# Growing On You Lamp: Negotiating Personal Space in Informal Social Environments

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**ABSTRACT**
In this paper, we introduce Growing On You Lamp, an interactive piece of "furniture" designed to encourage curiosity of surroundings based on user's own preferred social state. Like any piece of furniture, it can exist anywhere, but reaches its full capacity in a casual work/social environment, like a cafe or talking library. The Growing On You Lamp takes advantage of user's focus on their work to produce ambient media based on time passing and user's openness to conversation. Through movement, aesthetics, touch, and sense of personal space, this work explores reinforcement of personal boundaries, outsider perception of one's personal space, and perceptibility of openness to social interaction.

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Tangible User Interfaces (TUI); Ambient Interfaces; Ambient Media, Ambient Computing, Social Interaction; Ergonomics; Personal Space.

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**INTRODUCTION**
Tangible user interfaces often depend on metaphors to natural pre-existing actions for input (action) intuition. We hoped to tap into not only the casual action metaphor of brushing off a leaf as an inspiration for an intuitive and "non-committal" input, but also the metaphor of how people perceive nature in their surroundings.

In the field of Urban Studies and City Regional Planning, public space design, specifically private-public spaces (privately owned land that is open to the public, like plazas), are considered a major design challenge. Much research across many fields has postulated and discussed human interaction in such spaces, and most convene that public space should indeed be public. Everyone should be able to sit and enjoy a space; no one group should intrude upon another. In this way, William Whyte made a film mapping out the behaviors of people in various plazas and parks in New York and aptly titled it "The Social Life of Small Urban Spaces." In his recorded observations, he found that the corner and edge areas of the plazas filled up first and were common congregational areas, as can be seen in Figure 1. Few people stopped in the middle of the space to hold a conversation; most would move towards the edges.

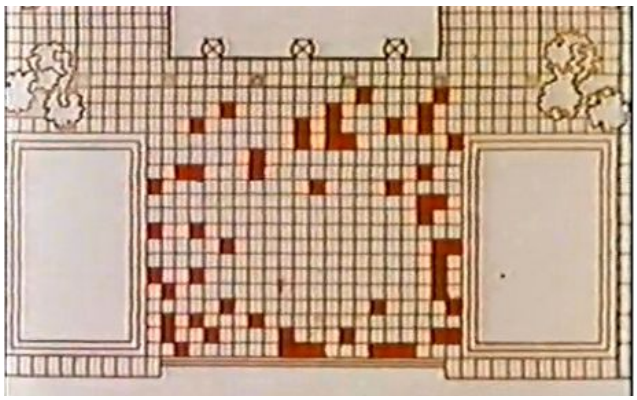

**Figure 1. A still from William Whyte's film "The Social Life of Small Urban Spaces" [3] depicting a diagram of where people held conversations on an aerial, gridded view of a plaza.**

Previous work and research on ambient media has focused on displaying information, and prompting interaction at certain stages or levels of data processing, such as time passing. Our approach with the Growing On You Lamp was to have the lamp function as a complementary "extension" and reinforcement of one's personal space, while still processing data (time), and prompting users for more information as needed. In this way, our interface accounts for active change that may be occurring. Still, our interface's output, given time is not as ambient, or may appear intrusive.

## RELATED WORK

In our search for similar work, we did not find anything directly plant related in shape or inspiration, but there has been much work done on how interfaces can "break the ice" in informal social spaces, or be used as a social furthering mechanism.

Yoon et al. at the Massachusetts Institute of Technology Media Laboratory created an interactive game-play tabletop called *FishPong* with a pond-scene projected onto the tabletops of imagined coffeehouses or cafes. The ebbing pond-scene is always active and could handle multiple player modes, "colorful fish serve in place of the ball, and inexpensive coffee cups with spill-resistant lids function as the paddles."[4]

Weiser and Brown at Xerox PARC wrote a piece titled "Designing Calm Technology," writing about and defining ambient surroundings as the "periphery." They write that the periphery is "what we are attuned to without attending to explicitly," yet upon stimulus (like an different sound from the engine while driving), we bring it to the "front" of our periphery to hold at attention. Weiser and Brown continue on to explain that a calm technology is one that "will move easily from the periphery of our attention, to the center, and back." This modality of calm technology is advantageous in two respects: 1) it does not overburden the user with demand for attention, it accepts that it is a "part" of the background, and 2) the re-focusing of something that was previously in our periphery establishes a sense of control over that object. This aspect of calm technology provides a fertile testing ground and field for the idea of comfort and personal sense of space.[2]

Rogers, Y. and Brignull, H investigated the use of the Opinionizer system, an interactive display that prompted users to share their opinions and see the opinions of others. [1] This study provided three modes of interaction that we would also like to study: Peripheral, Focal, and Direct. The display was an outlet for both direct and indirect interactions which fall into the 3 aforementioned modes. In the direct interaction case, users are directly interacting with the interface prompting for responses and providing signals for others to see and interact with as well, users were inputting their opinions into the system. Indirect interactions were made in both the peripheral and focal cases where attention was drawn by other parties to the system and the display of opinions. These 3 modes provide a grounds in which we can explore how people will interact with our artifact.

## PROCESS

We started with the idea of "breaking ice," and were inspired by a saying in English about something "growing on you," as in becoming more familiar to one. From this point, a natural progression was the temporal aspect of relationships as it often takes time for things to grow and for people to establish any sort of relationship.

We took further inspiration from the non-intrusive presences of plants in public space and how they, in a way, are their own "calm technology system."

## DESIGN OVERVIEW

The Growing On You lamp is a single artifact interface that is meant to exist in multiples in informal social or work settings.

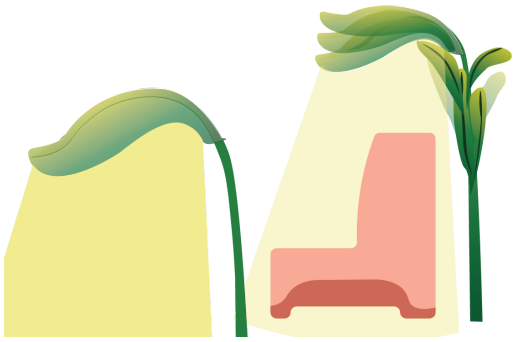

**Figure 2. First draft of imagined shape and form of lamp.**

It functions as a "workplace" accessory in that establishes a setting that reflects user's desires for their own space--whether it be more personal and private, or open. It is meant to be placed behind and between seating, as seen in Figure 3.

**Figure 3. Final imagined physical implementation and setting**

## MODES

The Growing On You lamp best functions in either an active work mode or a more idle play mode. First, the lamp is activated when it sense that someone has sat down. The

discerning leaf drops down to touch the user's head and attract the user's attention. Users then can enter one of the two modes.

### Work Mode

In work mode, the user is required to push the leaf back up, in a motion of establishing personal space. The discerning leaf then drops back down every 15 minutes to "ask" if the user would like to stay in work mode, or remain unbothered. If the user again pushes the leaf out of the way, leaves along the stalk/stand part of the lamp will open outwards. The longer a user stays in work mode, reaffirming that they do not want to be bothered, the more leaves fan out, thus "growing" on the user. The visual effect of someone who has been working for a long time is seen in Figure 4. It is a visual effect seen by others and felt by the user as reinforcement of their personal space.

**Figure 4. Possible arrangements of the Growing On You lamp in a cafe setting; the bottom shows two in comparison between two parties at various lengths into work mode.**

### Play, Social Mode

In play mode, the user does not respond to the discerning leaf. We considered the length of time that should be given to users for the input and decided that three to five minutes should be more than enough time to respond. When the lamp enters play mode, the discerning leaf gradually moves back up and the leaves rustle in place as would actual foliage in the outdoors. In this case, the leaves still frame the user's personal space, but more as a weakened border. This weakened border is a way for user's to ambiently be reminded of their surroundings. In the scenario that the user is looking to be joined by others, or is simply open to social interaction, this mode is meant to facilitate a more open setting.

### Second Stage Input and Mode Alternation

While work versus play mode are relatively rigid in structure and intended/imagined usage, as the lamp periodically takes in input, it can keep up with the user(s') intentions and social states. Since the input leaf of the lamp drops down whenever it senses new presences, there exist multiple opportunities for The following are a couple of the imagined scenarios in which the Growing On You Lamp can complement a social situation:

- A customer at a cafe gets there before his companion(s) and the discerning leaf drops down each time another one of his/her companions join them; once they have their entire party assembled, they choose to enter work mode to assert the personal space of the group.
- A student studying at a coffeehouse has been working at a cafe for long hours when they are joined by another person due to lack of open seats; the input leaf drops down and there is the opportunity for social interaction.

## IMPLEMENTATION

Growing On You Lamp is built using basic input sensors and mechanical end effectors in order to sense the presence of a user and create the motion that occurs around the user. The presence of a user is sensed using an infrared distance sensor and interaction with the leaves, defined as a push, is found using a strain gauge (flex) sensor that is placed on the stem of the leaf. Fluid motion of the leaves is achieved using 3 continuous rotation DC motors and a simple pulley-like system. Hinges were used to hold the leaves in place and minimize the friction created during the motion of the leaves. Processing of inputs and outputs is done on an Arduino Uno.

The leaves of the Growing On You Lamp were made of steel wire formed into the shape of leaves. Nylon stockings were then wrapped over these wires in order to give a translucent and filled appearance to the leaves. Lastly, the stockings were spray painted green to give a more realistic hue and color to the leaves.

The overall configuration of the Growing On You Lamp system is shown in Figure 5.

**Figure 5. Overall Growing On You Lamp System**

### Prototype Development

The technical implementation of the Growing On You Lamp went through several iterations, each with different focuses. The focus of the initial concept was to lay a foundation for the Growing On You Lamp design idea and had several small leaves that made use of small toy DC motors in order to drive motion of the leaves. The second iteration of the idea laid the technical groundwork for the prototype. It used a modular methodology in order to create motion in 3 dimensions with various degrees of freedom. This iteration used direct drive motors for the leaves as well with another servo motor in order to provide rotation around the trunk of the tree. However, when narrowing the focus of the final prototype to the motion of the leaves, a simpler approach was needed. In the initial stages of prototyping, sticks were used as the leaves and motion and evaluation of the mechanical advantage of the pulley system was performed. Further, distance and capabilities of the infrared distance sensor as opposed to a passive infrared (PIR) sensor were tested. Noise and the behavior of the PIR sensor were not suitable for the constant sensing of a person and therefore an infrared distance sensor was used. The development of the physical development prototype can be found in Figure 6.

**Figure 6. Development of Technical Implementation Details and Prototypes of Growing on You Lamp**

For the leaves, we used spray painted stockings stretched over 12-gauge wire. The thinness and elasticity of the stocking made it a flexible demo material, and successful in curving as a leaf would, pictured in Figure 7.

## EVALUATION

Perhaps the weakest part of our lamp is that it's intended functionality must be explained. While our lamp was inspired by already naturally occurring human behaviours in informal social settings, it is unlikely that when dealing with something totally "new," the modes and input actions would be a natural or obvious notion.

It is also possible that the visual effect of looking at someone who has been in work mode for a long time would attract attention more than reinforce privacy. Ideally with the placement of multiple Growing On You lamps, this could be less so.

### Demo

**Figure 7. Demo Implementation of Growing On You Lamp**

Upon initial explanation of the functionality and two modes of our lamp, most people found it curious and responded positively. However, when told to push the leaf upwards, many of them were unsure of how to execute the movement; how far should they push up? How strongly? How fast? Many of them pushed up hesitantly and lightly, which often did not register in the flex sensor. Furthermore, while sitting underneath the lamp, it was difficult to notice the leaves (surroundings) moving. Users had to actively look up to see the change, somewhat negating the sort of personal-bubble/enclave effect we were hoping to achieve.

Other unaccounted for actions occurred (as expected) during our demo. An odd realization during the demo was that no person carries their body the same way. They sat in various ways in the chair; some scooted all the way to the back to lean on the back of the chair, others seemed apprehensive of the leaf and sat closer to the edge of the chair. With our demo implementation of the lamp, this caused some issues with our infrared distance sensor registering their presence.

Some of the demo subjects also experienced issues of scale-- the input leaf was so directly above their heads, it was out of sight, and thus, unnatural to reach directly above their heads to touch the input leaf. Further unplanned interactions that occurred included trying to pull the leaf, petting/lightly touching the leaf, and general curiosity about whether the other leaves could take in input as well.

While the aesthetics and our successful likeness to natural plant movement sparked a lot of curiosity of user's surroundings, it caused many users to pay their full attention to it-- contrary to what we had intended.

## CONCLUSIONS

While the Growing On You lamp worked in some of these ways, it also opened a lot of avenues for future experimentation and thought. There were certain levels in which we found we could indeed control the user's actions, but in other cases, it seemed that the user's natural instincts were at odds with the intended user flow.

We believe that in the intersection of of calm computing and tangible user interfaces, the Growing On You Lamp offers a customizable experience that moves between the front and back of users' peripheries in ways that reaffirm their sense of personal space in a larger, public space.

## FUTURE WORK

Immediate future work on our lamp would involve experimentation with the effects of lighting on social and work interaction, expanding the physical and tangible range that the leaves of the lamp reach, and exploring more with types of intuitive touch input. The improvements we would like to make to the lamp are centered around complementing the user's body and sense of self, especially in relation to their surroundings.

In response to our demo work, more prototyping must be done to get a closer similarity to the intended aesthetics of the foliage.


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