Technology in Support of Returning: From Conscious Doing to Consciously Being

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Abstract

Virtual reality (VR) represents a turning point in technological development and human-computer interaction, since it allows abstract information to be experienced and acted upon as concrete objects and events. The interplay between consciousness, reasoning and action is reconsidered in the light of what is now possible with VR technology. Such technology provides tools for investigating the nature of consciousness, not merely for duplicating the products of conscious doing. From this perspective, it no longer seems plausible to view mind as an abstract, computational machine, the operation of parts of which just happens to be conscious. Rather, with technological support, we are returning to a non-mechanistic conception of mind that emphasises the primacy of consciousness.

1 Introduction

"Dear Prudence, won't you come out to play?
Dear Prudence, greet the brand new day?" - John Lennon

My main point in this paper is that something radically new is happening in the world through the development of particular classes of information technology, and that these new developments give us the opportunity to return to something like a pre-technological state of being. This returning can be seen as a threat or an opportunity. Certainly, it is an opportunity to learn more about consciousness, since technology now allows us to experiment with our own consciousness in ways that have only previously been possible through pharmaceutical intervention. On the other hand, a return to pre-technology, even a temporary, reversible one, is also a return to prehumanity. And it is not clear that on the social level this "prehumanising" effect really is reversible. The context for these developments includes the inevitability of our functioning in apparently three-dimensional (3D) virtual worlds in the future, the linking of ubiquitous computers in a world-wide communication network, and a coming breakdown in top-down control of the media.

In these days of computer graphics, everyone with complex data to explore is crying out for three-dimensional representations to provide alternative ways of perceiving possible relationships in that data. This is itself a major change in how specialists work, who have traditionally relied on their own skills of mental visualisation and imagination to perceive such relationships in complex data sets. Now internal visualisation and imagination are replaced by computer imaging - also called visualisation - and other ways of rendering abstract information in concrete, tangible forms. And these forms are not static; the specialist can interact with the data in many ways, choose the viewpoint, and manipulate the way aspects of the data are presented. Investment advisors, surgeons, engineers, industrial designers, meteorologists, geologists, crystallographers, molecular biologists, amongst many others, are using computer graphics, and sometimes sounds and also tactile displays, to experience information in ways that would have been impossible, or required tremendous imaginative efforts, to realise previously.

As more elements are visualised, aurelised, and in other ways converted to concrete representations that can be directly apprehended by the human perceptual system, information becomes realised by computer. In short, multi-modal computer-based realisations are removing the need for cognitive effort to be spent on realising information in the imagination. Many specialists believe that they can make more sense of information as a result, reflecting the view that sensemaking relies on concretisation (in the imagination or on the computer screen). By this view, to make sense literally means to make into a form that can be experienced by the senses, and in this task the computer is more powerful than human imagination. Sense is not made until a concrete representation is experienced in human consciousness but, as human consciousness is very limited, effort spent on the process of imagining and holding the information necessary for concrete mental representations is effort that is not available to reflect on those representations. Transferring the task of realisation to the computer frees conscious resources for other things.

The information that can be realised by computer may be physical or abstract; it may be information about information, as in 3D representations of the structure of the World Wide Web (WWW). What is the purpose of realising information? With the specialist, this is relatively easy to see. It is to find relationships that would otherwise have been missed, or whose perception would have required enormous mental effort. How information is realised depends in some cases on the purpose of its realisation, but in many others, and increasingly, there may be no clear purpose or one that can only be specified at a very high level (to have good experiences, or to become a better person, for example). With purpose or without, however, this process towards computer-based realisations is inevitable and apparently irreversible. We cannot avoid direct engagement with information now that it is available and now that dealing with information is so central to our lives.

The first step towards the direct engagement that conveys a sense of presence in a virtual world was direct manipulation of objects on the computer screen. Although not obvious at the time, we can see now that a change from an abstract, language-based way of interacting with computers to one where computer entities (such as files) and processes (such as delete) are shown as directly manipulable objects (file icons and trash cans) was the first step in a profound shift towards concretising the abstract by computer, rather than by conscious effort.

2 HCI: Designing Virtual Realities

"I sing the body electric,
The armies of those I love engirth me and I engirth them,
They will not let me off till I go with them, respond to them,
And discorrupt them, and charge them full with the charge of the soul." - Walt Whitman

Consciousness integrates two streams of mental processing: the concrete and the abstract. The concrete concerns the body, our everyday functioning in the world. We are conscious of the results (or intended results) of concrete processing, but not of its moment-by-moment execution. In contrast, we are conscious of the moment-by-moment execution of abstract processing, but not - with any precision - of its results. Abstract

thinking distinguishes us from most other animals, and it has been widely assumed that it helps us act more effectively. There is a generally held belief that consciousness can be equated with thought (mental doing rather than being). I refer to the prevalence of this view as the era of the mechanisation of mind. Starting with the Enlightenment glorification of rationality, it reached its climax with the cognitive science assumption that mind *is* computation.

I trace the historic progress of this mechanisation in Section 3. Very briefly: Starting with the development of language, moving through pictorial representation to written, alphabetic languages, and the development of mathematics and logic, we see a gradual, progressive separation of conscious doing from consciously being. This also represents a separation of science from the arts, and of the abstract from the concrete.

In traditional human-computer interaction (HCI) work, following this mechanical view of mind, it has been assumed that support for abstract thought is the purpose of HCI design. Computers are thus seen as having the purpose of supporting the abstract reasoning processes of their users (so-called 'reflective interaction'; Norman, 1993). This led to largely unsuccessful attempts to develop "cognitive artifacts" that would help people think better. However, the arrival of multimedia, cyberspace, and virtual reality has forced a realisation that the main impact of information technology is not in solving difficult abstract problems, but in having rich sensory experiences (Waterworth, 1997a). This has generated new approaches to work in HCI, such as experiential HCI design (next section), and to a major change in how we think about consciousness: what it is, what it is for, and why it matters where we put it.

2.1 The Body in the Mind: Is There Anybody Home?

The problem of interface design has often been characterised as one of communication between the designer and the users. Norman's (1986) well-known account of HCI design centres on three kinds of model: the *design model* (in the head of the designer), the *user's model* (in the head of the user) and the *system image* (as presented in the designed interface). The system image serves as the medium of communication between the designer and the user. In the ideal case, the user's model comes to match the design model closely. The common approach to facilitating this process has been to incorporate one or more metaphors in the system image. It then becomes of great importance that the designer choose appropriate metaphors which convey relevant aspects of the functionality of the system in terms that are understandable to the user (Erickson, 1990, pp. 68-70). A good metaphor is supposed to permit the user to apply knowledge of the source domain of the metaphor to the unfamiliar target domain of the interface (Gentner et al., 1988).

In several books published over the last two decades, George Lakoff and Mark Johnson have presented a theory of meaning that casts a completely different light on the role and importance of metaphor (Johnson, 1987, 1993; Lakoff, 1987; Lakoff and Johnson, 1980). According to Lakoff and Johnson, metaphor is much more than a specialised rhetorical device. They argue that we always think metaphorically, that our everyday experiences are shaped by three kinds of metaphor: structural, orientational and ontological. Lakoff and Johnson are suggesting that, at bottom, meaning is rooted in basic, bodily, experiences of life as animals with a certain physical configuration residing on a planet with certain characteristics (notably, gravity). When we use expressions like, "I fell asleep" or "Wake up!" we use metaphor in a way that reflects the physical nature of life on earth.

Johnson (1987) provides more detail on the grounding of our (fundamentally metaphorical) conceptual system in corporeal, earthly existence. He proposes the existence of image schemata, which are basic structures of experience. These structures are then projected metaphorically onto more complex experiences. Lakoff (1987, pp. 271-278) suggests that image schemata i) are based on bodily experience, (ii) have structural elements, (iii) have a basic logic and (iv) are manifested in actions and expressions. He gives many examples of image schemata, including the container, the centre-periphery, and the verticality schema.

From the experientialist view, what is needed in HCI design is for the interface to be a source of experiences, designed in such a way that the experiences generated may be structured by the projection of image schemata. What the resultant interface means, *what it is* for a given user, depends on his unconscious reactions to the structures provided. If the interface feels right for its purpose, it is successful. In this respect, an interface is like a poem, and the role of metaphor is similar in both (hence the extract from Whitman at the beginning of this section).

No designer can know what the system really is, in general. It is what it means to individual users and, like life or poetry, it means what it is experienced to be. Several recent VR systems make this clear. For more information on experiential interface design, see Lund and Waterworth (1998). Figure 1 shows an example of an interface (SchemaSpace) designed along experientialist lines.

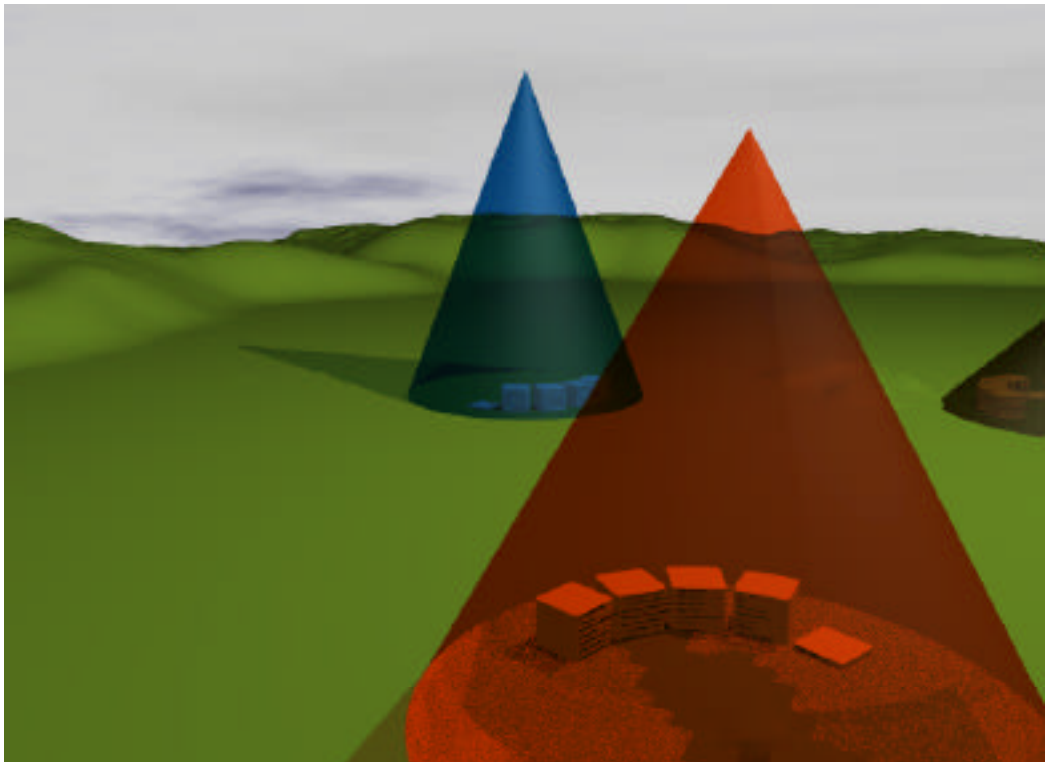

Figure 1 - A screenshot from the SchemaSpace environment

2.2 The Mind in the Body: Where Does It Hurt?

If our bodies can, in some sense, be said to be in our minds (because concepts only have meaning insofar as they can be related to bodily experiences), our mind can also be said to be in our bodies. This is because our body, and its relation to the spatial world around it, provides an anchor for mental activity. We locate our thoughts and plans in space and thus reduce the burden on our very limited consciousness (see, for example, Kidd, 1994). When we forget something, we can often retrieve the memory by revisiting the location, acting out the same physical movements, in which we first had the thought. This principle, acted out in the imagination, has served as the basis for many mnemonic systems through history (Yates, 1984).

It seems plausible that virtually-spatial interfaces to information systems can themselves serve as artificial memory for their users, in the same way that physical spaces such as offices can. Because such systems are artificial but not merely imaginary, they can capitalise on both imagery and spatial memory in the recollection of the location of items of information. We might thus expect that once users have explored the 3D objects and seen what items are associated with what location in the structure, they would experience little difficulty in recalling where to find a particular item the next time it were needed. This has interesting and significant implications for the design of HCI in general, and

especially for the design of VR environments that support conceptual work through interaction with virtually-concrete objects and forces (see Waterworth 1996 and 1997b for more details). In essence, physical placement works as a mnemonic device (see Yates, 1984) because it transfers the burden of association from ongoing abstract processing (in consciousness) to ongoing concrete processing (largely automatised and so unconscious).

One way of characterising the dichotomy between the two streams of mental life is as a question of where consciousness is located. Although concrete processing is largely unconscious it is not, of course, entirely so. We are aware of what we are feeling and doing. And while cognitive processing is largely conscious it is not entirely so - we are often unaware of where our thoughts come from or are going. The problem of consciousness is that of limited capacity. We have very little attention at our disposal and we must share it between sampling from the physical environment (and controlling physical actions) and carrying out conscious mental work (reflective cognition).

Changes in this balance between abstract, reflective cognition and concrete reasoning affect the nature of our experience of the world around us. For example, when our conscious processing load is heavy (during difficult abstract reasoning), our experience of duration is short - "time passes quickly" (Waterworth, 1983). We pay little attention to our bodies or the world around us. And when our conscious processing load is light, duration seems long - "time passes slowly". We trade off stimulus sampling with conscious processing as we switch between the abstract and the concrete. Figure 2 illustrates this graphically. We can see the non-processing stimulus sampling zones of the loops as windows on reality, and the size of the processing zones as an indication of the degree of abstract processing.

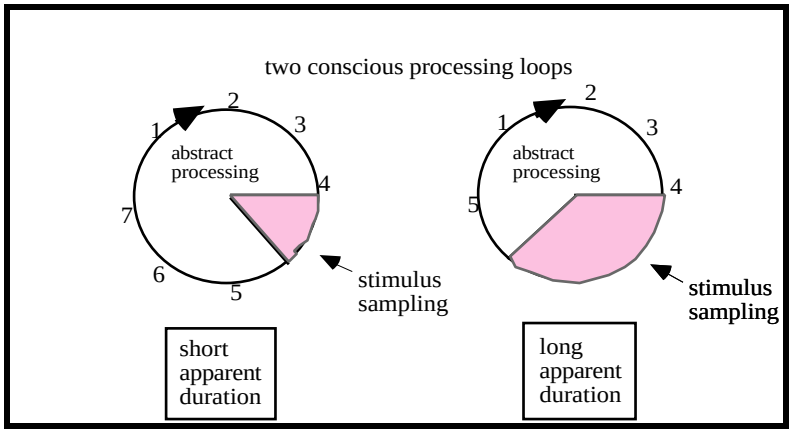

Figure 2 - The Location of Consciousness: switching between mental doing and being

Anchoring the abstract in the concrete reduces the demands on our limited attention span, our consciousness. Losing the abstract does not (usually) result in our losing track of planned physical actions (the concrete). But if we lose track of our mental stream of abstract thought, re-enactment of the most recent physical sequence of actions enables us to recover the mental sequence. The physical landscape contains and supports cognition. In the same way, a virtual landscape will support conscious processing; its nature will help determine the location of consciousness, as well as its content.

2.3 Consciousness and Information Exploration

Figure 3 represents an attempt to identify the main dimensions of mind. The high-low focus axis refers to the extent to which our attention is directed to fine-grain detail or the broad stroke features of a situation (see Gelernter, 1994). This may be our sampling of the environment or our conscious processing of previously-sampled information. The conscious-unconscious axis refers to how conscious we are. This is often correlated with level of "wakefulness" although we may actually be largely unconscious while awake and highly conscious when asleep (as in vivid dreaming). The frequent-infrequent

sampling axis refers to how frequently the individual samples from the stimuli received by the senses (as illustrated in Figure 2). Rapid sampling will tend to occur when the conscious processing load is light and will be accompanied by the experience of time passing relatively slowly.

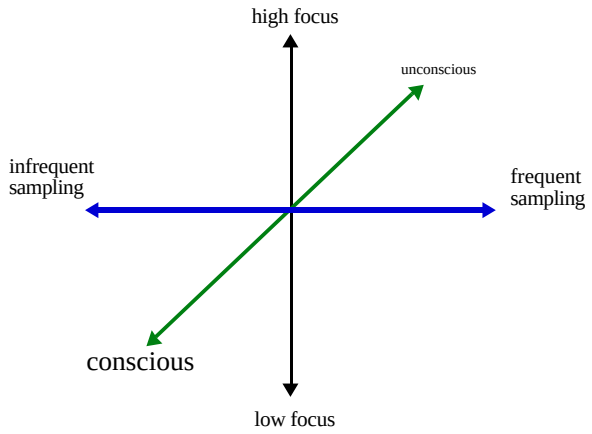

Figure 3: Dimensions of Mind

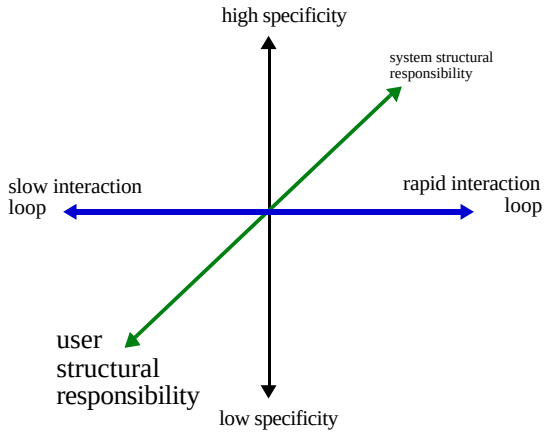

Figure 4: Dimensions of Information Exploration

There are interesting parallels between this model of mind and identified dimensions of information exploration. Figure 4 illustrates the information exploration model of Waterworth and Chignell (1991). The high-low specificity axis refers to how clear the explorer is about what is being sought - a specific information query versus browsing around. This corresponds to the high-low focus dimension of mind. The system-user responsibility axis refers to whether the system or the user does the searching (and must therefore be aware of the information terrain). This corresponds to the conscious-unconscious dimension of mind. The rapid-slow interaction loop refers to the style of interacting with the information system. Rapid loops typify interactions based around direct manipulation and the manual following of links by the user. Slow loops arise when the user adopts a conversational style, perhaps describing a complete information request to an automated agent that will return with a response some time later. This corresponds to the frequent-infrequent sampling dimension of mind.

I suggest that it is no accident that there is this correspondence between the dimensions of mind and of information exploration. Consciousness gives information meaning, through reflected bodily experiences. As Rose (1992, p.91) states "Meaning implies a dynamic interaction between myself [i.e. his consciousness] and [in his example] the digits; meaning is a process which is not reducible to a number of bits of information".

This way of looking at consciousness and its relationship to computer systems also gives us a possible approach to the difficult problem of understanding and supporting creativity (see also Waterworth, 1997a). Often, creativity is seen as mysterious or even mystical. One reason for this is that new ideas seem to enter consciousness almost spontaneously, presumably from the unconscious. The correspondence of the conscious-unconscious dimension with the structural responsibility dimension (see Figure 3) fits this state of affairs quite nicely.

The realm of unconscious ideas corresponds to the unknown structure of a world of information embodied as a mystifyingly confusing electronic network. In much the same way as new ideas suddenly emerge in consciousness, so are new items of information revealed to us on the computer screen. By this view, the World Web Web can be seen as analogous to Jung's Collective Unconscious or de Chardin's Divine Milieu. To be creative in the face of the Web, we may need to abandon the idea of finding what we are looking for and instead be open to that which finds us.

3 A Very Brief History of Being

In Section 2.2 I suggested that the contents of consciousness are limited and comprised of the results of a trade off between sampling from the environment (or the computer display) and holding and performing operations on held items to achieve some kind of problem solving. This trade-off corresponds to an emphasis on being or doing.

In this section I will roughly sketch an historical view of the effect of technological development on the way in which we think about consciousness, and indeed of the contents of consciousness. Figure 5 presents a very crude time-line of conscious being and conscious doing (numerals in the following refer to the four major divisions shown in Figure 5).

1. Pre-literate man - man before he really was man - was much like any other animal. He responded to the immediate situation according to his perceptions of the current situation. His response tended to be automatic - instinctive - and unreflective. In other words, his cognition was unconscious. He did a lot of work with his legs and hands and almost none with his consciousness. But still, he was conscious. He did experience pleasure and pain, comfort and discomfort, hunger and fullness. And at some point, he started to do a bit of work, consciously. He started to plan his day to maximise his success in hunting and minimise his tiredness. He began to work out how to avoid dangers before he encountered them.

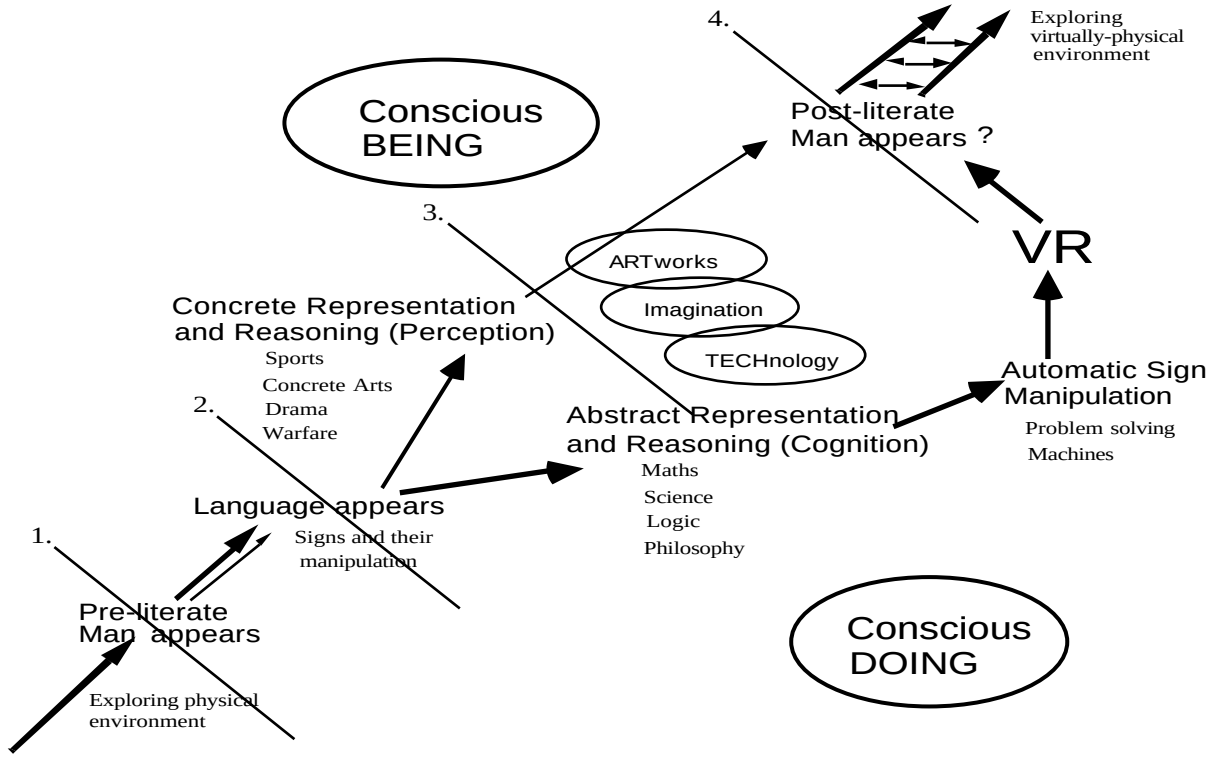

Figure 5: Technology in Support of Returning

2. The development of language co-occurred with, and enabled, increased cooperation between early people in activities such as food collection and hunting, shelter construction, childcare, and so on. This also required an increase in abstract reasoning, an increase in conscious doing accompanied by a decrease in conscious being. Innocent being-in-the-world, which is still the state of the vast majority (possible all) of other animals, was lost in the process of acquiring language, and man started down a long path of abstract thinking, leading to the knowledge gained through philosophy, the sciences, maths and logic. At the same time, concrete reasoning still went on, in the arts, drama and sports, but already the two strands of human psychology were separated and tended to be emphasised in different individuals.

3. As time passed, the pinnacle achievements of man became associated with conscious doing - abstract thought - rather than the products of contemplative being. At its height, this was reflected in a scientific optimism that all things would eventually be understood through the pursuit of science based in rational thought. The Arts became personal statements by individuals and largely peripheral to the thrust of modernity. God was declared dead and religion relegated to one day a week, at best. The separation of our minds from our bodies, our reason from our emotions, was complete. But at some point, perhaps as a result of world wars whose horror was largely identified with technological developments (such as weapons of global destructive capacity), people lost their optimism and enthusiasm for the products of conscious doing. The time was ripe for attempts to recombine being and doing, minds and bodies, rationality and feeling.

4. Computer technology, and associated communication capabilities, were largely a result of efforts to win wars. However, and surprisingly, this most technological and abstract of inventions provided the means for a reintegration of being and doing,. Virtual Reality, through its creation of a concrete world from abstract data, opens up the possibility of man recovering his being while not forfeiting technological progress. This is technologically-enhanced, post-literate man, in the situation where computer systems do the work of abstraction, and leave him free to contemplate and manipulate the concrete results.

To quote Rose (1992, p.93) again, "Modern technologies - photography, film, video and audiotape, and above all the computer - restructure consciousness and memory even more profoundly [than the introduction of printing], imposing new orders upon our understanding of and actions upon the world".

Rose sees this as a step further than printing, which stabilised uncertain observations into "facts". I, however, am claiming that while this was true up to some point of history, the development of virtual realities effectively lead us back beyond pre-printing, to pre-literate modes of being.

This is not to say that the world of man will revert to prehistoric times - this is no pre-technological Luddite vision. Rather, man's consciousness is reverting to an earlier state, a state in some ways of innocence, where consciousness is concerned with being rather than the doing - the hard conscious work of making concrete sense of abstract information - that has been a dominant feature of mental life since language first emerged.

4 Conclusions

"The closer we come to the danger,
the more brightly do the ways into the saving power begin to shine,
and the more questioning we become". - Martin Heidegger

With Virtual Reality, we make tangible the intangible, "concretise" the abstract.

Concretisation means that what was once thought about in an abstract way can now be experienced directly, through direct experience, physical action and associated emotions. This brings a profound change to our perception, and emphasises that, however useful it may have been for solving practical problems, mental life also has the primary purpose of experience, of imparting a sense of *being.*

Far from arriving at some "post-biological" era, as some have claimed, we are just beginning to re-discover that we are biological and what that means. We are alive and we are beings in the world! This has happened through the development of new, reflexive, interactive technology. Because the technology does the work of realisation for us, we are encouraged to reason concretely, which means to experience what it is to be. This is a major change in human consciousness, and in our ideas about consciousness, which may also enhance our creativity. It also brings dangers, but with the dangers come new opportunities.

It no longer seems plausible to view mind as an abstract, computational machine, which just happens to be conscious. We are emerging from an epoch where abstract reasoning was seen as the point of human existence, and entering a new age of self-discovery made possible by the development of immersive virtual realities.

In these environments, we can experiment with what it means to be, not only with what it is possible to do.

Prudence is coming out to play.

5 Acknowledgements

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