Body Mnemonics

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ABSTRACT
Body Mnemonics is an interface design concept for portable devices that uses the body space of the user as an interface. In this system information can be stored and subsequently accessed by moving a device to different locations around one's body. The system is designed to ease cognitive load by relying on our proprioceptive sense, vibrotactile feedback, and the use of the body image of the user as a mnemonic frame of reference. Feedback from interviews conducted while developing this system suggests that the body view is a very personal artefact and that it is rich in meaning. It therefore has the potential to serve as a powerful memory aid. We are currently integrating an inertial measurement system into a portable device to enable us to conduct studies to validate our approach.

General Terms
Design, Human Computer Interaction.

Keywords
Portable device, proprioception, spatial interaction, ubiquitous computing

1. INTRODUCTION
Body mnemonics began as a interaction design proposal at the Royal College of Art and a working prototype is currently under development at Media Lab Europe. The project explores a novel interaction paradigm for portable devices that has wide-ranging applications. It is intended to improve the usability and reduce the attentional load of mobile interfaces. The mobile market is rapidly expanding and novel interface designs addressing the specific problems of the field are likely to find immediate real world applications.

Initially, the project examined the potential for a spatial interface from a psychological perspective; whether or not it makes sense to a user. The second stage is currently under way and is concerned with a technological implementation and validation of the system. The final stage will involve a number of evaluations of the system in a real world context to establish the appropriateness of our design.

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2. DESIGN CONCEPT
Body Mnemonics is a project that continues the work conducted by the primary author exploring embodied interfaces; using the real space and the body of the user. Interface design for portable devices is an ideal challenge for this approach, as the perceptual bandwidth [1] provided by the physical design of the devices is very limited. It typically comes in the form of a small touch screen, a few buttons and low quality audio output. Exacerbating this problem is the fact that portable devices are often used in situations where the user is simultaneously engaged in other cognitive tasks. Consequently, it is desirable to reduce the attentional requirements of the interface.

The fundamental concept in Body Mnemonics is that information can be accessed and stored in the space defined by the user's arm's reach - known as the reach envelope[1] - by moving a hand held device as illustrated in figure 1. The concept is very similar to a traditional desktop metaphor, where objects can be moved and activated with a cursor.

Using body space, however, has several advantages over on-screen interface in mobile scenarios. Firstly, the dimensions of the portable device limit its screen size. Expanding the working space to the reach envelope has the potential to enable direct access to significantly larger amount of data [2].

Secondly, the movement of one's hands in the body space can be perceived through the proprioceptive sense, our innate awareness of the position of our body and limbs [3]. This activity can take place in the background of our awareness and frees our vision for other tasks.

Thirdly, body image, the cultural construct through which we view our bodies, can be used as an aid to the storage and subsequent recall of information. This rich wealth of symbolism is influenced by factors such as up-bringing, education, constitution, body decoration and different hobbies and skills.

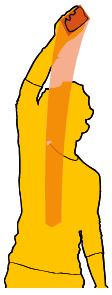

Fig. 1 Moving the portable device in one's hand to activate and store different information.

For example, the associations that might be meaningful to a skydiver, used to finding critical controls on their chest could differ radically from those of somebody with a tattoo in this area. A doctor with detailed anatomical knowledge might have yet another association.

Finally, body image can be related to the mnemonic device known as the method of loci [4]. This millennia old technique uses space to organise information and distribute memory. The memorised material is associated with different places and objects in an imaginary or real space. Journeying through the space is a key to the recall of the material. We propose that the body space can be harnessed in a similar manner, using different body parts as mnemonic cues to help access information.

3. INTERVIEWS

In order to gain insight into the validity and feasibility of this approach, preliminary interviews and questionnaires were conducted in the Royal College of Art to investigate the different mapping strategies that people might develop. The interviews were relatively unstructured, representing our desire to explore the conceptual space of the project. 10 subjects were interviewed face to face in either one or two sessions and questionnaires were sent via email to 35 individuals. 15 replies were received. All the participants were experienced computer users and were between 21 and 38 years old. In all cases participants were asked what applications, urls or other data they would store on their body and where and how they would position them. They were also given a more specific task; to distribute their personal phone book entries within their body space. The replies received were very varied, concentrating on many different forms of content and revealing four basic mapping strategies: *emotional, associative, functional and logical.*

3.1 Body mapping strategies

Emotional mappings tapped into the culturally shared symbolic perception of the body and resulted in such structures as "*husband and children in the heart area*" and "*my dad by my head cause he always knows best"*, reflecting the personal meaning of the stored information.

Associative organisations were based on the same kind of emotional history but were connected to specific past experiences, and hence made sense only to the individual. For example: *"my sister and my close friend [I would store on my neck], because they gave me necklace and pendant separately but I always wear them together*".

Functional mappings were connected to specific tools or to ergonomic or behavioural characteristics of the body. For example: *"MP3 archive to my left ear", "to-do-list to the back of my head, because I scratch my head when I try to remember"*.

Logical mappings treated the space as having some associational starting point, and then built complex information in relation to it. For example, *"Right side is generally the more logical side, analysis, work etc. and left the emotional and fun side. My dad would go to the right side of the head, mom on the left, and sister somewhere around the head too, as they together form my family."*

During the face to face interviews whole body maps were composed around a specific content arrangement task. These described the associative maps of a variety of domains including music genres, application shortcuts, phonebook entries and bookmarks. Typical arrangements are illustrated in Figure 2.

Even though the association tasks in the study were conducted as mental exercises only, and hence lacked the depth and environmental influence that real life usage of the system would provide, the results were strongly suggestive that the body could serve as a versatile canvas on which to store information.

An underlying trend was that certain body parts possessed a strong association with a specific person or function, and this would set the frame of reference around which related information would be stored in a logical or spatial framework, using top-down or left-to-right symmetries, circular envelopes or the body shape.

Two participants in the study felt that using the body as an interface was not appropriate. One saw the method as cumbersome, and the body lacking relevant associations to the kind of content available on a portable device. The other was concerned that the body would form an overly emotive frame of reference. Arranging the contact details of one's acquaintances on the body might convey too open and strong a statement about his or her interpersonal relationships.

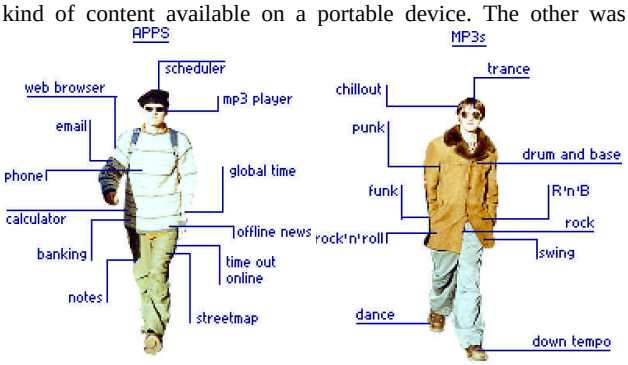

Fig. 2 Example body maps organising music archive according to genres and applications by function.

4. RESULTS AND FUTURE WORK

The interviews and questionnaires conducted suggest that the human body can provide a versatile associational space for meaningful organisation of a variety of forms of data. The range of different strategies reported in the study also supports our hypothesis that the body space is a very individual culturally defined construct, and thus can provide a highly personalised and meaningful interface. Further studies are needed to establish to what extent the associational process works in relation to personal experience and to what extent there are universal guidelines according to which data can be stored.

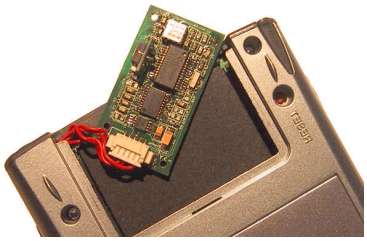

Fig. 3 Three axis inertial measurement unit developed to detect the motions of a HP Jordana PocketPC.

More importantly, however, we are currently working on building a functional prototype of the system using inertial sensing [5]. This is shown in Figure 3 and will enable us to begin empirical evaluation of our design. Only through real life testing can we establish whether or not this novel application of body space perception provides real world usability benefits

5. ACKNOWLEDGMENTS

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6. REFERENCES

[1] Biocca, F., A. Tang, and D. Lamas, *Evolution of the Mobile Infosphere: Iterative design of a high infomation-bandwidth, mobile augmented reality interface.* 2001.

[2] Yee, K.-P. *Peephole Displays: Pen interaction on spatially aware handheld computers*. in *CHI 2003*. 2003. Ft. Lauderdale, Florida: ACM.

[3] Goldstein, E.B., *Blackwell handbook of perception*. 2001, Malden, Mass.: Blackwell. xii, 788.

[4] Yates, F.A., *The art of memory*. 1966, London,: Routledge and K. Paul. xv, 400.

[5] Benbasat, A.Y., *An Inertial Measurement Unit for User Interfaces*. 2000, MIT.