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# Hands On With Nature: Designing Tangible Interactions With Plants

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**Abstract**

The unique affordances and properties of plant life hold many possibilities for augmentation with digital interaction without detracting from their natural presence. These possibilities have the potential to create more organic interactions with nature. This paper draws on previous work we have conducted relating to interactions with plants, alongside an account of a Social Media and Interaction themed Hackathon<sup>1</sup> that used plant life as a key material to prototyping interactive media to promote sustainability. From this, we propose early questions, abstract ideas and the possible challenges researchers and designers will encounter working with human-plant interaction.

**Author Keywords**

Plants; organic; emotion; interface; interaction;

**ACM Classification Keywords**

H.5.2 [User Interfaces]: Haptic I/O; Input devices and strategies

**Introduction**

Modern technology can often intrude on our experiences with nature and the world around us. A simple glance away from the beautiful horizon to look down upon our smartphones can completely remove us from the moment. In

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<sup>1</sup><http://www.planthack.org>

some cases, it can be argued that the information being delivered and engaged with is not the issue, rather more the technology that delivers it. Technology can function to enhance engagement with nature (e.g. [3], [6], [7]). It can be the tool to find nature trails, information about wildlife or the camera that captures those important memories. It can even act to bring creativity and self-expression people often seek from nature. With this, we believe the tools which we use to interact with information in our natural environments need to be natural too, so as not to remove us from the moment. Nature is a diverse tapestry for interaction opportunities and we believe that using plant life can offer unique and fun experiences for creating more natural engagement with digital systems when in an area surrounded by nature. Our current work has sought to understand user experience when using plants and explore their different properties and affordances that might function to create such unique experiences. In this workshop paper, we discuss our works implications for designing “Unobtrusive User Experiences with Technology in Nature”.

### **Related Work**

Previous work has explored the use of living interfaces for tangible interaction (e.g. [3], [6], [7]). *Botanicus Interacticus* [6], gave both visual and audio responses to capacitative touch sensing of an array of gestures on a variety of plants. They demonstrated how certain gestures are more natural on particular types of plants. Another study named *My Green Pet*, addressed the difficulty that children have in perceiving plants as living [3]. The system recognised touch gestures with which the plant would respond with humanoid reactions. Our recent work attempted to build upon this research by deeper understanding how users interact with plants for digital tasks [7]. This work is discussed throughout this paper. Other work explores using plants to communicate information to users (e.g. [5], [4] [2] [1]). This is

done by manipulating plants in a variety of ways from light tropism [2], controlling photosynthesis [4, 5] and changing the colour of cabbage by adjusting its pH level [1]. These plant-based prototypes were appealing to people, describing the sense of emotion via organic change.

This prior work shows the beginning of what is possible when creating interactive plants and the experience it provides to users. In this paper we use this previous work, research we conducted and an account of ideas from Hackathon in Social Media and Interaction that used plants as a key component of the ideas developed. To propose early questions, abstract ideas and the possible challenges around the use of plant interaction for designing “Unobtrusive User Experiences with Technology in Nature”.

### **Unique Challenges and Opportunities**

#### *Tangible User interaction*

Tangible interactions with plants offer diverse textures and gestures. Our interviews with participants showed that this exploration and the idea of the interface living enhanced experiences [7]. We also observed how common elements of plants such as leaves, stems, vines and branches afforded diverse sets of gestures. Plants with thick rubbery stems can be plucked, causing the stems to wobble due to their elasticity. Plants with hanging vines and leaves afford the gesture of users brushing their hands through the hanging leaves or tilting certain branches. In our past study, this was described as relaxing and therapeutic. Leaves of plants can be rubbed, touch and even removed. Other gestures like tilting the stems, mimicking a joystick. These gestures were seen in a small subset of plants. Exploration of the many different species opens a broad opportunity for tangible interactions. The next challenge is how we would provide a natural means of feedback to the user.

### *Organic Output Methods*

In our previous study [7] we used screen output in the form of mini-games and interactive graphics. During ideation, this was never seen as a concern as we were interested in how people would use them for computer input. An interesting question would be how removed are users when switching to look at the screen compared to keeping the system as both plants based input and output. Which could serve to minimising obtrusion on users experience when interacting with nature. This is a significant challenge due the lack of control we have over living interfaces to provide alternative feedback methods. One approach would be the use of audio feedback, this way feedback would be received but not distract from the plant. Another method would be physically actuating the plant, similar to how you would certain puppets. This would require an understanding of natural movement as unnatural moment could take the user out of the experience, like poor special effects in a movie. The final method we identify is the manipulation of tropisms. Tropisms is a plant's response to external stimuli such as light, water, gravity, touch etc. Designers using these methods of manipulating the plant life will need to be mindful of the speed of output. The majority of tropisms that effect the plant's to growth, change and decay happen over days, months and years. This long period of output provides its own set of unique design opportunities and challenges.

### *Growth, Change and Decay*

Plants are highly ephemeral over the course of growth, change and decay interaction can be different. This can be due to the passage of time and the environmental factors at work. This opens opportunities and challenges surrounding how interactions are affected by such changes and what influence this has on the user. As the naturally changing properties of plants will change the gestures, textures and user perceptions. Our past study highlighted how partici-

pants interacted differently with a more withered plant. This could offer slower digestion of information and organic control over content, with each new leaf grown new media can be accessed. Taming their ephemeral properties proposes a challenge to designers, the natural interaction it affords could offer users a more natural engagement with nature.

### *Emotional Connections and Context*

Another key aspect to interaction with plant based interfaces in the emotional connection it brings. Plant are almost like pets in the sense that understand they are living and with their own set of need's that we care for. These factors bring a deeper emotional connection to the interface. A key voice that emerged from our interviews was the concern for the plant's wellbeing [7]. They reflected on using the interfaces as a collaboration, they felt as if they were working with the plant rather than using it. This theme is very interesting as it begin to show how interfaces made from plant material remove some feelings of using a computer.

### *Physical Digital Prototyping*

The many prototyping kits and technologies provide the opportunity to connect plants to digital interactions. MaKey MaKeys and Arduinos allow us to rapid prototype with sensors to quickly form basic interactions. These forms of kits are affordable and require little engineering knowledge to start making interactive prototypes. This low barrier to entry opens opportunities for members of schools, communities and families to begin prototyping new engaging ways to interact with nature. Looking to the future, researchers and engineers have the challenge of advancing the diversity and level of fidelity for natural and unobtrusive interactions.

### **Ideas and Use Cases**

We held a social media and interaction Hackathon with the key challenge of using plants as interactive material to pro-

mote the concept of sustainability in the field of HCI. During this event, we gave HCI researchers and designers prototyping kits and a variety of different plants. The ideas developed there hold potential points of interest for designing “Unobtrusive User Experiences with Technology in Nature”.

One team’s prototype was “Planticipation”, this is a networked communal watering system and with sound art installation designed to be situated throughout a residential tower block. The foyer area acts as a communal indoor garden. Each plant within the garden is paired with one in the residents homes. The watering of a plant in one area triggers watering of the plants partner. “Planticipation’s” output from cooperative watering was a beautiful soundscape alongside tweets of stories and information, to draw in and support the gardeners. The system promotes social connections via plant life, as well as to create a space for shared responsibility, action and improving the built living environment. This integration of plants and technology engages people with nature in the city where nature can often be difficult to find and connect with, this integration of technology is a great example of the possibilities the technology has to attract people to experience with nature.

Another team’s prototype was “Family Tree” this aimed to aid the sustainment of life-long relationships through shared passions. The team’s scenario envisioned grandparents and their grandchildren sharing knowledge about gardening. Each family member is given a plant, then interactions such as touching and talking about the plant will be recognised and shared with the grandparents. This feedback is then output on the grandparent’s plant via movement and the grandchildren can see that the interactions are being shared via LED indicators. Hoping the next time they meet these interactions probe conversations with the family members about their knowledge their shared passion. Both of

these prototypes present the idea of connecting nature across distances. The addition of technology enables plant interaction to encompass engagement beyond their roots. Another interesting factor in the shared experience with others via nature both prototypes

### **Future Work**

This paper has identified many of the opportunities and challenges that occur when using plant material for HCI. To better understand its application for the future we identify some future work and research questions. Beginning with research of plant interfaces in nature-rich environments. This opens possibilities to understand how these forms of interfaces can offer interaction away from individual experiences, and instead with our environments. Within this context, we believe applications such as games and interactive art installations would be beneficial use cases for promoting education about wildlife and sustainability. We also identify exportation of using plants to enhance user creativity, for work such as graphic design or music creation. With the different textures and new gesture, sets of plants could afford new creativity possibilities and more natural mediums for people to express themselves. Nature is already a source for creative and technology its a great tool for creative. The seamless connection of these two should aid to free people’s self-expression.

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