

re-acT-able pH: polyphony * Heredity

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ABSTRACT

pH is a Smart Furniture that helps user relax. pH functions normally as a table but in the background, it functions as a sound playback device for better relaxation. pH operates according to user's context and has the generated sound transit depending on how much user "breaks in". If it settled in the place where lots of people come and go ceaselessly like a public space, it may develop into a new table which continues to create new sounds based on the surrounded guests' various way of situation.

Categories and Subject Descriptors

H.5.2 [User Interfaces]: *Auditory (non-speech) feedback*

H.5.5 [Sound and Music Computing]: *Signal analysis, synthesis, and processing*

J.5 [Arts and Humanities]: *Music*

General Terms

Algorithms, Design, Human Factors, Theory

Keywords

Interactive Art, Sensor Technology, RFID, Context-Aware

1. INTRODUCTION

In the future, furniture will not only have one superficial main function, but also carry a multitude of functions operated in background that will enrich the user's daily life. Based on the concept of Disappearing Computer [1] stated by Prof Mark Weiser, we define the furniture that has functions to fit in the daily life [2] and to enrich user's emotion as Smart Furniture.

According to the vision, we developed re-acT-able pH as a series of Smart Furniture for supporting relaxation (Figure a). To

support relaxation in pH, we adopted sound generation method of relaxation and that of context aware system. We realize the former by applying the study cases of acousticopsychology for pitch and tone of generated sound, and by implementing sound transition caused by "breaking in" the device with using hereditary algorithms. In addition, we realize the latter by bringing in the sensing system for periphery environment.

2. CONCEPT

We have a vision of the future digital contents including furniture, and pH is a prototype of one of them. In the future, furniture will not only have one superficial main function, but also carry a multitude of functions operated in background that will enrich the user's daily life. We designed to realize smart furniture that casually exist and enhance lifestyle and enrich user's emotion. 20th century style contents and digital furniture are - masculine, silently expressing its existence - is an exact opposite of a feminine existence. Our vision is a new way of content/furniture, in line with Prof. Mark Weiser's disappearing computer theory.

And another aspect is the idea that furniture has memories. Pre 19th century furniture carried with it, its user's memories embedded in a superficial, physical way, and the memories were transferred from people to people. In pH, the user's log of usage is stored in the system, and inherited as genetics. As the result of this, the sounds are generated with reflection of the usage and continue to change hereditarily. pH reestablishes the relationship between man and object, and the now so vanishing relationship between man and man through the relationship with object.

3. CHARACTERISTICS

We will state two essence of realization for supporting relaxation.

3.1 Sound Generation Method of Relaxation

There are various research works about the method of sound production for supporting relaxation in the field of acousticopsychology. Being different from conventional research work, the approach of this research work is that we model the classic relationship between man and tool, to make user feel affection for tools with spending long time, and apply for computing.

In addition to the approach of acousticopsychology for pitch and tone of generated sound, the main feature of this approach is the vision to support relaxation by forming intimacy like the affection of tools. "Breaking in" is one of the trigger to feel affection for tools. Generally speaking, there is a phenomenon that tools fit comfortably in user by "breaking in" the tools in his own way.

* "Breaking -in" in this line means as a phenomenon of sound change by user's instrument usage history in analog instruments, especially applied for strings instruments.

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Speaking of musical instruments, especially string instruments, you can recognize “breaking in” prominently. For example, the guitar and violin of tones change according to the decades of use and the habit of user. At the present day, there is a way to formulate the sound generation algorithm from physical model by extract the factors of sound formulation in specific analog instruments. However, we don’t have any research works for sound transition by “breaking in” the analog instruments.

In pH, we adopt the model of “breaking in” tools like analog instruments and develop a table which continues to change the generated sound. We try to make user feel affection to objects and form intimacy and support relaxation by adopting not only the acousticpsychological effect of generated sound but also the sense of “breaking in”.

3.2 Sound Generation Method by Context Aware System

To support relaxation, active involvement can be possible but not necessary. Therefore, we realize the system that is able to generate sounds according to the periphery environment of table including user, without user’s active input action.

Specifically, it generates sound based on the user’s condition around the table. If only one user is there, the system changes the sound in order to follow the natural physical actions like standing or sitting. When plural users are there, the rhythm and volume of conversation produce the sounds. We think that the system doesn’t need user’s intentional input action and can afford relaxation by generated sounds according to the environment.

SYSTEM ARCHITECTURE

Without the user’s active involvement, pH implements a system that automatically can generate sounds by sensing and analyzing the periphery environment. To be concrete, sound is played back using a context aware ball that moves on its own in reaction to changes in the environment (Figure b), some balls that integrated a RFID tag and 8 pads located inside the chassis. The pads consist of a pressure sensor and an RFID reader, and functions as an 8 step sequencer. First, a micro-computer integrated in the context-aware ball analyzes rhythm of conversation and changes the rotation speed and the direction of the motor in the ball. When a context aware ball moves around in the chassis corresponding to

rhythm of conversation and makes a RFID integrated ball touch a pad, the corresponding sequence to the ID is switched on. Each ball represents a different sound. If 4 balls of which each has single tone of drum, bass, synthesizer or high-hat are used for example, it means that the balls generates the sound real-time consisting of a sequence of 4 tracks * 8 counts.

We implemented the generated sound in pH to make users feel calm and not annoy. And we intended to make user enchanted temperately by constructing automatic polyrhythm corresponding to the number of sequences.

Also, pH accepts user’s original sounds through its sampling function and put them into the system. By putting message into sampling ball, user can use the same fragment sound of other RFID integrated balls. To be more precise, by putting message into sampling ball directly, user can use it like the same fragment sound of other RFID integrated balls.

Moreover, pH adopts a model of the way how analogue instruments change sound quality by "broken in". In detail, it realizes by accumulating the way of the ball’s touch to the pressure sensor in the pad as analog data and by data mining of those accumulated information in the system. As often as the system accumulates a certain degree of data to a specific pad, the system changes multiple parameters in the process of generating the sound corresponding to the ball’s ID and outputted sound varies gradually. By repeating these several times normally or many times if you need, sound track which has a unique transition with the user’s way oh use can have been constructed.

4. RELATED WORKS

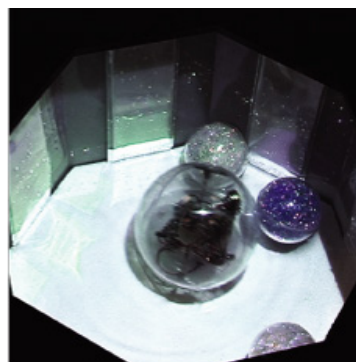
There are 3 main previous works.

4.1 Tangible Sound Systems

Examples include Music Bottle [5], Audio Pad [6]. Music Bottle functions specifically as a sound playback device and it is not possible to create sequences with it. Audio Pad can be used to create sound, but is limited to mixing. P+H has sequencing and sampling functionality that makes it much more interactive than any of these earlier systems.



a



b

Figure a: A whole image of pH which normally functions as a table.

Figure b: A context-aware ball and three RFID embedded balls

4.2 Playback Systems based on Voice Analysis

Examples include Suirin [7] and Voicecontrolled plucked bass guitar [8]. Suirin uses sounds from water and glass to create a sound that resembles a cricket, and focuses on making the user relax. However, it is not easy to require active participation from a user that wants to relax. Voicecontrolled plucked bass guitar has the same problem in that it requires the user's active participation. In contrast, P+H can playback audio in the background without active participation from the user by quantitative analysis of the ongoing conversation, and controlling the balls' movements with the acquired data. A multitrack polyrhythm generation and the synchronization of the rhythm of the self moving balls and the conversation presents relaxation to the users.

4.3 Physical Modeling

Examples include virtual violin [9], virtual drums[10]. These are both models that recreate real analogue instruments. There are two kinds of physical models: models that mimic build, and models that mimic changes. Most physical models are models that mimic the build of a physical instrument. P+H is a model that mimics the changes that occurs in the physical instruments, which points to the uncharted territory of changes in sound quality by "breaking in".

5. CONCLUSION

We developed re-acT-able pH as a series of Smart Furniture for supporting relaxation. To support relaxation in pH, we adopted sound generation method of relaxation and that of context aware system. We realize the former by implementing the model of "breaking in" tools. In addition, we realize the latter by constructing the system that is able to generate sounds according to the periphery environment of table including user, without user's active input action. Hereafter, we will try to conduct quantitative evaluation of relaxation and examine the effect of these approaches through evaluation experiment.

6. ACKNOWLEDGMENTS

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