CREATIVE ZEN LEARNING SPACE AND COMMUNITY

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We describe a creative Zen learning space built on interactive technology, digital art, and installation art, including three parts “zen_Sit,” “zen_Move,” and “zen_Circle.” It allows any place, any time, ubiquitous Zen – with mindfulness and meditation exercises for concentration, sitting meditation, and walking meditation. It supports the beginning of a digitally-enhanced Zen community.

PREVIOUS WORK

As mentioned above, interactive multimedia technology has been used widely in a variety of artistic, educational, entertainment, and industrial applications. (Space limitations prevent us from giving a full survey.) Particularly important for developing our work have been the technologies of chat rooms, smart phones, and wireless sensor networks.

- Chat rooms: Our creative interactive meditation space uses chat rooms as a simple solution to scalability and mobility issues in zen_Move. Chat rooms are fairly widespread across the Internet and serve a broad range of entertainment and information dispersal applications. Some exemplary application fields are defense; [1] entertainment; [2] and educational study assistance. [3] Below, we show how we used chat room technology to create a communication mechanism across a sequence of computers in the zen_Move meditation environment.
- Smart phone remote control: Our creative interactive meditation space uses smart phones as both remote control devices and to present interfaces supporting “meditation anytime and anywhere” in zen_Move. Control applications using cellular telephones have become widespread, through ad hoc Bluetooth networking, [4] and as remote controls for a variety of appliances. [5]
- Wireless sensor networks: Wireless sensor networks (WSNs) have been widely deployed in a variety of applications including national defense, health care, environmental monitoring, industrial control, etc., [6,7] but only rarely have found use in fine arts. A major exception is Intelligent Interactive Museum [8] which used ZigBee wireless sensor networks, interactive technology, and content management systems to create a museum environment which dynamically adjusted content according to participants’ gender and age. We used WSN technology in zen_Circle and zen_Sit.

Two notable applications of multimedia technology to support meditation are:

- The 2003 installation *ZENetic* Computer created by Japanese researchers Naoko Tosa and Seigow Matsuokam. *ZENetic* Computer transformed traditional meditation content into multimedia to teach meditation practices and guide participants to feel and learn meditation through computer systems. [9]
- *AltarNation* created by US artists Michelle Hlubinka and Jennifer Beaudin in the wake of the 9/11 terrorist attacks. The community created a multimedia prayer room in each member’s home and networked them together. Members could share thoughts and emotions with other remote members and console each other by lighting memorial candles, praying, etc. [10]

In contrast to the above systems, our environments teach mindfulness exercises via interactive meditation environments with a focus on walking meditation; with the ultimate goal of helping participants approach the ideal of treating every moment as a meditative moment.

ZEN_MOVE

zen_Move is an interactive installation environment installed along a corridor at DDBC that allows participants to use ten touch-screen computers to engage in a mindfulness exercise. As Fig. 1 shows, zen_Move is public installation deployed in a linear design with visual effect. As participants move from screen to screen to follow the exercise, they are encouraged to pause and practice mindfulness exercises.

SYSTEM AND INTERACTION SCENARIO

zen_Move uses a long wooden box embedded with ten touch screen computers, wireless network cards and a cover permitting ventilation and access for maintenance. Using a chat room as a tool to support scalability and mobility, we have built a smart-phone version of the application that can be exercised in any location, but further, it remotely triggers the installation.

Participants attempt to move a "Zen ball" (the red dot) along the basic line showed in Fig. 2. The Zen ball is surrounded by a traditional calligraphic Zen symbol representing emptiness – a circle which is the touch sensing area. The participant interacts with the Zen ball using a finger. This involves a careful exercise in which the participant must guide the Zen ball with a finger along a base line at a uniform rate without deviating from the line. After extensive experimentation, we set a time limit for movement on a single screen at 25 seconds. We calculate a focus index (using a function determined by statistical analysis and experimentation) from the horizontal movement along the baseline and any vertical offset from the baseline. The focus index shows how smoothly and accurately the participants manipulate the Zen ball. Depending on the focus index the participant can move the Zen ball (red dot), the dot will "jump" to one or more screens.

- The basic mode involves dragging the Zen ball (red dot) along the base line within 25 seconds. The focus index is calculated and the ball is advanced to another screen based on that focus index. The exercises ends when the participant reaches the tenth screen; when this happens, a traditional low Buddhist chime sound is generated, acting as a reminder to the participant and to all in the area about mindfulness. Because posture, smooth movement, and careful attention are required to succeed in the basic mode of zen_Move, participants find that it heightens mindfulness.
- The mobile mode extends the basic mode so that a participant can practice the mindfulness exercise anywhere using a smart phone. The smart phone acts as a remote control displaying a single screen of the full installation at DDBC (which reacts in real-time) to the exercises being driven by the remote user. As observers see the Zen ball moving without any participant at the installation, they can infer that someone is performing the mindfulness exercise remotely. Fig. 3 shows a participant using the mobile mode.

ZEN_CIRCLE

zen_Circle is an interactive installation environment that uses wireless sensor networks to help guide participants as they engage in various types of walking meditation exercises on a large outdoor mandala fashioned in the shape of two embedded spirals. Fig. 4 shows this zen_Circle; the installation environment plays natural sounds and brahma music to give feedback to participants as they engage in walking

meditation. zen_Circle encourages participants to take time to walk and to integrate meditative practices actively in their everyday movements. zen_Circle is public art deployed in a circle shape design with audio feedback to guide participants.

zen_Circle permits several types of meditation known as walking meditation, and uses wireless sensor network technology to support interactive feedback. The zen_Circle interactive installation environment encourages participants to take time to walk and think (or meditate) in face of a busy life. We believe that this practice will encourage people to adjust the pace of their life, to relax in movement, and experience the benefits of this form of dynamic Zen.

WALKING MEDITATION

To understand zen_Circle, it is helpful to have a little background on walking meditation. While sitting meditation is perhaps the most respected form of Zen meditation, ordinary circumstances often make it difficult; and walking meditation is an alternative. The theory behind this type of meditation is that movement can help stimulate insights and a meditative state.

Two types of walking meditation are supported by zen_Circle. One type is *jingxing*. This type of meditation uses slow walking with specific posture suggestions.

A second type of walking meditation is *paoxiang* – this is a composite form of meditation that includes *jingxing*. Paoxiang, which literally means "walking incense," is a group exercise – several monks, nuns, or lay people will walk in carefully coordinated sequence. Each participant must pay close attention to his or her movements at all times to avoid running into the person ahead, or creating a barrier for the person behind. Walking is divided into different phases – a slow walking phase (*jingxing*), a fast walking phase, and pausing phase. In classical technique, a meditation master guides the group by shouting out the different phases; in zen_Circle, signaling is given using sounds played on wireless sensor nodes attached to speakers.

SYSTEM AND INTERACTION SCENARIO

zen_Circle uses a double spiral laid out in the fashion of a large mandala (a traditional meditation tool associated with several forms of Buddhism and other Eastern religions) with five sensor nodes as shown in Fig. 4. In Buddhist thought, a mandala shows the cosmology of time and space. The zen_Circle interactive installation environment supports two modes. A simple switch in the control node shifts between basic jingxing and advanced paoxiang modes in the control node.

- *Jingxing* is the basic mode and supports a single participant. As the client sensor nodes detect that a participant is passing, they play sounds. The first sensor plays bird song, corresponding to the Buddhist "air" element. The second sensor plays the rustling sound of dry leaves, corresponding to the Buddhist "earth" element. The fourth sensor plays insect sounds, corresponding to the Buddhist "fire" element. The fifth sensor plays the sound of rushing water, corresponding to the Buddhist "water" element. The third sensor node has a special role, corresponding to the Buddhist "emptiness" element. The participant is directed to pause and meditate when he or she reaches the center. If the participant's meditation lasts longer than ten seconds, all the nodes receive a signal from the control node, and all the nodes play synchronized brahma music for as long as the participant remains at the center of the installation.

Paoxiang is an advanced mode for participants who have extensive walking meditation experience. This mode is designed for multiple participants, who walk in synchronized fashion, focusing their mindfulness on their movements. To achieve synchronized movement (and avoid collisions) careful attention is required. In this mode, the first, second, fourth, and fifth nodes each play natural sounds for ten seconds when they are activated – if they are reactivated while the sound is playing they continue playing and reset their clocks to zero as they count to ten seconds. The characteristic *paoxiang* movements (rapid walking, *jingxing* slow walking, and pausing) are controlled by the third node, which generates the different control sounds randomly for random durations.

Paoxiang meditation in general, and particularly *paoxiang* in zen_Circle, teaches a form of unity of thought, since the actions of each participant reflect on the ability of the group to successfully complete the meditation exercise.

ZEN_SIT

zen_Sit is an interactive installation environment built in inside a room that includes extensive wireless sensor technology to monitor posture of participants through pressure sensors embedded in the meditation cushions used by the participants in sitting meditation. Fig. 5 shows zen_Sit. Information recorded by zen_Sit is displayed in a ceiling display that shows meditators with stable, even posture using a large circular rippling wave. The Zen master leading a sitting meditation session can thus immediately diagnose any meditators who lack good posture. All the status data are stored in sitting meditation database. Alternatively, the information can later be used to analyze various states in long meditation sessions.

SYSTEM AND INTERACTION SCENARIO

We use several pressure sensors embedded in the meditation cushion. We also integrated low-power wireless technology (Zigbee) to transmit pressure values from the cushion to the coordinator (a personal computer), forming a wireless sensor network. The coordinator processes input data from Zen meditation cushion and performs real-time statistical analysis on it to calculate a mindfulness index. The mindfulness index is visualized as a ripple flash animation projected on the ceiling. A more active ripple indicates a meditator for whom the pressure sensors indicate a deeper or more effective state of meditation. This allows the Zen master to easily monitor the status of the individual meditator participants. We also develop a database for zen_Sit to record each participant's Zen meditation level showed in Fig. 6. Through the interface of the Zen database, both teacher and participant can check the participant's practice history and meditation levels.

ZEN COMMUNITY

In addition to these interactive installation environments, we are currently building several others. There are more and more people immersed in our creative Zen learning space. The system gradually and naturally forms a meditation community. We have used our systems to collect a wide variety of data through our existing installations. Researchers at DDBC are interested in the possibility of collecting and using data to investigate physiological and behavioral aspects of meditation practices. While previous studies have been dealt with sitting meditation practices, less data is available for dynamic meditation, such as walking meditation. Since our data is collected by sensors in a natural fashion, in the course of

the ordinary operation of our interactive installation environments, it could be especially useful for study.

Zen is not a mystical religious activity but an efficient method of improving human physical and mental health. People can do Zen exercises easily in their daily life. Be inspired by the idea of carbon footprint from environmentalism, we propose the concept of "Zen footprint": an index which describes the amount of Zen exercise to maintain peaceful minds. People who have a higher Zen footprint index are likely to have more peaceful minds. In zen_Move we will add up the total number of steps to calculate the Zen footprint. Similarly, in *jinxing* mode in zen_Circle we add up the total number of minutes that participants pause and think in the central node; in *paoxiang* mode, we collect the total number of the circles of the participants walking in the mode; in zen_Sit, we collect the total number of minutes that participants sitting with meditationpractice.

In the future, we will integrate the smart phone system , the interactive installations and Google Map to build a Zen map to show the footprint in different places. Zen maps will offer real-time feedback that adds a geographic dimension to web e-learning systems.

CONCLUSION

This paper makes a number of novel contributions:

- It describes our creative interactive meditation space which is also an intelligent, invisible, informative and interactive space.
- It uses technology to motivate participants to engage in "ubiquitous Zen" where people can engage in walking meditation at any time in a wide variety of circumstances.
- It presents the conceptual design of these interactive installation environments, together with a discussion of how interactive multimedia can (somewhat paradoxically) engage participants in meditative and mindfulness practices.
- It includes a discussion of the actual building of these interactive installation environments. These environments are not merely conceptual designs or prototypes, but real, working systems that are actively used every day.
- It includes a discussion of the real-world engineering issues faced in supporting mobility and scalability in these interactive installation environments.

In contrast to many interactive multimedia systems, we have found that the environments comprising our creative interactive meditation space actually decrease distraction and help their participants relax and make achievements in mindfulness and relaxation. The installations also act to help suggest to participants that Zen practice is available at any time, any place. The zen_Move interactive installation environment is always available for one to pause and engage in a mindfulness exercise even through the smart phone interface. The zen_Circle interactive installation environment acts as a reminder that meditation can be integrated with one's movements – even as part of one's daily walks. The zen_Sit environment provides real-time feedback for sitting meditation allowing a Zen master to more effective guide the meditator participants. We also hope to realize the concept of Ubiquitous Zen in a variety of cultural contexts and to support mind-brain cultivation.

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