Touch as the act of signification; naming as a key design concept for gesturally intuitive interactive space.

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The act of naming, where sign and the signified are coupled as an act of touching, establishes the foundations for the meaningful use of language. The computer, a language machine, possesses the capacity to input sensory data from the physical environment where signification occurs. To design a computationally extended sensory environment with intuitive gestural interaction will necessarily then have touch as a foundational factor. The universal element in such systems is language; the specific is the context of place, a space where the significating action of touch occurs.

When Bolt (Bolt 1980) presented his landmark gesturally interactive multimedia work *Put that there*, it assumed that the user saw *what* it was he wanted placed and *where* it should be placed. Intuitive gestural interactive environments are, however, not so straightforward and such assumptions not clear; where things are and what they in fact mean has been a significant design problem for human computer interaction (Quek, McNeill et al. 2002). The cause of this sensory disorientation is the result of a confusion between physics and aesthetics, a matter that the 19th century philosopher Croce(Croce 1995) went to some length to describe, presenting it as a perennial problem of perception. Foucault(Foucault 2004 original 1966) describes sensory dislocation occurring in an earlier epoch of European history in the transition from the medieval to the picture inventing Renaissance where spatial and temporal difference became acute. He states that

> ...language was never anything more than a particular representation (for the Classics) of signification (for us). The profound kinship of language with the world was thus dissolved. The primacy of the written word went into abeyance and that uniform layer, in which the *seen* and the *read,* the visible and the expressible, were endlessly interwoven, vanished too. Things and words were separated from one another. (Foucault 2004 original 1966)

For the contemporary period, it was McLuhan(McLuhan and McLuhan 1988) in his *Four Laws of Media* who explained how the electronic acceleration of media forms causes the space of communication to reverse and invert causing the pre-existing arrangement of sensory

perception to be challenged. In telematic communication, where one virtual environment is connected visually with another virtual environment, the high levels of electronic signalling de-contextualise environments and their established 'natural' meanings. Suchman's (Suchman 1987) work on this problem at Xerox Park was significant in this regard, describing the problem as 'situated action', analysing user's dialogue in an attempt to establish user intent with machine processes; that Suchman often focused on *dialogue* was significant in that verbalised language was understood as a the site of human-machine communication, pointing to the process of signification as a solution.

Examining the foundations of computer design, it follows logically that artefacts of language should emerge from the machine's continued evolution. The principles for electronic signal processing devised by Weiner at MIT in the 1950's clearly indicate that his work was modelled upon human principals of signal processing. He states that:

> When I give an order to a machine, the situation is not essentially different from that which arises when I give an order to a person. In other words, as far as consciousness goes I am aware of the order that has gone out and of the signal of compliance that has come back. To me, personally, the fact that the signal in its intermediate stages has gone through a machine rather than through a person is irrelevant and does not in any case greatly change my relation to the signal. Thus the theory of control in engineering, whether human or animal or mechanical, is a chapter in the theory of messages.

And further that:

> ...it is my thesis that the physical functioning of the living individual and the operation of some of the newer communication machines are precisely parallel in their analogous attempts to control entropy through feedback(Wiener 2001)

According to Weiner then, what you see should be what you get even when using technological extensions, but this is clearly not the case. The tendency in the search for solutions to the problem of intuitive gestural interaction was to opt for mapping; the massive presence of data lent itself readily to this conversion. Mapping however, does not account for spatial and temporal differences. Chadabe (Chadabe 2002), a pioneer of electronic musical and instrumentation where intuitive gestural interaction in sensate environments is a key design challenge, states the problem of temporal and spatial separation succinctly:

> ...mapping describes the way a control is connected to a variable. But as instruments become more complex to include large amounts of data, context sensitivity, and music as well

> as sound-generating capabilities, the concept of mapping becomes more abstract and does not describe the more complex realities of electronic instruments. Deterministic instruments include simple and derivative instruments such as electronic pianos, for example, but the category also includes complex and original instruments, where a performer for example, might use a multitude of touchpads or other devices to control the variables of probalistic expression, that automatically produce micro-events in the resulting music (Chadabe 2002).

Using language and touch as the act of signification goes directly to the crux of this problem; the semiotic notion of the *enunciation {Greimas, 1979 #586}* the spoken word, its instantaneous ephemeral presence in the present, stands diametrically opposite to the storage of data. Touch as a process of signification simultaneously resolves spatial and temporal disorientation - the micro event - in that an action of signification establishes linguistic co-ordinate values in a given moment and a given place with representations that are computationally and culturally useable. It is not so much a case of 'put that there' but more a case of 'this is called "X" and it sits here and this is how I use it'; these are the facts that significating touch can and should record.

To understand 'where' things are and how they might be used once communication artefacts are connected electronically can be classified into four categories describing how Cartesian coordinate geometry of mapping changes in electronic communication contexts. These are *reflected cartesian*, *reversed cartesian*, *accelerated cartesian* and *etheric*. These distinctions allow designers to begin to resolve some of the confusions that may affect aesthetics as the result of a physical limit being reached. This will be termed the *Threshold of Real Perceptions.*

Firstly, *reflected cartesian*: a version of the real world, the user looking into the outward looking infinite visual plane of landscape. This is an electronic version of perspective drawing, as invented during the European Renaissance (Field 1997), to which we have become accustomed to as an accepted cultural artefact. This relationship is that which we experience when looking into a desktop computer screen where graphics readily appear. Sensory integrity is continuous and uninterrupted; what one sees, hears and does are in unison and there is no challenge to known and learnt perception of the real world. Relationships with real objects are readily designable in this context of electronic communication.

Secondly, *reversed cartesian*: this is sensory perception that looks *into* the human body or object as an infinite landscape. Here information is structured according to specialised, biological categories, sensory perception structured according to these needs and mapping the inside world of the human or of matter as if it were the outside. The problems

encountered in such works are ones of orientation where the landscape must be signified from scratch.

Thirdly, *accelerated cartesian*: such systems are highly problematic in that sensory perception begins to diverge, and perception does not always correlate with known or learnt representations of the real. For example, Virtual Reality (VR) goggles with their separated visual world were not always in accord with what one touched. The earlier discussion on mapping and musical instrumentation is applicable here also.

Fourthly, *etheric*; this is what occurs in telematic communication where there is communication between one virtual world and another, with no real referent for the users. This is a highly problematic realm as context for communication in real terms is difficult to establish. All markers are virtual; all signifiers of communication are mobile and open to definition and re-definition.

Often, sensate environments are combinations of more than one of these categories. These four states can be tabulated as such:

category	conditions
Reflected Cartesian	Real world on screen
Reversed Cartesian	Internal world of perception
Accelerated Cartesian	Perception diverges: sensory ratios disordered
Etheric	Virtual representations only: no relationships to real environment

Figure 1. Threshold of Real Perceptions

One interactive work in particular by Char Davies (Davies 2006) *Osmose*, is noteworthy for its innovative solutions. This work, a reversed cartesian work - in that it *looks* inwardly - has successfully achieved to signify values in microscopic and aquatic worlds through touch. Herself, a scuba diver, Davies object was to create the underwater experience of scuba diving in an interactive work. To do this Davies used a sensor chest harness that responded to a user's breathing and moved the screen avatar up and down, left or right, within the depicted underwater or mineral environment similar to what happens to a diver in that the when lungs are re-filled with oxygen the body rises and when the lungs are expelled the body falls. The user straps on a harness and through their breathing progresses the avatar through the virtual worlds.

What makes this work notable is that it has utilised *touch* to signify the intention of movement in these worlds, the touch connection occurring at the level of the breath and its associated epidermal and muscular movements. The qualitative experience of the seen metaphor are fixed, but it is the sequential measurement of breathing that establishes values of movement within this world. The lungs touch space, so to speak, through the interface. Hence, *the intention to signify* as touch has been utilised to create perceptual navigation of the avatar. A map of the geography to touch/move through is as follows:

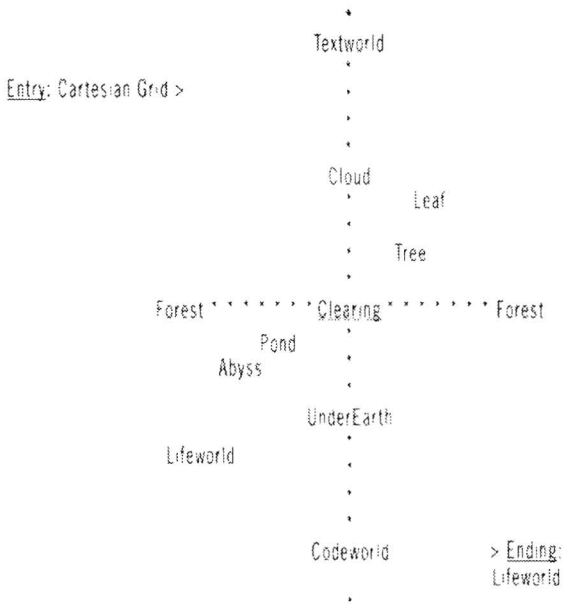

Figure 2. Map from *Osmose* (Davies 2006)

The computer then, exhibits the characteristics by which we know and use language ourselves where the location and naming of an object through signification – this is 'x' *here* and we call it by this name – is established through touch or its exhibited intention. Touching then, is a primary technique for design in gesturally intuitive interactive space; in this way the sensory dislocation brought into being by electronic signalling and computation is significantly resolved.

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