

# Human Data Highway: The Integration of the User and Environment into Computing

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## ABSTRACT

In this paper, I focus on the impact that intra-body communication systems may have on human and computer interactions. Intra-body communication is a near-field connectivity network, in which human body is turned into a data transmission path between two devices. An example of this technology is RedTacton. Yuichi Kado, leader researcher at Nippon Telegraph and Telephone Co., called it a Universal Interface, because it uses human actions to trigger the beginning and end of the communication process of the system. Therefore, I will discuss potential applications on Human-Computer-Interactions (HCI) systems and their direct repercussion on the pairing of environment, computing and users. In particular, I will focus on two issues I consider essential to understand when designing a human-computer interface: i) the concept of seamless communication between computing and humans, that means the coupling of a complete system: environment, computing and users; ii) the notion of universal interface in terms of objects physical affordance and the connection of body and existent behaviours. There is a long way to go before this embodied technologies become part of a normal routine, however what would it take to make them real?

## Keywords

Intra-body communication system, Universal Interface, Seamless, Communication, Design.

## 1. INTRODUCTION

Looking forward to the future of HCI, designers have taken different approaches to a seamless communication between humans and technology. The main focus is moving computing from screens and graphical user interface to more intuitive interactions [5]. In order to make computing seamless and invisible to us, it is necessary to embed our bodies into the physical environment and computing. Nonetheless, it is important to dismantle this concept into pieces, because even if the bodies are integrated into a system, it does not imply that there is a successful link between action and function (Figure 1).

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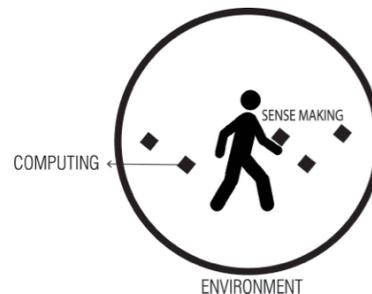


Figure 1. Integration of computing into the environment

The RedTacton system is a near-field connectivity network, similar to Bluetooth, infrared and radio frequency ID systems[11]. With help of a transmitter, the human body works as a path where information is conducted to another device (Figure 2).

For instance, a transmitter embedded in a phone carried by an employee, close to the body, sends a signal that is processed by a receiver built into the door knob, opening the door with a simple touch without need of an identification card. This system propose to integrate human 'natural actions like touching, grasping, sitting, walking, stepping on something or kicking' [6] to a physical environment where transmitters are located in particular places to enable communication with computers only by a simple touch.

This phenomenon could open a spectrum of new possibilities for designers in the field of User Interface (UI) and User Experience design (UX). However for it to succeed, another essential of user understanding have to be considered, which will be the key aspect of my analysis. Authors, as Goldstein, had already traced one of the problems in this matter, mentioning that this technology solves problems already solved [2]. Therefore, I will discuss the relevance that intra-body communication systems, namely RedTacton System, have in this matter and what are implications of the use of this new technology.

Further in this paper I will describe some applications of this technology in HCI systems. I will discuss how RedTacton approaches the concept of seamless communication and universal interface from my perspective. The intention is to create a better understanding of how designers could achieve to design successful interactions in the field of communication between users, interfaces and devices.

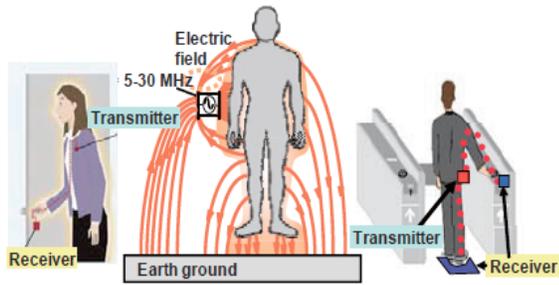


Figure 2. Intra-body communication system.

## 2. APPLICATIONS

Yuichi Kado points three main features that allow RedTacton technology be applied in different circumstances: i) natural actions trigger the operation of devices ii) there is no interference that allows keeping the communication speed, even when many people use the system iii) any material with a highly conductive surface can be used as part of the system, clothes, shoes, tables, etc. could build together a communication path for information [6]. Knowing this, several applications could be envisioned where diverse elements of every day life are pulled together creating a new form of interaction.

One potential application could be the intensified use of wireless exchange of information. Tables, walls, floors can work as transmission channels. For instance: one can access to Internet by placing a laptop on a conductive table [11]. Or a transmitter could be implanted in a wood-floor and just by stepping on it and holding a mobile phone, the user would have instant access to Internet on it. Therefore any conductive object could be turn into a transmitter or receiver of information, this would cause a change in the way physical objects are perceived.

In a business environment, just by shaking hands two people could exchange business cards, all the information could be stored in a mobile phone. The updating of information in personal electronic devices could be done through intuitive actions. Additionally, when arriving to an office just by touching a device, all the information could be synchronized according to every user's own needs, like log into webmail, update of news, access to databases, etc. eliminating the requirement of it being configured or registered in advance [11]. Security access installations, MP3 player with wireless headphones or automatic payment methods in metro stations are some other examples of the possibilities this technology offers [2]. One question that needs to be asked, however, is whether the development of this technology is driven by the intention of satisfying or solving current or future human needs or if it is mainly based on the achievement of a technological development. Engineers could come up with multiple applications for this technology but I consider it is indispensable to pay attention to the implications of using such technology. Besides its technical advantages, the use of this technology must answer the question of how is it better than what we currently have? Hui recognizes the power that connected devices have in designing interaction since they create richer and more meaningful experiences with the user. However 'that direct relationship requires the voluntary exchange of personal data and some loss of anonymity – and the benefit of that exchange in value must be clear to users' [4]. So far the value of the technology lies in the novelty of it, but in order of it to truly emerge, it needs to take into consideration some of the following points.

## 3. SEAMLESS COMMUNICATION

When discussing about seamless communication in technology, different points of view could emerge. From a more technical point of view, the word seamless could mean an interrupted frequency signal with no-interference. If it were referred from a designer point of view, it would be mostly related to the integration of all functional elements in an invisible interface to the user and if it were seen from a user perspective, it would be frequently related to the execution of an activity without internal or external interruptions or difficulties [13]. Nevertheless, for this paper my interest lies in the last two concepts: the integration of all functional elements and the execution of an activity without interruptions. I will discuss how the body creates a bridge that connects users and computing in a seamless way.

RedTacton combines the user, the environment and computing in one interconnected system of communication, it does not isolate computing from the rest of the space as traditional GUI, it turns the body into an input device. In my opinion, the strongest advantages of this product that enable a seamless experience between computing and body can be discussed under three notions: First, the incorporation of everyday objects into the computing system, by reducing the use of external physical input devices, activities become easier and effortless since they are activate through human actions. Interaction with electronic devices is simplified and standardized based on human movements; it means that specific intuitive actions inside the workflow (when correctly identified) could be transformed into trigger actions, coupling existing pattern behaviours to new meanings. Second, the more external devices are needed to accomplish a task, the more complicated it becomes. Having cables and wires commonly is associated with the opposite idea of seamless, therefore no requiring any physical item to establish communication with a computer or even no need of a key to unlock a door might give a stronger impression of continuity. A seamless experience is built based on the concept of using the body as a mean to conduct the direct communication between devices. Third, the environment and computing are linked through the body. Our surrounding is integrated to the digital world, thus the world itself is transformed into an interface, in which all kind of elements as structural, architectural components and physical objects have a relation with digital information. The concept of a seamless interaction is easily achieved as those elements have already been created to fulfil human requirements and have been adopted for a long time.

## 4. UNIVERSAL INTERFACE

Intra-body communication systems could be called universal interfaces for the simple fact of 'linking the user's own actions with the starting and stopping of communication' [6]. There is no need to decipher complicated graphical interfaces; instead a movement could be enough. This is one of the biggest challenges of this technology, for instance, if a traveller is in an unfamiliar country and has to access to an ATM or a computer in a cybercafé, the barriers of the language and the diversity of GUI would be overtaken, just by touching the device tasks would start. It avoids difficulties understanding the digital representations of software and hardware, which are commonly based on the designers own perspective and not in every users reality [1]. The challenge is that when the physical graphical interface disappears, it leaves the user without any physical clue of how to interact with the device; consequently the interface has to become easier to use cognitively speaking. I consider that interfaces within this kind of system need to be designed focusing on meeting people's social

and cultural attributes as well as cognitive and perceptual features in a situated environment.

Another aspect I would like to consider while evaluating the term 'universal interface' is related to the way the everyday world would be experienced if this technology were adopted. One theoretical issue that has dominated the field of design for many years is the inherent meaning of objects to users. This perception of objects is known as *affordance*. In the field of design, various definitions of affordance are found; nevertheless the term tends to be used to refer 'to the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used' [9]. Generally speaking, a table is understood as an object in which one can place things on top, in which people stand/sit around it and so forth. But if RedTacton enables the table to turn it into a transmitter of Internet signal, it will not be perceived the same way anymore. A redefinition of meanings would need to happen since 'what an object is depends on its use and the perceiver's frame of reference. The same is also true for how objects relate to the body'. [12] Following this definition, the everyday objects would need to communicate more than they do now in order to become a universal interface. Here is where designers play a big role in the embrace of new HCI interfaces. RedTacton will not become universal until every user will be capable of knowing which objects -or even humans- hold a transmitter or receivers within itself. The question that raises here is: What attributes of an object or space could communicate to users connectivity? The most common approach would be the use of materials and icons to identify elements with a receiver. I consider that the acceptance of this concept would be directly linked to the successful communication of this quality of connectivity to users. 'Affordances provide strong clues to the operation of things' [8]. Therefore even if natural actions trigger the functioning of a device, the device itself has to communicate enough to start a conversation with the user. What would happen if someone steps in the wrong place and his/her information is already gone?

Having defined what is meant by affordance, I will now move on to discuss the cultural role of the body in this interaction. As explained earlier, RedTacton allows transferring data by shaking hands or touching. In spite of the new improvements in technology, it is important to make sense of it as part of a situated world. Touch has a powerful and varied meaning in sociocultural contexts. The body movements and expressions while greeting are full of meaning; it is part of a small ritual. For instance, 'In some countries such as Turkey or the Arabic-speaking Middle East, handshakes aren't as 'strong' as in North America and Europe. A grip which is too firm will be considered rude' [7]. Other countries consider impolite shaking hands between men and women, therefore, how could this technology overcome cultural barriers to become a universal interface that could be used by everyone? Would handshaking become more intimate with this technology than it is now? Through a touch, people would be giving access to personal information to others.

The physical gestures and movements can decide what people share; the use of tools -or external artefacts- is replaced by intuitive and common actions. If those tools changed the way users encounter the world, the body would do it now, thus it would change the way users engage with the world and the way it is perceived. The thinking process will become stronger in the body than in the mind or objects, as opposed to others theories of cognition, where thinking just happened in the brain.

## 4.1 Mind and body as one entity for better coupling with technology

The notion that mind and body are separate things, would represent a barrier in the fully exploration of this technology. Merleau-Ponty made a difference between the objective body and the lived body, being the second one a 'medium for having the world' [8] opposite to the mind-body dualism of Cartesian theories, where the body is simply situated in a world and is unable to think. When implementing intra-body communication systems the body becomes a peripheral of computing and the relationship of perception and action should become stronger and closer to the world. 'Users do not have bodies; users are living intelligent bodies' [12]

The body helps users to make sense of their surroundings; human body has always a reaction towards the world, some of these reactions are imperceptible and others are more obvious, such is the case of bodily movements. Movements made on purpose are what enable users 'to step out of habitual behavior and use the body to communicate and explore alternative courses of action' [12]. A key feature that systems and objects using intra-body communication technology should have, is the direct coupling of spontaneous movements with the system feedback. This feedback has to be clear and easy understood by the body itself. Understanding the role that body has in Human-Computer-Interaction as a part of sense making is decisive for creating a real universal interface.

## 5. DISCUSSION

As pointed out in the introduction to this paper, this technology has to encompass different aspects to suit human's needs. Yuichi Kado believes in the potential of this technology, whereas Harry Goldstein believes that RedTacton 'has no compelling applications that aren't already available (...) and it will likely face perception problems among the general public' [2]. But instead of defining this technology as redundant, it could be seen as a frame of reference to develop new concepts and a better understanding of digital communication systems. Some gaps are still missing in that process, such as continuity among devices and user-friendly universal interfaces. RedTacton could be a tool to solve such problems if designers are able to decode the social and individual patterns of interactions and are able to grasp the complex relationship of a situated body in computing sense making.

Some authors strongly suggest that it is necessary to evolve from just haptic interactions to more comprehensive schemes. '(...) We have to move beyond ideals of meeting human sensor motor skills and somatic sensing, to include among others the human intellectual capacity to grasp and make sense of complex, contradictory and even ambiguous systems and situations' [9]. Intra-body communication system challenges the routine with a simpler interface coupling body with the external world systems. These systems are already established and in order to be accepted, they have to be intuitive and immersive, people need to be integrated in the developing process of these technologies. It is important to point out that for some products the incorporation of this technology on them could be a natural transition, for example its use in wireless headphones; on the other hand, for others it might represent a bigger challenge, specially in larger systems, for instance: systems for controlling the access to metro stations or airports.

## 6. CONCLUSION

This paper seeks to address the following questions: Is our body the best tool to communicate directly with electronic devices? How systems have to be designed to have a better coupling between users and technology? Since most of all the publications of new technologies are technical based, the purpose of this paper is to create awareness of new incoming technologies and how designers could benefit from it. Features of human social cultural context need to be understood for developing concepts that fits the needs of specific scenarios and users. This paper has explained the central importance of creating a new interface that aims to achieve a seamless communication between devices and humans, as well as the importance that design has while creating such interfaces to make them user-friendly and easy to embrace for users.

There is a long way to go before users can radically adopt and appropriate a new system structure as RedTacton. Therefore, more research on this topic needs to be undertaken to take advantage of all the benefits of this technology.

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