

Design of *Reveal*: Transforming Sound into Multi-modal User Interface

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Abstract. Sound is a natural media for communicating messages and information. Technically, sound is sometimes used for giving meaning to graphics and images such as in animations, games and movies. The aim of this research is to explore the possibility of translating sound energy directly or otherwise into motions which can be relayed physically or virtually, for the purpose of fun and entertainment, robotics or as visual aids for the hearing impaired.

1 Introduction

This project emerged in the form of design contextualization dilemma in a project targeted at enhancing social interaction among Process Plant workers through tangible interface design. The concept of relaying alarms on the walls and ceilings via moving arms on a mobile device was proposed, because an effective way for relaying the alarms was focused upon as the most important way of supporting the daily tasks of this category of workers. Return to the users revealed that this concept would not affect their routine in any way, since it is only the uncommon alarms and what was learnt from the alarms towards building their own competences that depict the interesting aspect for their context; hence the idea of an interface, which can move relatively to sound rhythm, for the purpose of dissemination of information or for play was saved for future development.

1.1 Sound and its usage

Since it cannot be disputed that communication is the pillar of every forms of collaboration, cooperation and socialization, then the importance of one of the oldest natural way of communication among men (sound) cannot be over-emphasized. Sounds in different forms and rhythms can be employed to express feelings emotions or the situated state of mind of the transmitter to the targeted receiver. For example, the

way a man screams from pleasurable excitement, such as sports, is quite different from that of anger, sorrow or pain.

Rhythmical sound is often regarded as music and this is also employed for the purpose of revealing the state of mind or emotions; entertainment, education or to convey general or specialized messages. In the study of physics, sound is confirmed to possess convertible form of energy, e.g. sound energy can be converted into electrical energy, which could in turn be converted into heat or light energy. In this paper, neither the psychology of the use of sound for conveying emotions, nor that of the physics of sound energy will be dealt with in details.

2 Framing the Problem

Because the concept of translating sound energy into motion for play, learning or for aiding the hearing impaired, was not considered as one of the focus for situated intervention [7], at the commencement of the project leading to its discovery, it was a little difficult to contextualize [2] the design foci. As explained earlier, the origin of this research was informed by the stumbling on the concept of *Motoric Sound Display System (M.S.D.S.)* in the process of designing *Flashback*, hence it could be said that the design provoked the other line of research. Thus, the design approach can be said to be that of *research through design* [12]. The idea was later dissected and three major concepts emerged out of the two initial ones. These are:

- (i) *Robotic Mobile Phone (RoMP)*
- (ii) *Virtual Dance Programming (V.D.P.)*
- (iii) *Visual Aids for the Hearing Impaired (V.A.H.I.)*

These three concepts were further investigated in accordance with the research objectives: exploring the concept of M.S.D.S and RoMP for the benefit of the community, academia and the industry.

2.1 Methodology

The origin of *RoMP* idea is rooted in the *Flashback* project. The approach employed for executing the *Flashback* project was of two basic directions:

1. Concurrent ethnographic fieldworks [6], observations and interviews.
2. Participatory Design, which entails co-authoring of the emerging artifact through workshops and iterative [5; 1] refining of concepts by returning to the users.

After the conclusion of the *Flashback* project, the approach for the further development of the concept changed a little, due to limiting factors such as: availability of fund for the research, the absence of other stakeholders [1] other than the designer, such as a company or other design professionals interested in the project. The research became an individual's work, driven only by desire and passion. These factors

affected the methodology, hence the approach changed from direct physical contact, interviews and ethnographic field studies to web visits for history of dancing dolls, sign languages and sound equalizers; emails (e.g. to Valerie Sutton, the inventor of the sign language in Copenhagen, 1974) and Telephone interviews were the other tools tried in the process. The setback of this type of approach is the impossibility of evaluating the use context first-hand and hence having to rely on censored or exaggerated account from the informant, which is a factor of the background and emotional state of mind of such informant. This method can only be complementary to the former.

Reflecting [9] on the approach for the later aspect of the research in comparison to previous Participatory Design exercises, in which there was higher commitment from other stakeholders, revealed the following hypothetical statement, which could be applicable in most Participatory Design Practice:

The outcome of any Participatory Design exercise is a function of the number of different methods adopted, the available research funds and the length of research period, provided that the commitment of the designer is kept constant throughout the process.

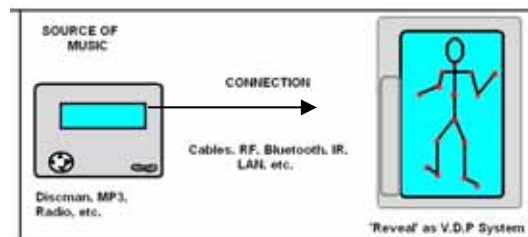


Fig. 1. The principle behind the operation of the *Reveal* for the Virtual Dance Programming (V.D.P.)

2.2 Robotic Mobile Phone (RoMP) concept

Why robotics in phones? Because every aspect of the human endeavors which have enjoyed robotic assistance had experienced advanced revolution. Take the case of car, plastics and microchips manufacture as examples: The entrance of robotics into these industries resulted in the astonishing results we are seeing today. The field of Medicine has their own stories about robotics too; so is geology, entertainment and many manufacturing and packaging industries.

The call for inculcation of robotics into mobile phones is informed by the reasoning that computer industry grew rapidly after it stopped being a secret machine for ballistic calculations in the military and the advent of the Personal Computers, which invited the involvement of every possible discipline into the innovation of the PC. The result is that computers kept on becoming more user-friendly.

By the same token, the case of robotics is gradually becoming closer to the homes, through programmable interactive toys, mostly in the form of cars, planes, boats, etc. LEGO is leading the way by coming up with the idea of LEGO MINDSTORMS, a

set of toy that is aimed at encouraging robots building, but they are bulky and not as easy to carry about as mobile phones.

Inculcation of robotics into mobile phone (One of the world's most popular personal computer) will not only increase the degree of fun people could have with their phones, but also encourage programming by all and sundry. This will encourage the development of more user-friendly programming languages, which in turn lead to more people programming without stress, since they are doing it for fun. The end result will be that people will stumble on many new uses for the computer, the robots and the programming methods. It will also lead to increased sales of phones and component parts (and accessories) which will be required to fulfill people's dream robots. Soon there will be competitions at various levels, where people will show their new creations. A new play has emerged!

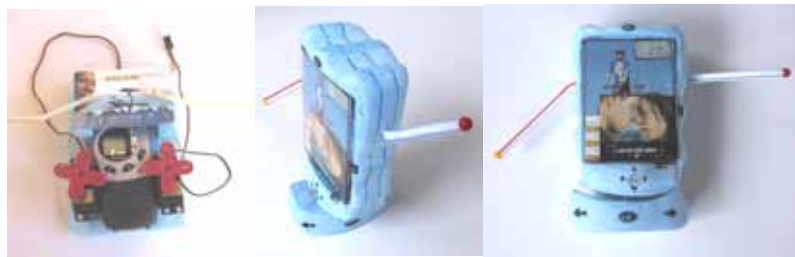


Fig. 2. Electronic prototype and mock-ups of the robotic mobile phone (RoMP) concept

2.3 *Reveal as Virtual Dance Programming (V.D.P.) device*

The idea behind this concept is based on the fact that since it is possible through the use of high-tech equalizers, such as the *Constant-Q Graphic Equalizers* and electronic filters [3] to resolve music into their component sounds; then it should be possible that certain selected, movable parts (*Hot points*) of the human body can be represented graphically and programmed to move with respect to the rhythm of a specific frequency or amplitude generated by the equalizer. This concept, if realizable, will make it possible for dances to be programmable for the purpose of training, fun or for learning and practice of dances. The device may either stand alone or be connected to existing music devices such as MP3 player, radio, Discman, etc. It may through this concept be possible for a lame person to experience the joy and elation of not only dancing, but winning dancing competitions, through their *virtual puppets*.

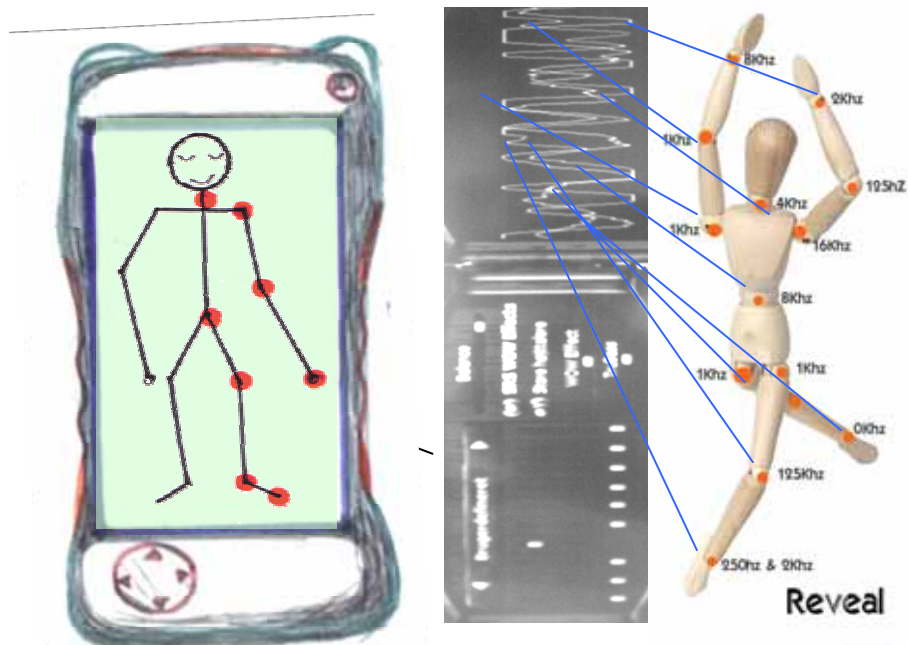


Fig. 3. Reveal relaying suggested hot points for the human body which is mostly used in dancing. The values are in Hertz (units) and it was obtained when a particular music was resolved into its most prominent component sounds and lyrics through the use of Graphic Equalizer. A dancer's movements in relative to the rhythm was associated with the specific values on the equalizer's ranges

2.4 Reveal as Visual Aids for the Hearing Impaired (V.A.H.I.) device

This concept draws on the potentials of the unfolding pervasive computing technology to propose that it should be possible to translate spoken words into readable sign language via networking the device with the *Sign Bank's websites*, through the WAP or Internet access available in the present day mobile telephony. Coupling this technology with good *Voice Recognition* technology could make it possible for an untrained person to hold private telephone conversations with a hearing impaired family member, friend or business associate without the invasion of their privacy by a third party helping with the interpretation as is the case today. The reverse may also be possible, wherein sign languages will be processed to arrive at the other end as verbal messages.

4 Conclusion

All the three concepts mentioned in this paper, though connected to sound could each be independently developed further. The purpose of this paper is to bring these concepts out for evaluation and critiques, which will guide future works on the concepts. This is not to say that the concepts have been considered feasible or complete, but this paper should be seen as a form of setting the ball rolling in this direction to see what benefit the concept can bring to our community, the industry and the academia.

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