Digital games can engage children in therapeutic and learning activities. Incorporating living media in these games can create feelings of empathy and caring in users and add more motivation and involvement to the gameplay. We present, Rafigh, a living media interface designed to motivate children to play learning games that involve repetitive and sometimes boring tasks. In the current implementation the interface is used for speech intervention games. During gameplay, children practice their speech and care for a living mushroom colony in the process. The mushroom’s growth is used to communicate how much speech is used, as an indicator of degree of speech practice, during interaction.

Author Keywords
Living Media Interfaces; Speech Intervention; Embedded Computing

ACM Classification Keywords
H.5.2. User Interfaces

Introduction
In the face of increasing urbanization and lack of contact with nature, it is important to design systems that facilitate a re-connection or at least dialogue around our interaction with living beings. Embedded
electronics allow for new ways to interact with living beings. Many new designs attempt to bring us closer to nature and use technology to mediate a dialogue between us and other living beings (e.g., *Botanicalis* [5] and *Babbage Cabbage* [3]). These interfaces explore novel ways to engage users through combining digital and biological elements in design. Additionally, therapeutic games have the potential to motivate users, especially children, to perform repetitive and otherwise boring tasks for long periods of time. We bring together these two ideas in an empathetic living media interface that focuses on caring as interaction goal in learning and therapeutic games. Currently, we use this interface as part of a speech elicitation system for children with speech delays.

Our design is motivated by the observation that many children (and, indeed, adults) are naturally fascinated by plants and animals. By developing technology that encourages and builds on this fascination we can support children’s relationship with nature and the environment around them. Additionally, this area provides opportunities to build in caring and empathy into interaction; elements whose absence have been a cause of concern for the critics of computer games [1].

The need for regularity in the care of living beings corresponds well with therapeutic and intervention applications for repetitive and regular use [6]. In this work, we present a design that requires children to take responsibility for taking care of living being with regularity and by performing tasks that would benefit them therapeutically and aid with intervention.

**Rafigh: A Living Media Interface for Learning Games**

*Rafigh* (which translates to “companion” in Farsi) is an embedded tangible interface that uses a living mushroom colony as part of its display, where its growth rate corresponds with the amount of speech practiced through its use. It is designed to motivate primary school-aged children with speech disorders to use their speech to play a game that results in the irrigation of the mushrooms.

![Rafigh interface](image)
Figure 1 shows Rafigh. The interface consists of a box designed to house a mushroom colony (with its growing side exposed), an irrigation system controller by a wireless microcontroller and housing for an iPad. The child can start playing the game on the iPad at any time but typically we expect them to play it at least once a day.

During gameplay the iPad can be removed from the interface or can stay mounted depending on the user’s choice. The iPad is mounted by default for two reasons: to facilitate its use for children with motor or mobility disabilities and, to create a stronger association between the game and the watering of the mushrooms.

The irrigation mechanism consists of a wireless Arduino microcontroller that activates a small water pump that irrigates the mushroom colony for durations calculated based on the amount of child’s input speech. We use a mushroom colony developed by the Back to the Roots Company and designed for educational purposes [2]. We have chosen to use mushrooms as the living interface because of their relatively rapid growth rate that is suitable for engaging children (typically 6-10 days). The mushrooms are edible and can be consumed by the child’s family and friends after growth. Therefore, another aspect of the design is that it empowers the child through food production.

**An Edible Installation**

While Rafigh is primarily designed for speech elicitation and intervention for children with speech disorders, as an empathetic living media interface it can be used in other similar contexts.

The interface for the child consists of a game that requires him or her to say a specified set of exercise words and phrases so that the mushroom can be “fed”. We have set three levels for the amount of water to be administered to the mushroom based on how regularly and thoroughly the child repeats the set of exercise words and phrases: High, Medium and Low. For ethical reasons, we have set thresholds such that the mushroom colony will always live and grow no matter how little speech is used.

As an installation, Rafigh is displayed publicly to an audience who can interact with it by doing a series of exercises on the iPad. Upon the completion of each set of exercises, they get a message indicating that they have contributed to a score that determines how much water the mushrooms will receive. The volume of the water administered to the mushroom depends directly on how many people complete the activities. The mushroom will grow during the course of the installation. Visitors can check back to see how much it has grown and can, potentially, eat the fully-grown mushrooms at the end of the event. Through this mechanism, members of the audience collaborate with each other and contribute to the growth and well being of the mushroom.

**Design for Happiness**

Rafigh is developed using a holistic design framework inspired by the Bhutanese concept of Gross National Happiness (GNH) [7]. GNH emphasizes several domains for applications that can contribute to happiness. A key principle of the framework is to identify areas of positive impact a design can target. Thus, in our work we aimed to not only target speech intervention but also facilitate other important learning outcomes as
related to the user’s relationship with the environment and other living beings such as interspecies awareness, enabling care and responsibility and the empowerment of the child through food production for friends and family.

To inform the design, we conducted interviews with several Speech-Language Pathologists (SLPs) who work with children [4]. They mentioned that children are very interested in playing with digital devices and the SLPs sometimes use devices such as iPads to engage children in dialogue and speech. The fact that more and more SLPs use iPads and similar devices in their practice was an important motivation as the software can be installed on the devices they already use and are familiar with. In addition to these interviews, we observed several children and conducted informal interviews with their parents that informed us that they are generally interested in living beings and nature. These ideas inspired us to incorporate a living being into our design and make the child responsible for caring for it. While there is merit in including rewards such as badges and scores in games, we wanted to experiment with caring as a mode of interaction and the health of the living component and its growth as a form of alternative (possibly more meaningful) reward.

**Conclusion**

Rafigh is an empathetic living media interface for learning and therapeutic games. It consists of a living mushroom colony that grows as a user plays the game and its growth is affected by the amount of gameplay. By involving the care for a living being in the interaction, Rafigh, aims to explore the dynamics of caring and empathy during gameplay.

**References**


