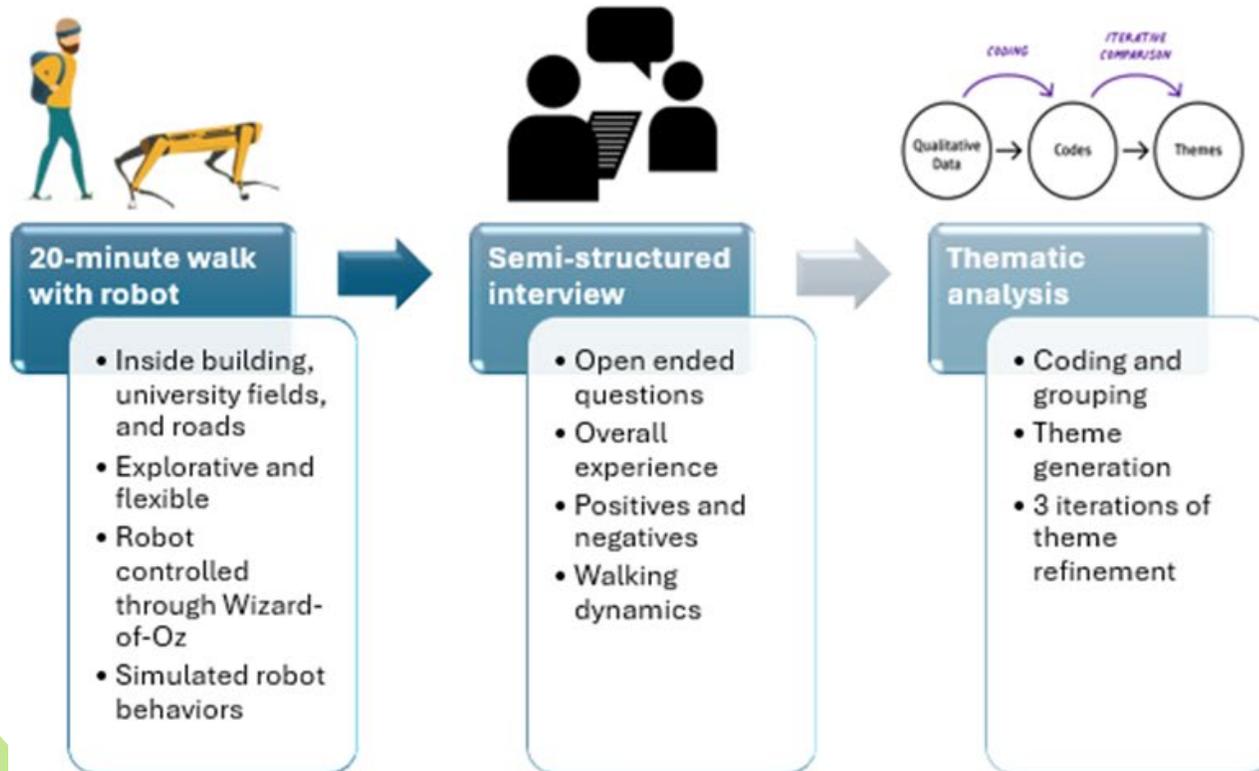
*Stanby,  
Invisible*

*Harmonious*

*Authoritarian,  
cautious*



# Outdoor Walking with a Robot Companion





# Insights from Outdoor Walking

- Projected relationalities
  - Robot needed care?
  - Robot was non-sentient and non-judgmental
  - Robot was like a pet or a child
- Robot adds dynamism to embodied interaction
  - Influence on walking speed, direction, and attention.
- Robot affects social perception of self and others
  - External attention – positive & negative
  - Being looked on strangely or judged
- From ambiguity towards playful explorations
  - Playing to know
  - Curiosity led to reduced ambiguity





# Playful Ideation and Design of Forest-Robot (MtH) Interactions

  Play as a mode of creation or creativity

 Fake Forest News!

 Powerpoint Karaoke

 Plush Toys

 Spot robot

  Bodystorming

  Storyboarding and video sketching

  Video Filming





# Walking in the Forest with A Robot

- An experiment in the forest
  - RQ
    - How do a companion robot's varying levels of engagement and authority influence humans' nature connectedness and perceived companionship during a forest walk?
  - Interaction
    - A forest walk of approx. 12-15 minutes
  - Protocol
    - Each participant takes 2 walks, each followed by measurements
  - Measurements
    - Nature connectedness
    - Focus and mindfulness
    - Companionship
    - Trust in the robot





# Preliminary Insights from “Walking with A Robot in the Forest”

- Robot Roles
  - Protector
    - “I felt safer when it was following me, it was like a protector that is watching your back”
  - Jogging or Exercising companion
    - “With the speed it walks (they experienced higher speed), it is more of a jogging or exercising companion, not a walking one”
  - Explorer and Facilitator
    - “It was looking around and checking its surroundings, which made me follow its gaze. I looked at things that it looked at”
  - Analyzer
    - “It was analyzing the area, maybe looking for something”
  - Just a Dog
    - “It was just like a dog, trying to sniff things, and stopping at trees to take a piss”
  - Navigator
    - “I did not need to see my phone to know the path, the robot already knew it”



# Preliminary Insights from “Walking with A Robot in the Forest”

- Focus, Mindfulness, and Engagement
  - Participants followed robot’s gaze and looked at things in the forest.
  - Robot’s active states (stopping at places, looking into narrow trails, examining a water stream, etc.) sometimes were perceived as distractions and interruptions.
  - Robot’s active state was more playful and engaging for HRI, but not for HNI.
  - Robot’s passive state (just walking alongside) resulted in more relaxed and focused forest experiences.
  - Participants were more engaged with the robot in the first walk.
    - but showed better forest engagement in the second walk.





# What the Future Holds...

- Robots as playmates in the forest.
- Robot facilitated forest-culture engagement.
- Improving Human-Robot Communication.



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# Thank you!

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