

Small Trees, Big data: Augmented Reality Model of Air Quality Data via the Chinese Art of “Artificial” Tray Planting

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CCS CONCEPTS

• **Human-centered computing** → *Mixed / augmented reality; Participatory design;*

KEYWORDS

augmented reality; gamification; polyaesthetics

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1 INTRODUCTION

Our prototype app, Pocket Penjing, built using Unity3D, takes its name from the Chinese “Penjing.” These tray plantings of miniature trees pre-date bonsai, often including miniature benches or figures to allude to people’s relationship to the tree. App users choose a species, then create and name their tree. Swiping rotates a 3D globe showing flagged locations. Each flag represents a live online air quality monitoring station data stream that the app can scrape. Data is pulled in from the selected station and the AR window loads. The AR tree grows in real-time 3D. Its L-Systems form is determined by the selected live air quality data. We used this prototype as the basis of a two-part formative participatory design workshop with 63 participants.

2 OUR APPROACH: PARTICIPATORY DESIGN

We followed a participatory design workshop studies format, inspired by Gaver, et al.’s [Gaver et al. 1999] notion of open design approaches. Users had one week to use the prototype app, reflect on its design, and develop new design ideas. The researchers conducted a collaborative mind mapping exercise to capture emerging categories of users’ ideas using coogle.it during the reporting back. We also audio and video recorded the participants’ sharing and discussion of their design concepts for further analysis. The researchers conducted a collaborative mind mapping exercise to capture emerging categories of users’ ideas using coogle.it during the reporting

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3 GAMIFICATION; POLYAESTHETICS; AND SHARING

Features of the co-design can be grouped into three areas: gamification; polyaesthetics; and sharing, each of which deploys locally relevant imagery and/or activity to engage people with air quality. Participants expected the app to be more game-like, less a simple simulation. Froelich et al.’s sustainable HCI research into green transportation behaviors also found that, while they did not describe their product, the UbiGreen Transportation Display, as a game, many users interpreted it as one and expected more game-like features such as points and levels [Froelich et al. 2009].

More than two thirds (49 out of 63 total) participants designed features to increase the app’s game-like features and enhance social interaction (gaining tokens to enable delivery of seeds and flowers, FB sharing). Giving tree-related gifts, from seeds to a whole tree they had nurtured and pruned into a novel form were popular ideas, “I believe that the social functions are necessary. [...] Most importantly [the app] requires a “check in” function to share how my penjing has grown. This sharing with friends could be accomplished through third party platforms such as WeChat or Facebook. As I am spending effort everyday cultivating the tree, I wish my friends could see the [everyday] outcome of this effort.” S7, 19M, Civil Engineering.

Pocket Penjing’s users have multisensory involvement in AR [Froelich et al. 2009]. One participatory designer suggested using a finger snipping action to prune trees, and another suggested shading the tree by cupping a hand over the phone to literally cast a shadow onto the screen. These gestures typify the way AR use reminds us of our embodiment as we twist and turn our devices and bodies to see virtual and real worlds combined on screens. AR affords a sense of spatial and emotional immersion that has been described as “polyaesthetic” [Bolter et al. 2013] as it engages “multiple senses, and not only the senses of sight, hearing, and touch but proprioception as well” [Engberg and Bolter 2014].

The mind maps and transcripts of the presentations show numerous references to the desire for additional features that relate strongly to the local environment. This is in keeping with studies that show that we are disinterested in images of places and animals [Webster and Dyball 2010] that are not part of our everyday lives and that locally relevant images and cultural artefacts are more likely to carry scientific knowledge in ways we find engaging [Webster and Dyball 2010]. Half the groups (6 out of 12 groups, 28 out of 63 participants), suggested the addition of regionally-specific

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weather events and environmental conditions such as smog, typhoons, and heavy rain. Locally important, socio-cultural features were also suggested like this idea, “To encourage the players to interact with each other, we allow the players to plant conjoined trees. In Chinese culture it is similar to getting marr[ied to] the other players.” The participant referred to a particular phrase in a Tang Dynasty poem written by Bai Juyi, translated as “In heaven, let us be birds with shared wings and body, and on earth, let us be trees conjoined.” This combines two Chinese cultural notions, penjing and a Chinese idiom about intimate social relationships. We are now implementing the most popular of the participants’ ideas, some of which are shown in Figures 1 and 2.

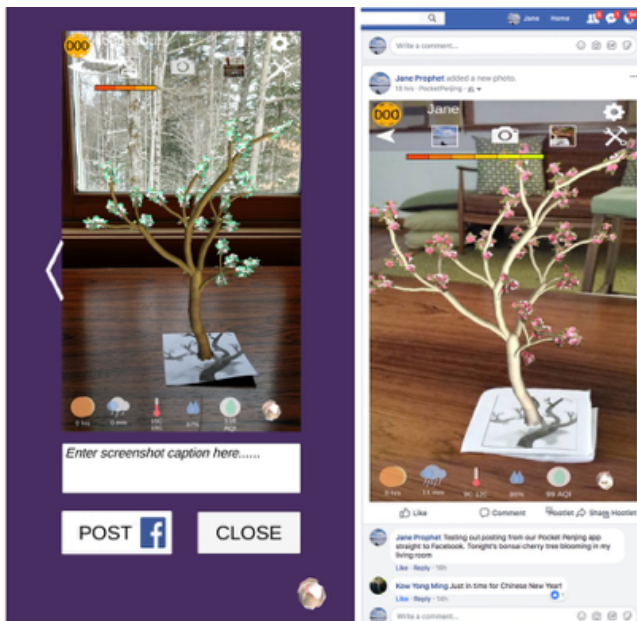


Figure 1: Left: new camera feature to create gallery, scroll through saved images and caption them for Facebook. Right: images are then immediately shared to Facebook.

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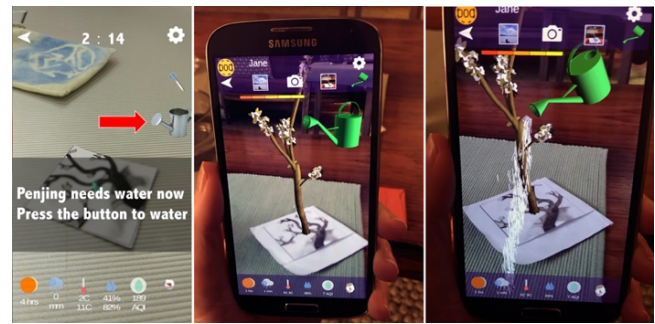


Figure 2: Left: participatory designer’s idea to replace tapping on icon to water tree with image of a watering can. Middle: our implementation, plus implementation of idea to render leaves brown to show dryness. Right: our addition of animated tipping of can and particle systems water.