A critical explorative Investigation into the Operation of Memory in Human Expression and Artificial Intelligence:

A Joussean perspective.

Nareen Moodley

Submitted in partial fulfillment for the Master's Degree in

Orality-Literacy Studies,

University of Natal, Durban.

December 2000

ABSTRACT

There is a supposition that with the current progress in artificial intelligence (AI), machines that surpass the cognitive functioning of human beings is imminent. There is no doubt that singular human functions can be performed more efficiently by machines, however, the complexity of human functioning involves the simultaneous cognizance of information received through the various senses. The complexity of human functioning is best reflected in the perceptions of Marcel Jousse in *The Anthropology of Geste and Rhythm (1997).*

Whilst proponents of AI envisage the cognitive functioning of the computer surpassing human cognitive functioning, they fail to acknowledge that human cognitive functioning extends beyond mere information processing and expression of predictable responses. The complexity of human expression is influenced by a variety of sensory environmental stimuli as well as previous experience.

The fundamental 'law' of the indivisibility of the psycho-physiological complexus of the human composite identified by Jousse, indicates that human memory emanates from human interaction with the environment. The computer is incapable of interacting with the environment in the way that the human being interacts, which implies that it cannot replicate human memory.

This study argues that:

- The human being operates simultaneously as a psychological, physiological and biological being, which implies that human memory, is simultaneously biological, psychological and emotional.

- Human memory arises out of mimism and is biologically rhythmed, and that this rhythm operates in synchrony with the universal cosmological rhythms.
- Computer rhythms do not operate in synchrony with universal cosmological rhythms, which implies that the operation of its memory is very different to that of the human being. Therefore the computer will not be able to replicate human functioning.

CONTENTS

ACKNOWLEDGEMENTS

Special thanks to:

Professor Edgard Sienaert, my supervisor, for 'pointing my feet in the right direction', and encouraging me to believe in myself.

Ms Joan Conolly for her endless patience in reading and editing the many drafts, for broadening my vision through stimulating discussions, and for her continuous encouragement.

Dr Graham Stewart, for his encouragement and interest, and for providing me with relevant information, and answering the most trivial questions with patience, when required.

Nelson Moodley, for being my support and spurring me on when my spirit was flagging, and for the stimulating discussions that provided me with alternative perspectives.

A very special thank you to my parents, for their unselfish love, support and encouragement in all my endeavours.

I am indebted to USAID for providing me with funding for my research. As well as the TELP office at ML Sultan Technikon for assisting me in obtaining the necessary funding.

GLOSSARY

Anthropos — The term 'Anthropos' signifies holistic man. Jousse (1997) talks about the Anthropos as "an interactionally miming animal" (ibid: 128), i.e., he re-plays the actions, sounds and movements of the world around him. He also sees him as one who "has the ability to develop abstractions" (ibid: 547).

Geste — The 'geste' according to Jousse (1997) is much more profound and primary than language and gesture. The geste is action, but it is action that allows us access to reality, a reality that exists within ourselves, for that is the only reality we know. The actions are "received through our multiple reception apparati. Whether macroscopic or microscopic, whether we are conscious of it or not, that received reality is the human geste" (ibid: 658).

Macroscopic (geste) — The 'macroscopic' gestes are gestes that are externally expressed, that are visible to those around. Examples of macroscopic gestes would be ritual and facial expressions.

Microscopic (geste) — The 'microscopic' gestes are those that are minute and are not externally visible to anyone, but are nevertheless constantly occurring. They include the pulses of the body, and our thoughts.

Tri-phasism "Triphasism is fundamentally the unconscious play of cosmological interaction. This cosmological interaction becomes anthropological from the moment it reverberates in the Anthropos" (Jousse 1997: 115). Jousse views all interactions as taking place in clusters of three, i.e., An Acting One acting on the Acted upon. The Acting One and the Acted upon are clusters of energy that propel a characteristic action. Therefore, in the universe, there are actions acting on other actions constantly, which generate interaction. "[F]rom this infinite Acting One an indefinite number of *transitory* Actions will be able to spring forth" (Jousse 1997: 116).

Anthropocybersynchronicity This is a term that has been coined by Joel Orr. "[A]n*thro*po*cy*ber*syn*chro*ni +*ci*ty n [fr Gk anthropos, man + cyber, governor + synchronicity, coming together in time]. The study of the rhythmic aspects of the person – computer interface" (Orr n.d.). What underscores his discussion is that productivity in any human/ computer interaction would be increased if the computer and human being were in rhythmic harmony.

Re-gister Jousse uses the word 'register' as in 'carrying recorded things again' or 'carrying recorded things once more'. The etymology of the term is derived from Latin: re – 'once more, again, afresh' + gerere, gestus, geste – 'to carry' (SOED). We re-gest(er) or 'carry again' all the

'gestes' by re-ordering them. This process is continuous and constant and involves symmetrical oscillation, for man is a bilateralised being.

Mimism

Jousse uses this term to describe the human being's acquisition of knowledge, which is obtained through man's instinctive tendency to "*mime* all the actions of the living beings and all the traits of the non-human objects that surround him" (Jousse 1997: 63). The human being's interaction with the environment has changed in the current social milieu, for man has adopted a more 'bookish' learning rather than his instinctive tendency, which is *mimism*.

Rhythmism

The human being's interaction with the universe is essentially rhythmic and arises out of mimism. "Rhythmism comes into action *simultaneously* with Mimism" (Jousse 1997: 122). Rhythmism is ordered and logical because it arises out of a pattern. In tri-phasic interaction there is the pattern of the Acting One acting on the Acted upon, which is fluid and continuous. Rhythmism is logical because it is constantly being ordered through the process of 're-gistering'.

Bilateralism

The human being is a double-sided being and he operates as such in his interaction with the universe. When he interacts, whatever is outside of him becomes a part of him through mimism, and whatever he ex-presses influences what is around him. Bilateralism manifests in

balance, which implies that all the human being's interactions are balanced. In all man's movement (i.e., walking, running, rocking) there is bilateral balancing. This bilateral balancing influences the rhythmic nature of man's interactions.

Formulism

Formulism is "...the stereotyped propositional geste" (Jousse 1997: 665). The 'propositional geste' refers to gestes that have not been broken up into parts, but they contain a unit of meaning. When these 'propositional gestes' recur, they give rise to formulas. "One of the most powerful notions associated with formulas is the notion of returning events. If something has happened in a particular way once, it will happen again in the same way at a later time" (ibid.). Formulas are recurring patterns, which implies that they are rhythmic.

Intussuscept

The term 'intussuscept' derives from 'suscipere', which is the grasping of the external world, and 'intus', which is the internalising thereof (Jousse 1997: 661). The human being takes all the actions from his interactions and synchronises them in order to ex-press them. In synchronising the gestes within him, he makes them a part of him.

Mimeme

The 'mimeme' is the reanimation of the characteristic action of the mimed object, which reanimation occurs within the human being. "It is

through the Mimeme that man constructs his first *ex-pression*" (Jousse 1997: 123).

CHAPTER 1

INTRODUCING THE STUDY

> Before the next century is over, human beings will no longer be the most intelligent or capable type of entity on the planet. Actually, let me take that back. The truth of that last statement depends on how we define human. And here we see one profound difference between these two centuries: The primary political and philosophical issue of the next century will be the definition of who we are (Kurzweil 1999: 2).

The 20th century has been a century of progress and development in science and technology that has culminated in statements such as Kurzweil's, which questions how we define 'who we are'. The question arises, because there has been a dark side to technological development, which has been the disruption and destruction of nature, and nature forms an integral part of humanness.

To be human[1] implies a living, breathing being that possesses a dynamic memory that is spontaneous and serendipitous. It implies having intelligence, emotions[2] and consciousness, which lead to creativity. Jousse (1997) says that we are afraid of 'life' and therefore in trying to understand the living, breathing Anthropos, we study bones, skeletons and artefacts rather than living, breathing beings.

It is only through the study of living, breathing beings that one can attempt to understand the human being's capacity for memory, intelligence and consciousness. For it is memory that establishes personal identity.

> Memory for our own personal history is of great importance since it is an essential element of personal identity. To a considerable extent we are what we remember (...) [But], Memory for

> personal experiences has other functions besides that of reinforcing personal identity. It provides us with a store of 'recipes' for handling current problems and current situations" (Cohen 1989: 109).

The human memory consists of "patterns of connections in nerve cells" (Cowley & Underwood, et al 1998). The generation of 'patterns of connections' is stimulated by interaction with the environment. It is the human being's capacity for identifying 'patterns of connections' as well as creating novel connection patterns that demonstrate his intelligence. Therefore memorisation[3], in the form of rote learning, should not be mistaken for intelligence. An illustration of the difference between intelligence and rote learning would be how a set of instructions is used to construct a geometric object. The ability to assimilate the instructions and apply the knowledge, motor and visual skills to construct the object is a sign of intelligence, as opposed to simple regurgitation of the instructions without being able to construct the object.

It is the lack of understanding of intelligence, consciousness and the operation of creative memory that has allowed the proponents of artificial intelligence the freedom to view the computer as a means for the human being to achieve immortality. Is it not ironic that man seeks to use a non-living creation to achieve eternal life?

The dictionary definition of 'human' makes it clear that to be 'human' is to be viewed or held apart from machines. The human being is able to show emotions and feelings, he[4] is able to reflect on events and experiences and apply the acquired knowledge to current and future experiences. Therefore, the popular belief that the computer will at some point possess a general level of intelligence comparable to that of man and will eventually supersede man because it will be able to operate cognitively like a human being poses a

problem. Man does not function only as a cognitive being. There is also an emotional aspect to man's behaviour that cannot be dismissed, for the emotions influence cognition.

This study is an explorative investigation, concerning the quest to create a machine that is able to function intelligently like a human being (the Anthropos). The issue of creating a machine of this nature poses a great challenge to the scientists in the field of artificial intelligence and is fraught with many dilemmas. Nevertheless, the quest continues and I am fully aware that, as I write this, many new developments are taking place in the field of artificial intelligence (AI).

The thought that scientists actually believe that the computer can be a superior 'being' to Man and will therefore supersede man in the evolutionary process raises concerns and questions numerous moral and ethical values. Moravec (1988: 1), one of the supporters of the evolution viewpoint says,

> Today, our machines are still simple creations, requiring the parental care and hovering attention of any newborn, hardly worthy of the word 'intelligent'. But within the next century they will mature into entities as complex as ourselves, and eventually into something transcending everything we know—in whom we can take pride when they refer to themselves as our descendants.

The prediction that machines will 'transcend everything we know' is yet to be realised even though the end of the century has come and gone. But there have been further developments in the field and there are many scientists nurturing their creations. One such creation is 'Cog', a robot developed at the Massachusetts Institute of

Technology (MIT) under the direction of Professors Lynn Andrea Stein and Rodney Brooks.

> It is being designed to pass through an extended period of artificial infancy, during which it will have to learn from experience, experience it will gain in the rough-and-tumble environment of the real world. Like a human infant, however, it will need a great deal of protection at the outset, in spite of the fact that it will be equipped with many of the most crucial safety-systems of a living being (Dennett 1994).

Cog is being likened to a human infant, which will grow into a human-like adult, which brings us once again to the definition of 'human'. Jousse (1997: 56-57), when he talks about the human being states:

> Viewed from the outside, man is a complexus of gestes. To all the movements executed by the human composite, I will give the name gestes. Visible or invisible, macroscopic or microscopic, developed or only hinted at, conscious or unconscious, voluntary or involuntary, these gestes, nonetheless, manifest the same essentially motor nature (...) Only man has gestes which are played and re-played. Gestual play and re-play of all sorts are mostly unconscious; but, for all that, they develop tirelessly and interchangeably.

This implies that the human being is constantly involved in movement. From the 'microscopic' physical and psychological pulses within his body (which are invisible to others) to the movement of his arms and legs as forms of expression, man is continually involved in movement. All meaningful movement is 'geste', which can be understood as action. Jousse coined the term 'geste' for the very specific type of action that he is

referring to, which is what is "received by the anthropos" (Jousse 1997: 658), and becomes a part of him. The gestes can be microscopic or macroscopic, voluntary or involuntary. An accumulation of gestes within the human being constitute his memory. Man is continually re-ordering, re-patterning and re-playing these gestes/ actions in order to express himself. It is this ability to re-order, re-pattern and re-play these gestes/ actions in creative and original formulas that is exclusive to man.

This study will relate these perceptions of Jousse to the notion of developing a machine that will possess a general level of intelligence comparable to man by identifying and discussing some of the major theories on artificial intelligence proposed by the various schools of thought (Dreyfus, Weizenbaum, Dennett, Moravec, Kurzweil, Franklin, etc.), which will be explained in the literature review.

My hypothesis is based on the perceptions of Marcel Jousse in his theory of *The Anthropology of Geste and Rhythm* (1997), which elaborate certain behaviours that are exclusive to man. I will evaluate the similarities and differences between computers and humans, with particular reference to how the memory operates in human beings, according to Jousse's understanding of:

- The indivisibility of the psycho-physiological complexus of Anthropological geste;
- The Psycho-physiological laws of human expression;
- Tri-phasic interaction;
- The Universe plays in and the Anthropos re-plays;

And Orr's of:

- Anthropocybersynchronicity: Rhythm in human and computer memory and expression.

I have opted to use Jousse's theory predominantly because he identifies the indivisible psycho-physiology of the anthropos which implies that all experience is psycho-physiological, i.e., in the whole being, therefore **simultaneously** biological, psychological, emotional and spiritual. This in turn implies the biological nature of memory and intelligence. Theories of human memory other than that of Jousse have been excluded from the parameters of this study and will therefore not be discussed.

Jousse (1990: xix) says that Man's "obsession with tools to apprehend and grasp reality pre-occupied man, from the making of all his muscles into tools, to the creation of those admirable machines which astonish us today." Man developed these tools to assist in his interaction with the environment. At first, the human being fashioned his own body into a tool to carry out tasks that were necessary for his day to day functioning. This soon developed into the use of external devices or tools. These tools were simple and hewn of stone, then bronze, and used to perform very basic functions with increasingly greater ease. Later he developed more complex tools to carry out more complex tasks.

The computer is just one of the **tools** that was developed to assist man in carrying out mundane and repetitive tasks as it does not share the same physiological make-up as man. Bush (1945:3) confirms this when he says,

> But creative thought and essentially repetitive thought are very different things. For the latter there are, and may be, powerful mechanical aids.

> Adding a column of figures is a repetitive thought process, and it was long ago properly relegated to the machine.

The idea of using computers merely for performing mundane tasks were thoughts of an earlier era (pre-1950). Since Turing's 1950 article in the British philosophical journal *Mind,* where he proposed what was subsequently known as the "Turing Test" (Gray 1999), many new developments have taken place in computer operations. Therefore, the computer is now being viewed in a very different light.

The Turing Test or "imitation game" was developed to test the intelligence of the machine. It pitted two subjects, one a human being and the second an inanimate machine against a third subject, a human being. The third subject would question the two subjects and receive responses from them, through a typed medium. The third subject would have to identify which of the respondents was the machine and which the human being. The result would depend on whether the machine was able to convince the third subject that it was human. At this time, no machine has been able to 'pass' the Turing Test.

In the same 1950 article Turing "proposed the idea that a machine could learn from and thus modify its own instructions" (Gray 1999). This idea was the forerunner to what is now called "Artificial Intelligence" or "AI". Scientists such as Franklin (1995), Moravec (1988), Levy (1992) and Kurzweil (1999) working in the field of AI are propounding a theory of evolution for the further development of artificial intelligence. They do not see it just as the evolution of AI, but rather as part of the development of the Human Species.

The line of distinction between humans and computers is fading rapidly with the innovations in the field of AI, and very soon we will question the role that the computer

will play in our lives. For as McCarthy (1983) points out, we already ascribe anthropomorphic terminology to the machines that we use by saying things like the machine 'thinks' or 'knows', etc. While the computer may be programmed to perform many 'human' tasks in the real world that may indicate that it 'thinks' or 'knows', it is not able to originate thoughts. Another question that is raised is whether it should be **allowed** to perform these 'human' tasks as it does not interact with the real world in the same way that a human being does.

> The point is that there are some human functions for which computers *ought* not to be substituted. It has nothing to do with what computers can or cannot be made to do (Weizenbaum 1987: 270).

The two issues raised here regarding computers are first, the moral issue and second, the functional issue. The moral issue regarding computers will not be discussed explicitly for it underpins the argument presented. What this study will focus on are the functional capabilities of the computer and whether these capabilities can be compared to those of a human being.

CHAPTER 2

SETTING THE PARAMETERS

2.1. Aim of Study

The aim of this study is to use the theories of Marcel Jousse to investigate the functioning of memory – defined as 'the act of remembering' or 'the faculty by which things are recalled to or kept in the mind' (*The Concise Oxford Dictionary)* - in human beings (the Anthropos) and artificial intelligence ('the application of computers to areas normally regarded as requiring human intelligence' (*The Concise Oxford Dictionary)).*

This study will investigate the Anthropology of Geste and Rhythm for Jousse's perception of how memory functions in humans, and will then relate these perceptions to the operation of memory in AI.

There is a certain perception (e.g. AI, science fiction, etc.) that implies that 'thinking machines' (higher order computers) are developing a capacity to operate independently of human beings and will eventually develop sufficient capacity to operate as intelligently as human beings, thereby replacing them. The rationale is that some theorists view the development of the computer as part of the evolutionary process. This study will examine this perception critically, and demonstrate that:

- Jousse's perception of the human being as an indivisible psycho-physiological complexus implies that man operates **simultaneously** as a biological, psychological and emotional being.

- The process of 'receive, re-gister and re-play' as expostulated by Marcel Jousse in his theory of the Anthropology of Geste and Rhythm operates differently in man and computer.
- Jousse's perception of the mnemonic laws, which are fundamental to human memory and expression, operate differently in man and computer.
- Interaction with the universe – both internal and external – as manifest in Jousse's understanding of '*im*-pression' and '*ex*-pression' operate differently in man and computer.

In order for the computer to do what the human being does, it must operate in the same way that the human being does.

2.2. Scope of the Study

This study involves a qualitative interdisciplinary analysis, interpretation and evaluation of relevant texts. Consequently, certain aspects need to be considered to substantiate material selection.

Firstly, because this is an interdisciplinary study there are volumes of information available in the form of articles, books, papers, etc. that cover the field of AI, as well as the many other areas of study that feed into it, namely, philosophy, psychology, languages, sociology and science. The literature is diverse, therefore, I have had to restrict my study to theorists whose work related most specifically to the focus of this study, which relates to memory in human expression and AI.

Secondly, there are a number of issues that are pertinent to the AI debate (e.g., language acquisition, speech recognition, etc.). Discussions of these issues are minimal, for these concerns are not the focus of this study. However, where it has been necessary to elaborate on these issues to support the central argument, more detailed discussions are presented.

Thirdly, this study provides a synthesis of information, which poses certain problems. Some explanations for certain concepts like memory, intelligence, etc., may be considered inadequate. What has been compiled is supporting data for an argument that gravitates around a Joussean viewpoint that is persuasive and consistent. I have deliberately excluded a discussion on spirituality from this study, as it would broaden the parameters substantially. For the sake of brevity, comprehensive arguments for every aspect have been deliberately omitted without compromising the study.

2.3. Literature Review

Many theorists have made contributions to discussions on memory and human expression as well as to the development of AI. In this section I will briefly discuss some of the perspectives of some of these theorists who I have considered important for this study. Because of the expansive nature of this study, there has been a need to place certain restrictions on it. I have therefore decided to focus on theorists whose contributions have covered as broad a spectrum of my study as possible, as well as theorists who have embraced interdisciplinarity.

The theorists whose works have been consulted for this study come from the fields of psychology, anthropology, sociology, philosophy, linguistics, computer science, neuroscience as well as the biological sciences.

The focus of this study is Jousse's perceptions of memory in human expression and how this relates to artificial intelligence. I will not discuss Jousse's work here, as there will be a discussion of his theories that underpin this study in the section 'Theoretical Framework'.

The theorists whose work will be looked at here are Dreyfus, Weizenbaum, Franklin, Kurzweil, Dennett, Turkle, Moravec, McCarthy, and Bronowski. There are a number of competing paradigms in the AI debate. Although not distinct, three 'schools' emerge from the literature regarding AI, which I have grouped according to their views on AI. The selection was based on how the views of the theorists relate to the focus of this study. They are:

1. The AI Protagonists
2. The AI Antagonists
3. The AI Agonists

What follows is a brief discussion of the views of selected theorists who represent the different schools of thought.

2.3.1. The AI Protagonists

This 'school' believes that in the not too distant future we will have superintelligent machines whose capacity for functioning intelligently will supersede human functioning. This belief stems from pioneering work by Newell and Simon and is upheld by Moravec (1988), Kurzweil (1999) and Dennett (1994).

In 1956 Simon and Newell's success in "programming a computer using Symbolic representations to solve simple puzzles and prove theorems in the propositional calculus" (Dreyfus & Dreyfus 1988: 19), led them to believe that they could achieve greater heights in the future. They believed that this success would lead to further developments in computing until in the near future, a computer would be able to handle a range of problems that would be comparable to the human being's capacity for problem-solving. That eventually thought and learning would not be exclusive behaviours to human beings, but that a computer could be programmed to exhibit these behaviours as well. Moravec (1988), Kurzweil (1999) and Dennett (1994), who are followers of this tradition, lent support to this idea by claiming that these superintelligent machines, that were still to be developed, would be our descendants.

Moravec's (1988: 115) vision is that we would one day be able to make copies of ourselves that would inhabit different bodies and that it would be possible to merge memories from these copies into a single one. The "memories of events would indicate in which body they happened," which he compares to human memories which are defined by a context. He also talks about a human being carrying "a kind of

portable computer" (Moravec 1988: 110), which would be programmed with the human being's genetic makeup. This computer would be able to monitor and mimic every action that the human being executes and would eventually be able to provide a "convincing imitation of you. When you die, this program is installed in a mechanical body" (Moravec 1988: 110-111) that would take over the life and responsibilities of the human being.

In a similar vein, Kurzweil (1999: 53) proposes a supposition of scanning a human being's "entire brain and neural system (...) and replacing it with electronic circuits of far greater capacity, speed, and reliability." He does acknowledge that at present these are frightening thoughts but he feels that human beings will ultimately recognise the benefits of such a system. He feels that all that is needed to solve intelligent problems are simple methods and ample quantities of computation. He also predicts that by the year 2029 computers would far exceed the functioning capacity of the human brain.

Dennett (1994) is one of the members of a team who have developed Cog, a humanoid robot. He presents Cog as being an infant even though it is the size of an adult and alleges that Cog will pass through an "extended period of artificial infancy." During this period of its 'life' it is expected that it would 'learn' from experiences in its interaction with the environment. He also states that one of the talents they would like to teach Cog is an aptitude for human languages so that it would be able to behave like a human being.

2.3.2. The AI Antagonists

The second 'school' include those theorists who express negativity regarding the possibility of creating a machine that will be able to replicate human intelligence. This negativity ranges from moral and ethical concerns to the impracticality of replicating the mental function of the human being, which is not fully understood. In this 'school' I have included Dreyfus, Weizenbaum and Bronowski.

In 1972, Dreyfus predicted that the proposed development of a machine that could replicate human functioning was doomed to failure. The reason for his argument lay in his belief that conceptions of mental functioning at the time were naïve, as well as his view that digital computers are limited not so much by being mindless, as by having no body. While his view was widely attacked at the time, his work has subsequently been studied and is often quoted. When he first wrote *What Computers Can't Do* (1972) he provided a controversial position in a current debate. However, in the later edition of his book *What Computers Still Can't Do* (1993: ix) he reinforces his argument that "After fifty years of effort, (...) it is now clear to all but a few diehards that this attempt to produce general intelligence has failed." He also clarifies his position that even though it has failed, it does not mean that artificial intelligence can never succeed, because there is no proof of that. However, he does think that it is highly unlikely that it will succeed.

Weizenbaum's (1987) contention is that the disparity between the human being's capacity for understanding and the computer's capacity for understanding is unbridgeable. His point of view is that for understanding to be shared, both parties require a similar internal knowledge base that is similarly structured and that is

similarly defined for a particular domain of knowledge. Understanding is therefore domain-dependent.

> Weizenbaum contends that the limited successes of AI research using restricted domains are misleading, because as the domain of discourse grows, the difficulty of the problem and the size of the computer programs needed to deal with the problem grow exponentially. Thus, he argues, machine intelligence that duplicates human intelligence is impossible (Albus 1981: 297).

Bronowski's (1965) discussion centres on the human being and how he interacts both with his environment and other human beings. He observes the human being's capacity for the development of language, literature and drama and infers that these areas of interaction are unique to man. He perceives that no animal or machine would be able to replicate this behaviour of the human being because of their inability to interact the way the human being does through these various modes of expression.

2.3.3. The AI Agonists

The third 'school' includes McCarthy, Franklin and Turkle, who have all evoked interesting discussions on AI and raised many relevant questions that are important considerations for the further development of AI, but who have not explicitly assumed a position in the AI debate.

This school raises questions that relate to issues about the place of the human being and the computer in the order of things, for even though we may be able to

create machines with "mental qualities more like our own, we'll probably never want to deal with machines that are too much like us" (McCarthy 1983: 9). What we need to think about is designing programs that facilitate the human-machine interface.

Other questions pertain to 'what is the mind[5]?' and 'what are the differences between the mind and the brain?' (Franklin 1995). Franklin's bias is towards a paradigm of mind that questions the purpose of the mind and he presents an argument, which culminates in him naming this paradigm the "action selection paradigm". The "action selection paradigm" is based on his view that cognition is "the process by which an autonomous agent selects actions, including those processes which by objectification, categorisation, and so on create the agent's own world from its environment" (Franklin 1995: 420).

Turkle (cited in Brody 1996) on the other hand looks at the effects of cyberspace on real life as well as the question of identity when interacting in cyberspace. But this is not her only contribution, for she has highlighted the reason for a noticeable lack of psychological approaches to memory in the infancy of the AI debate.

During the early 1950's, American Academic psychology was dominated by behaviourism. The essence of the period can be summed up in stimulus-response theory and any discussions of memory were seen as a violation of scientific thinking. It was only with the further developments and new thinking about the computer in the 1950's and later, that people were beginning to see the mind in a different light. "The computer presence relegitimated the study of memory and inner states within scientific psychology" (Turkle 1988: 242). It is for this reason that a substantial portion of the AI debate stems from philosophical considerations.

This literature review highlights a few of the current debates in AI. There are a number of other theorists and other points of view to be expressed, however, many of the arguments are embedded within the study and have therefore not been discussed here. Theories of memory and human expression as relates to Jousse have not been presented in this literature review as these themes form the crux of the argument presented in this study. Instead, this literature review establishes a foundation on which to base the argument that follows.

2.4. Theoretical Framework

This study is based on the theory of Marcel Jousse, a French linguist, anthropologist, psychologist, educationist and theologian. What follows is a brief discussion of what prompted Jousse to develop a theory of memory and human expression in the Anthropos, which theory underpins this study. The basis of his research was the anthropos with particular reference to the areas of memory and human expression. This study will look at how his observations of memory and human expression relate to the debate on AI.

Jousse's aim was to establish universal, anthropological laws that would apply through all eras and all cultures. The laws are derived from a fundamental law, which is the indivisibility of the psycho-physiological complexus of the human composite, which is pervasive and durable in time and space. While the laws remain constant, the application of these laws of expression vary from one ethnic milieu to the next and that is what accounts for the uniqueness of each individual. This uniqueness of each individual directed him to explore how the individual interacts and expresses individuality within an

ethnic milieu. The laws that have been identified by Jousse (1997) and that form the basis of this study are:

- Mimism
- Rhythmism
- Bilateralism
- Formulism

As stated above, these four laws are rooted in the indivisibility of the psycho-physiological complexus of the human composite, which will also be discussed in detail in order to provide a foundation for the four laws.

A brief comment on Jousse's use of the word 'law' is appropriate at this stage. The time of Jousse's writing was a time of scientists, a time when they presented their perspectives as laws. Current thinking excludes the notion of absolutes, so the term 'laws' is inappropriate. The more appropriate term to use today would be 'operating principle'. They are ideas that can be advanced and contested. The use of the word 'law' situates Jousse in a particular time and I will therefore continue using it in the following discussion of his work.

The second theorist who has provided insights to this study is Joel Orr who coined the term 'Anthropocybersynchronicity'. He coined the term "to describe an area of person/ machine interface" (Orr n.d.), which he felt was largely unexplored. The focus of his study was rhythm in machines and the importance of rhythm in operating the computer. This formed a link with Jousse's law of rhythmism, which is a fundamental anthropological law.

What has been presented here is a brief discussion of the views of the two theorists who form the basis of this study of memory in human expression and AI. The theories presented provide a foundation for the detailed study that follows.

2.5. Methodological Considerations

The nature of this study has generated certain difficulties that need to be considered for the methodological structure. One of the considerations is Jousse's terminology, which was coined by him in the interests of semantic precision, and therefore requires some explanation. Explanations of some of the terms as they relate to this study are to be found in the glossary, and where necessary they are embedded in the text.

There are a number of common terms that have been hyphenated by Jousse. This has been done to emphasise the etymology for greater precision in the usage.

Another consideration is the difficulty in compartmentalising the information into sub-headings in order to create a readable structure. The Anthropos is a composite, and ex-presses itself as such. It is impossible to divide it into parts and still expect it to function as a complete being. In the same way there were problems in trying to physically divide arguments about memory, thinking, intelligence and consciousness, as well as the role that the brain and the body play in all of this. I found that some of my arguments were being repeated and some of my supporting quotations covered all these areas as one. There may be a number of points that are cross-referenced, however, I can only hope that the argument is clear and succinct in its logic and that the reader will accommodate this complexity and its associations, as only a **human** can!

CHAPTER 3

CREATING THE CONTEXT

This chapter outlines some important issues concerning this study. It looks at the human being's dependence on computers, some of the questions that have been raised in AI, as well as some of the problems experienced. It creates the context for the argument that follows.

Man has created a dependence on computers without even realising he has done so. Had computers been removed from society a few years ago we would still have been able to function normally; however, because we have now incorporated computers into every facet of our lives, it would require a certain measure of adjustment and at times would appear to be quite impossible to continue without them.

> We appear to have come to a time in which the ideas that there are differences between human beings and machines, that there are experiences that human beings can have but machines cannot, and that therefore (at least!) there are thoughts humans but not machines can have, we have come to a time in which the holding of such ideas is a lonely preoccupation, a business that tempts one to doubt of one's own sanity (Weizenbaum 1987: xiii – xiv).

As the importance of computers continues to grow and innovations in the field emerge at a fast and furious pace, computers are becoming increasingly entrenched in the general activities of our lives. It is this reliance on computers that has suppressed the voices against the development of AI, which are growing fainter. This comes down to the fact that very little distinction is being made between the computer as a tool to **assist**

man, and the computer as a form of AI, which has the capacity or potential to **substitute** man. While scientists have developed machines that can replicate the mechanical behaviour of human beings, either independently or as an extension of the human body, up until now they have not been able to create a machine that is able to think like a human being or exhibit human intelligence in its fullest sense. An attempt to create a human-like machine is the creation of the Virbot, which is a 'virtual mannequin' that seems to be almost semi-human (Setton 2000). Although it is virtual, which implies it does not operate in real time and space, its interaction is almost human-like in terms of its gestures[6], speech, etc.

Therefore the moral and ethical issues that are certainly considerations for further developments in AI, and that are quite often not thought about are certainly taking on a more serious dimension.

> One position I mean to argue appears deceptively obvious: it is simply that there are important differences between men and machines as thinkers. I would argue that, however intelligent machines may be made to be, there are some acts of thought that *ought* to be attempted only by humans. One socially significant question I thus intend to raise is over the proper place of computers in the social order ... (Weizenbaum 1987: 13).

This again raises concerns about the moral issues involved in developing artificial intelligence. While this study does not focus on the moral issues explicitly, they do form part of the context of the argument to follow. Wittman (2000), in his discussion of "thinking software" asks a fundamental question that certainly is an important moral consideration for artificial intelligence. "What then will we do about "thinking software"?

What rights will it have? (...) if you unplug your well-behaved thinking computer, have you violated its fundamental rights?" These questions would also pertain to the Virbots, especially because they appear almost human-like in their functioning. What rights would they have?

Another consideration is that of accountability. Who will be held accountable if the computer suddenly lost control and went crazy? Would it be the programmer/s or the computer itself? The notion of accountability is not exclusive to AI, for there is a similar debate regarding the social and moral responsibilities of scientists generally. While these are important considerations that need to be seriously considered for the future of AI, this study will not focus explicitly on the moral and ethical issues any further. Instead, the moral and ethical considerations underpin the discussion of the functional capabilities of the computer as compared with the intellectual capacities of the human being.

Developers of AI foresee the computer as a replacement for the human being, especially when they talk about "scanning the brain to download it". The expectation is that they would "capture every little detail" from this type of scan and that "the new person will claim to be that same old person and will have a memory of having been that person..." (Kurzweil 1999: 124-125). However, memory and thought are not localised in just one part of the human being. Jousse (1997) argues that there is much more to human memory and human thought than can be accounted for by the activity and capacity of the brain.

> Primacy of thought and memory has been erroneously accorded to the brain. Professor Janet, my master, was justified in emphasising the exaggerated role attributed to the brain. Historically, the

> brain was regarded as the sole source of thought and memory. I have dethroned the brain and accorded it its rightful place: it is a 'commutator' which switches us into consciousness.
>
> Our thought, which is the bringing into consciousness, will thus no longer pulse to the rhythm of the brain, and our memory, which is the re-play of consciousness, will thus no longer respond to the rhythm of the brain. It is to the rhythm of the body as a whole that thought and memory will pulse and respond. Rhythm is collectively and continuously imbricated: the rhythm of our hearts, the rhythm of our breathing, the rhythm of the balancing of our hands, of our footsteps, of our actions, depending on which part of our bodies we use to ex-press the intussuscepted, intelligised and globally re-played Cosmos (Jousse 1997: 195).

In the above discussion Jousse looks at the role of the brain in memory and human expression. The studies that have been carried out into the functioning of the human brain indicate that developers of AI (e.g., Albus) would like to replicate the functioning of the brain in order to replicate human thinking and memory. This kind of thinking is doomed from the start.

Firstly, as Aleksander & Burnett (1983: 60) point out, "The construction of robot brains poses a problem (...) they have no blueprint of the model they seek to imitate, the human brain...." They extend their argument further when they point out the philosophical limitations to the brain undertaking an introspective study of how it works. This would not really be an appropriate approach for the possibility will always exist that the conclusions will be coloured by some inherent bias, which implies that the results of this introspective study would be inaccurate and incomplete because the thought processes are constantly changing.

Secondly, it is impossible to deduce from the study of a dead brain, how a living brain functions. All that can be studied in a dead brain is its structure and component parts: the

functioning, the processes, and the products of the processes, which are the most pertinent to AI, cannot be understood by a study of a dead brain.

And thirdly, it is due to the fact that "the brain is quite simply a conglomerate of switches (...) it is not the brain that determines psychological activity; it only regulates it" (Janet cited in Jousse 1997: 70). For as Jousse (1997: 195) says, "It is to the rhythm of the body as a whole that thought and memory will pulse and respond." Therefore a study of the brain will not provide a key to unlock the door to understanding how memory and thought operate in the human being.

Jousse's perceptions of the operation of thought and memory in man are multi-layered. In order to understand these perceptions and compare them to AI, I will discuss thought, memory, intelligence and consciousness under the following headings:

1. The Psycho-physiological Complexus of Man – which will look at how man interacts with his environment and the implications that this interaction has for AI.
2. The Psycho-physiological Laws of Human Expression – the four laws of Mimism, Rhythmism, Bilateralism and Formulism, and the role they play in memory and thought in the human being as well as the computer.
3. Re-ceive, Re-gister, Re-play – how the process of 're-gistering' informs man's ability to re-play what he has re-ceived and whether the computer has the capacity for re-gistering in order to, and before re-play.
4. Im-pression and Ex-pression – that man will ex-press what has been im-pressed, though not necessarily as it was im-pressed due to the process of re-

gistering. And whether this ex-pression functions in the same way in the computer as it does in man.

CHAPTER 4

THE PSYCHO-PHYSIOLOGY OF HUMAN INTERACTION

This chapter provides a detailed discussion of man's interaction with the universe, which involves both brain and body. It is interaction with the universe that leads to knowledge acquisition. Initially the discussion centres on **The Psycho-Physiological Complexus of Man**, it continues with a discussion of **Tri-phasic Interaction**, for all human interaction is tri-phasic.

4.1. The Psycho-Physiological Complexus of Man

The psycho-physiological complexus of man is an important consideration in the development of AI because there is a need to study man as a composite i.e., a combination of mind and body. This view is supported by Wittgenstein's understanding of the psychological aspects of the human being i.e., thinking, intelligence, memory, etc. that are based on two proposals. The first is that "the very features of our minds are in some essential way tied to the specific organisation of our physical organisation, our body" (Neumaier 1987: 151). Secondly, "If we want to know whether a certain being can 'think', we do not only investigate its ability to perform specific tasks but, rather, the total of its *behaviour*" (ibid: 152).

Many mechanisms have been developed to replicate the functioning of human limbs, some of which have been a great success (e.g., mechanical arms used in industry, as well as robots that are able to pick up and move blocks about a room).

These have been successful particularly because their function has been limited to mechanical movement without any thought involved. The great challenge now for the developers of AI is to develop a mechanism that has the ability to function cognitively and emotionally like a human being. It is for this reason that the brain has now become the focus of study. There are, however, some fundamental problems with this focus.

Firstly, "there is never a body without a brain in nature" (Pollack cited in McFarling 2000). Which implies that to study the brain in isolation would pose some very serious problems. (cf. Pg. 24).

Secondly, while robot bodies have been created that can replicate human movement, there are some very basic human characteristics that they lack which may not necessarily be localized in the brain. Janet (cited in Jousse 1997: 70) expresses a similar view to that of Wittgenstein when he says:

> In reality, man thinks with his whole body; he thinks with his hands, his feet, his ears, as well as with his brain. It is absolutely ridiculous to claim that his thought depends on a part of himself: it is tantamount to saying that our manual ability depends on our fingernails.

Jousse supports Janet's doctrine that "man thinks with his whole body". This doctrine arises from the argument that 'to think' is to do and man is constantly in the process of doing which means that he is constantly involved in action. "Action does not depend on the brain; it is not performed by it (...) A brain separated from a living being is incapable of thought or of action" (Janet cited in Jousse 1997:70). The reasoning Jousse uses is that the muscles form part of the circuitry that is involved in

action, so if the brain were detached from the muscles it would be incapable of action. We may be able to copy all the neural connections in the human brain, but that would not produce the psychological activity that is very much a part of the Anthropos' interaction with the environment. In addition, muscles without a brain would also be incapable of action, which confirms the complex nature of man. He further states that, "Psychological activity is an activity of the whole – it is not a localized activity" (Jousse 1997: 70).

Albus (1981: 298) on the other hand feels that "There is no reason to suppose that the present human brain represents any theoretical maximum of intellect." In fact, he feels that to educate the human mind in logic and reason requires enormous effort, which implies that "other methods for computing and remembering could be much superior." While he recognises that there is more to the human mind and memory than the brain, he does not acknowledge the role of the body in constructing memory. He believes that it is possible to construct a robot brain that would be able to store all the information in all the libraries of the world and that if one adds another hierarchical level, it would be possible to "make robots more intelligent than humans" (Albus 1981: 298).

What he disregards at this point is the fact that there is an enormous difference between the capacity to store information and the capacity to manipulate stored information in order to function intelligently. One definition of intelligence is the ability to organise components of information to solve problems with the highest degree of efficiency (Klix 1987). Therefore to function intelligently the human being is able to re-organise and manipulate the components of information with the highest

degree of efficiency to meet the needs of a given situation by using stored information and past experience as reference points. Albus (1981: 298) does admit, "Nevertheless, because of their very different physical forms and prior learning experiences, robots and humans will forever remain very different creatures."

Jousse, however, is quite clear in his assertion that the psycho-physiology of man is indivisible and it is the same indivisible human composite that underpins psychological activity. This implies that man functions **simultaneously** as a psychological, physiological and biological being. The brain merely operates like a switchboard (cf. Pg. 23-25) that diverts the various pulses that are received by it. This view is supported by the research of two Americans, McCulloch and Pitts, who in 1943 demonstrated that the neurons (nerve cells) which form the basic components of the brain functioned similarly to "the valve circuits which provided the switches in machines like ENIAC [Electronic Numeral Integrator and Calculator]" (Aleksander & Burnett 1983: 79). The ENIAC could be considered the ancestor of the computer, notwithstanding that it operated on a decimal system.

The computer, just like the brain contains a conglomerate of switches that work on a binary system of 0's and 1's (unlike the ENIAC), that control all the processes in the computer. The switches that make up the human brain, however, do **not** entirely account for the various psychological activities that the human being can accomplish. In other words human intellectual capacity stretches beyond the capacity of the brain.

This view is supported by Pert (1997) who says that research carried out by Dr Eric Kandell and his associates have proved that "biochemical change wrought at the receptor level is the molecular basis of memory." What happens is that when a

receptor is flooded with ions or molecules, the cell membrane changes so that the probability of an

> electrical impulse travelling across the membrane where the receptor resides is facilitated or inhibited (...) These recent discoveries are important for appreciating how memories are stored not only in the brain, but in a *psychosomatic network* extending into the body, particularly in the ubiquitous receptors between nerves and bundles of cell bodies called ganglia, which are distributed not just in and near the spinal cord, but all the way out along pathways to internal organs and the very surface of our skin (Pert 1997: 143).

The decision about whether a thought becomes conscious or remains in the subconscious is mediated by the receptors. It is because of this that she feels that "memory processes are emotion-driven and unconscious" (ibid.), though they can become conscious because they are receptor-mediated. Because of the relationship between memory and the emotions, memory as well as performance are affected by the mood the human being is in. Strong emotions amplify our experiences and fix our memories.

The body is therefore an important factor in human thought and memory, which implies that it cannot be disregarded in the development of artificial intelligence. This is substantiated by Dreyfus (1972: 147) when he points out some of the shortcomings in artificial intelligence related specifically to the notion of the brain being the centre of intelligence.

> In thinking that the body can be dispensed with, these thinkers again follow the tradition, which from Plato to Descartes has thought of the body as getting in the way of intelligence

> and reason, rather than being in any way indispensable for it. If the body turns out to be indispensable for intelligent behaviour, then we shall have to ask whether the body can be simulated on a heuristically programmed digital computer. If not, then the project of artificial intelligence is doomed from the start (Dreyfus 1972: 147).

Dreyfus raises an important question here when he mentions the indispensability of the body for intelligent behaviour. If the body is dispensable then why do the computers that are presently in operation not demonstrate a capacity for intelligence and reasoning that is comparable to the human being's capacity for intelligence and reasoning? In their attempts to develop an intelligent machine, Minsky and Papert developed a computational model that looks at the mind as "a society of interacting agents. These agents are anthropomorphized, (...) but they do not have the complexity of people" (Turkle 1988: 259). Each agent is "dumb", but when they interact, the conflict that emerges from their opposing views generates complex behaviour like thought or emotion. In order for the system of interacting agents to function coherently, an intelligent system must be able to repress certain conflicts while allowing others to be expressed. In order for intelligence to emerge, the system would need censors to identify which conflicts to repress and which to express (Turkle 1988). The censors are inherent in the human being, but in the computer would have to be programmed.

Each agent in this model is dependent on other agents and unlike a human being would not be able to function on its own. Therefore if the machine had to exhibit intelligence, it would be intelligence built into it by the programmer based on a particular context, but it would not have the capacity to allow it to adapt to other

contexts. The human being's capacity for intelligence stem from his ability to re-organise and manipulate the information received from the environment efficiently and to identify what to repress and what to express. The adaptability of the human being is an important consideration for his development, for progress is a function of adaptation.

While the computer is able to simulate the performance of tasks that are performed by human beings like processing, storing and retrieving information; the execution of these tasks is very different to that in the human being. The computer is able to identify different aspects of a situation because it has been programmed to do so, but it is not able to "**originally** [emphasis added] establish the terms of a distinction" (Sokolowski 1988: 60). A simple example to illustrate this point is the computer's inability to recognise the indent required for the beginning of a paragraph in the main text when the paragraph starts after a 'stand alone' quotation. It is not able to identify the one as a quotation, or as a group of words that do not form part of the paragraph in the main text, though they differ in size. This substantiates the point that the computer is not capable of processing information in the way that a human being does.

What it is able to do is to manipulate formal symbols. The fact that the human being, who is the programmer of the computer as well as the interpreter of the output generated by the computer, extrapolates the symbols to his reality is beyond the scope of the computer (Searle 1987). The computer has the ability to operate on the symbols but has no understanding of the symbols. One of the reasons for the difference in human and computer processes may lie in Dreyfus's explanation that:

> A brain in a bottle or a digital computer might still not be able to respond to new sorts of situations because our ability to be in a situation might depend, not just on the flexibility of our nervous system, but rather on our ability to engage in practical activity. After some attempts to program such a machine, it might become apparent that what distinguishes persons from machines, no matter how cleverly constructed, is not a detached, universal, immaterial soul but an involved, self-moving, material body.
>
> Indeed, it is just the bodily side of intelligent behaviour, which has caused the most trouble for artificial intelligence (Dreyfus 1972: 148).

Our ability to 'engage in practical activity' involves an entire body that is able to extrapolate not just thoughts and ideas from one situation to the next, but also actions, which form an integral part of the human being's interaction with the environment.

The above arguments sustain Jousse's perception that the human being is an indivisible psycho-physiological being. However, Jousse (1997: 70) further states that "man is a complexus of gestes" and that "the universe presents itself as a formidable interlacing of unconscious, predetermined interactional gestes which he can and will re-play consciously and voluntarily." The human being interacts with the environment through the geste. The geste can be both microscopic e.g., in dreams as well as reflection or meditation, as it plays and re-plays itself within the human being through the vibrational energy received from the environment; and macroscopic e.g., when one sleep walks or in a ritual act, as it presents itself in the form of action that is visible to others. This ability to play and re-play gestes is unique to the human being.

The human being's interaction with the universe unfolds from the very tips of his fingers to the innermost workings of his body. It is for this reason that Turner and Poppel view

> Human information processing ...[as being] hierarchical in its organisation. In the columns of neurons in the sensory cortex a plausible reconstruction of the world is created by a hierarchy of cells, the ones at the base responding to very simple stimuli and passing on their findings to cells programmed to respond to successively more complex stimuli. Likewise, motor decisions are passed down a long command-chain of simpler and simpler neural servomechanisms (Turner & Poppel n.d.).

The idea of the hierarchy that exists in human information processing links up with Pert's discussion of the psychosomatic network (c.f. Pg. 31), for the operation of the various cells in the network become increasingly complex as they form a link with the central nervous system.

Jousse (1997: 57) sees the human being as the "emitter of physiological gestes, and psychologically capable of intellectualizing and of 'propositioning' these gestes in order to express the most spiritual of his mental attitudes." The human being's basic form of expression is and always has been the geste, which stems from intussusception. Intussusception is "the grasping of the external world and the internalising thereof i.e. the synchronising of all the gestes that flow from nature into man, so that he can *ex*-press them" (Jousse 1997: 661). Each human being intussuscepts differently for each human being is different. The manner in which the intussusception is played and re-played within the human being is "personal and particular". Because we are not all equal, the preservation of the re-play depends on

the depth of the intussusception and the capacity of the human being (Jousse 1997: 123). The internalising and conscious re-play of the geste arises out of the human being's interaction with his environment.

As Turner and Poppel (n.d.) state, 'human information processing' which is the internalising of the geste, occurs in a hierarchical fashion. It originates at the extremities via sensory experiences, and through continuous play and re-play it is intellectualised and intussuscepted. There are a variety of sensory experiences that are unique for each individual. Once the sensory experiences have been intussuscepted they can be re-ordered, re-patterned and categorized by the individual in order to express himself in creative and imaginative ways. The categories constructed by the human being as well as the re-ordering and re-patterning are not fixed, but constantly change to accommodate new experiences.

One of the stumbling blocks in artificial intelligence has been the inability of the computer to interact with the environment in a way that is comparable to the interaction of the human being with the environment. For as Bronowski (1965) says, while we may not understand how memory and the brain function, we would be quite mistaken to assume that the human being's picture of the world is a "passive record". For the picture is made up of all the human being's activity from the inner operations of logic and emotion to the external actions of expression which include his use of tools. The picture of the world "is not the look of the world but our way of looking at it: not how the world strikes us but how we construct it"(Bronowski 1965: 34), and this construction would include not just the external stimuli, but our internal associations as well.

Dreyfus, who presented arguments against artificial intelligence since the 1960's, was initially dismissed. However, in recent years his arguments have been considered in a more serious light. His argument stemmed from his belief that Man's relevance was holistic and that we have "common sense background understanding that allows us to experience what is currently relevant as we deal with things and people [which] is a kind of *know-how*" (Dreyfus 1993: xi).

By 'know-how' he is not referring to procedural rules, but rather knowing how to deal with exceptions, and this would arise out of man's interaction with the environment and his intussusception thereof. The human being is often not aware of the extent of 'know-how' or common sense understanding he possesses. Minsky (1982) points out that some of the earliest AI programs "excelled at 'advanced' subjects, yet had no common sense." He attributes the success of these "expert" programmes to the fact that experts can sometimes "get by with deep but narrow bodies of knowledge – but common sense is, technically, a lot more complicated" (ibid.). When a computer is presented with a problem, it needs an algorithm (set of rules) to solve the problem as well as instructions to perform all the other processes involved in solving the problem, which in a human being is common sense understanding (Aleksander & Burnett 1983). The computer does not have this common sense understanding because it does not share the same kind of interaction with the environment that the human being does. The problem that arises would be to program this 'know-how' into the computer, because 'know-how' does not necessarily operate logically.

Jousse (1997) argues that this 'know-how' which derives from memory, is embedded within us through memorisation. Memorisation is the

> unconscious interactional montage which we bring wholly into our consciousness before releasing it in the gestual and rhythmic mechanisms (...) Intelligence is then enabled to be infinitely more supple, more enthusiastic, more combative, more victorious (...) The truest manifestation of 'man' is he who has the greatest number of habits, intelligently accumulated in him (ibid: 141).

He can allow these 'habits' to lapse into his unconscious in order to free his intelligence to focus on current situations. An example of this would be explained by the human being's capacity to drive a car. Once the gestes of driving a car have been 'brought wholly into consciousness' through intussusception, the driver does not have to think about how to change the gears, or how to turn the steering wheel because these gestes are a part of him. These 'habits' would have lapsed into his unconscious, which would allow him to focus on what is happening on the road ahead.

The human being uses his whole body to memorise. The interaction of the human composite with the environment and the intussusception of this interaction gives rise to memory, which implies that memory is dependent on man's experiences. Bronowski (1965) regards experience as a critical factor in knowledge acquisition.

> In order to see if there is a self in man which is not mechanical, we have to look not inside the brain, but into his acts of experience. We have to analyse the nature of different experiences, and how they are turned into knowledge. This is critical, because once the

> knowledge is decisively fixed for action, the biological machine must take over (Bronowski 1965: 21-22).

Bronowski is quite certain that the body is important for the acquisition of knowledge, which occurs through experience. The process of 're-gistering' (which will be discussed in chapter 6) is responsible for transforming these experiences into knowledge which forms memory. 'Re-gister' refers to man's ability to re-order and re-pattern intussuscepted gestes in different ways, which accounts for creativity and imagination. Man then ex-presses what has been intussuscepted, through action. In Jousse's terms, all action is geste and all geste is action, but because his understanding of the term 'action' is very specific, he coined the term 'geste'.

In acknowledging the complexity of man, one can understand the problems experienced in developing a machine that will function as intelligently as a human being. Moravec (1988: 52), a staunch advocate of the theory of evolution (c.f. Pg 3), recognises the problems of creating a machine that will function intelligently like a human being. He asks, "How much further must this evolution proceed until our machines are powerful enough to approximate the human intellect?" and acknowledges that, "Too little is known about both the overall functioning of the human brain and how an intelligent computer would operate to make this estimate directly." What he fails to recognise is that the human intellect is not localised in the brain; that the brain is merely a control centre for the Anthropos in that it contains switches that direct and redirect pulses in order to send information to various destinations. For the brain is where all the connections are made.

Maddox's (1999) statement supports Moravec's view concerning our lack of understanding of the human brain, and also identifies our lack of understanding of the capacity for imagination, decision-making and consciousness, which are exclusively human, as being problem areas in AI.

> The catalogue of our ignorance must also include the understanding of the human brain, which is incomplete in one conspicuous way: nobody understands how decisions are made or how imagination is set free. What consciousness consists of (or how it should be defined) is equally a puzzle (Maddox 1999).

The questions he raises are important considerations for AI, for the human being's capacity for creativity and imagination cannot be logically programmed into a computer. Neither can his capacity for consciousness, for the question of consciousness is still a burning issue in philosophical and scientific circles.

Jousse's understanding of consciousness stems from intussusception, which is the internalising of the external world. This implies that consciousness originates from the interaction of the human composite with the environment. This brings one back to the point that the human being is an indivisible psycho-physiological complexus of gestes which reflects the indivisible complexus of the universe, indivisibly.

4.2. Tri-phasic Interaction

Jousse (1997) says that tri-phasism i.e., An Acting One acting on an Acted upon "is fundamentally the unconscious play of cosmological interaction" (ibid: 115). It is "the first and essential Law of Cosmological Energy, and it operates as such at all levels" (ibid: 117). He says, "the essential element of the Cosmos is an *Action* which Acts on another Action" (ibid: 116) and the cosmos is actually energy. The Acting One and the Acted upon are essentially each a cluster of energy, and it is the energy which then drives the action/ geste.

The human being "intussuscepts the *cosmological interactions* and reverberates them in *Anthropological interactions*" (Jousse 1997: 120). The 'interactional geste' will be intussuscepted by the human being, using his sense of sight, and he will then revivify the action. The human being will choose a characteristic geste of the 'Acting One', which becomes the miming geste. The human being re-plays the miming geste of the 'Acting One', the miming geste of the action that is performed by the 'Acting One' as well as the miming geste of the acted upon. "This essential characteristic geste becomes, as it were, the Name of the being, regardless of whether the being is living or inanimate" (Jousse 1997: 121). This continuous re-playing of tri-phasic interaction in the human being, particularly the child, occurs spontaneously. In this continuous re-play, the human being amasses a number of mimemes, which have been intussuscepted by him. The 'Mimeme' is the "revivification of the characteristic or transitory geste of the mimed object within the Human Composite"

(Jousse 1997: 122-123), which is the reconstruction in our receiving mechanisms of the movements of entities around us.

Rasmussen (1986: 100) proffers a similar explanation, which is "a large repertoire of different mental representations of the environment." He feels that the human being's ability to choose from this repertoire, rules to control behaviour, would provide an explanation for the human being's efficiency in dealing with complexity. Jousse's proposal of the 'mimeme' goes much deeper, for it is not merely a 'mental representation', but a psycho-physiological geste that has been intussuscepted by the human being. And this implies that it constitutes and is constituted by the viscera of the human being.

Jousse (1997: 124) says that the character of the human being stems from his ability to intelligise "the Interactions of what is real". The human being is no more than a receiver of interactions for everything starts with the interaction. The essence of the human being is his 'miming' cluster of energy. Simon (1966 cited in Rasmussen 1986: 74) states that the human being as a "behaving system" is really quite simple. The manifestation of complex behaviour over a period of time stems from "the complexity of the environment in which he finds himself (...) his behaviour will reflect characteristics largely of the outer environment." The characteristics mentioned here are a reiteration of the 'characteristic gestes' that Jousse mentions. The human being's behaviour would therefore arise from the intussuscepted gestes of his interactions.

"The Geste is the living energy which vitalises the global whole, the Anthropos (...) The Geste is truly something which plays and re-plays..." (Jousse 1997: 119).

The human being's interaction with the universe is therefore tri-phasic, because of his gestual re-play, and repetitive in nature and can be either microscopic or macroscopic, for man's interaction with the environment is driven by energy which is the geste. The only way the human being will know something is when it is played or 'gestualised' within him.

Bronowski's explanation supports Jousse's notion that "*to know* an object in some depth, the 'human composite' must first receive within itself, and thus become capable of re-playing *consciously* and *intelligently,* a number of this object's transitory actions upon some other object" (Jousse 1997:69). Bronowski (1965: 90) says:

> The kinesthetic gestures stretch naturally into the forms of ritual. Before they go out to hunt dangerous animals, many tribes have a ceremony of incantation, and it commonly includes some hunting actions. These actions have been described so often that we accept their presence as self-evident. Yet what can be their purpose? They are said to give the hunters courage. But it would be truer to say that they give them the feel of the hunt: they make the Pygmy hunters at home with their pursuit, and take them into its coming turns and surprises with the sense of action already in their muscles.

It is man's rhythmic, mimetic geste that is transformed into ritual; and in the re-playing of the geste during the ceremonial, re-gistering takes place which accomodates the action that will take place during the hunt for the human being would have intussuscepted the geste of the hunt. When the human being is faced with the animal during the hunt it would provide him with the cue to remember the intussuscepted geste of the ritual so that he can carry out the required action. The

ritual that Bronowski discusses is a conscious performance. Consciousness, he says is "not merely an awareness of self" (Bronowski 1965:79), but it is also an awareness of our limitations within the environment and how we are able to operate within it. It involves an understanding of nature as well as an understanding of self.

The computer does not have a conscious awareness of its actions or the environment within which it operates because it does not operate tri-phasically. The computer does not have the living energy which is the geste and is therefore not able to interact with the universe on the same level as the human being. Neither is it able to re-gister impressions.

> The Anthropos finds himself — the essence of his individual 'miming' cluster of energy — in the midst of the indefinite interactions of the Cosmos like a kind of living resonator, which resonator can only receive a limited number of vibrations (Jousse 1997: 124).

The biological apparatus of the human being is fairly limited in its ability to receive the vibrations, for it does "not perceive vibrations below or above a certain frequency. Our apparatus is therefore selective" (ibid: 124). There are infinite vibrations that make up the Cosmos. The limited vibrations that the human being receives would be related to the intrinsic rhythms of the human being. Therefore the environment has a profound effect on everything that man does and the computer can never replicate this interaction, for the universe plays in and the anthropos re-plays.

CHAPTER 5

THE PSYCHO-PHYSIOLOGICAL LAWS OF HUMAN EXPRESSION

This chapter will look at the psycho-physiological laws or the mnemonic laws of human expression as identified by Jousse, and their function in providing an understanding of the operation of human memory. It will also critically analyse the capacity of computer memory in relation to these laws.

Before discussing the psycho-physiological laws of human expression, there are certain methodological considerations that need to be explained. Jousse's concepts and perceptions are layered, complex and iterative and therefore form many different connections. The psycho-physiological laws of human expression that he has identified are no different in their complexity and their layeredness and therefore pose certain difficulties when discussing them on paper. The psycho-physiological laws are interrelated, for man interacts with the environment using the four laws **simultaneously**.

The problem that arises, is the method to follow in discussing them for one cannot discuss all four laws simultaneously without confusing the reader. This section will therefore start with an exposition of each of the laws and their function in human expression as separate entities before bringing them all together in a discussion of how they operate simultaneously in man. The discussion will then continue with a focus on how the computer functions in relation to these four laws.

The psycho-physiological laws of human expression are **Mimism, Rhythmism, Bilateralism, and Formulism.**

5.1. Mimism

Jousse (1997: 668) identifies Mimism as "the instinctive tendency which the Anthropos alone possesses, to re-play all the gestes of the universe." The human being mimes what is around him involuntarily and through his own volition.

Aristotle identifies mimism as a possible human-specific capacity, "For miming is congenital to the young Anthropos, who differs from other animals in that he is the greatest mimer and that he acquires his first knowledge through *Mimism*" (POETICS IV 2 cited in Jousse 1997: 63). The human being acquires knowledge from miming what is in the environment whether it is in the form of nature, animals, or other human beings. In his miming of the interactional geste, the whole Universe 'is reflected', therefore "the whole Man 'reflects'" (Jousse 1997: 147). The actions, shapes or words that are mimed are not imposed on the human being. The computer on the other hand operates very differently because it is not able to interact with the environment in the way that the human being does.

What was envisioned by the early pioneers of AI, especially Alan Turing, was that computers "might possibly go beyond arithmetic, and maybe imitate the processes that go on inside human brains" (Minsky 1982). In fact this ability to 'imitate' has already been achieved by developers of artificial intelligence and is evident in a number of different programs, one of which is ELIZA, developed by Weizenbaum.

ELIZA was a computer program that was developed to 'converse' in English. A human being would be required to type his message into the computer, the computer

under the control of the program would analyse the message and compose a response to the message in English. The program was constructed in a "two-tier arrangement, the first tier consisting of the language analyser and the second of a script. The script is a set of rules" (Weizenbaum 1987: 3). The two-tier arrangement derived from the need for conversations to be context-related.

This program developed into what became known as DOCTOR, which was ELIZA playing a psychiatrist. Even though his program became quite popular, Weizenbaum had certain reservations regarding it. First, he was concerned about how emotionally involved people were becoming with the computer and how willing they were to anthropomorphize it, which highlights the moral and ethical issues. Second, he was concerned that there was a widespread belief that the program "demonstrated a general solution to the problem of computer understanding of a natural language" (Weizenbaum 1987: 7). Weizenbaum is under no illusion about the functioning of the ELIZA program and is quick to point out that

> language is understood only in contextual frameworks, that even these can be shared by people to only a limited extent, and that consequently even people are not embodiments of any such general solution (ibid.).

Even though the computer is able to give the appearance of functioning like a human being, it actually does not. Gleick (1983) mentions the ability that the computer has to 'imitate', but also points out its inability to perform simple functions that the human being is able to perform.

> It's no longer astounding to hear about computers imitating anything from a psychiatrist to a schizophrenic. Yet some of the abilities that add up to intelligence – abilities as simple as recognising the letter A, or predicting the next number in a sequence (1-2-2-3-3-3-?), or doing Jumbles – have stayed as mysterious as ever (Gleick 1983).

The computer's ability to 'imitate' as mentioned by Gleick, must be distinguished from the human being's capacity for mimism. The human being has the capacity for Mimism as well as imitation. The computer does not have the capacity for mimism as it does not interact with the environment in the same way as the human being. Jousse (1997: 646) makes a clear distinction between the two terms for he says, "Mimism is instinctive: imitation is voluntary" and that mimism involves unconscious, involuntary action, whereas imitation is conscious and voluntary. The computer's ability to imitate a psychiatrist then would stem from the conscious and voluntary programming of the computer by a human being. The computer is dependent on the rules that are programmed into it by a human being and can only operate on those rules within a predefined logic. Therefore it does not have the capacity for recognition and neither does it have the capacity for prediction.

The 'knowledge' or information that the computer receives is imposed by the human being that operates it. The computer does not choose the information that it would like to acquire and in fact it is not able to acquire 'knowledge' or information in quite the same way that the human being is able to.

As Franklin (1995: 11-12) says,

> AI systems tend to be designed and programmed, rather than trained or evolved. They tend to be propositional in nature, that is, based upon rules or some other data structure expressed in some language.

The language that is used is not a natural language developed by the machine in the way that human beings developed their languages, but rather they are languages that have been specially designed by human beings for machines to be able to receive instructions. Natural languages evolved out of the human being's interaction with the environment within a social context through the human being's capacity for mimism. It is the capacity for interacting and re-organising information within a social context that manifests in intelligence. The computer does not have this capacity, therefore the notion that Moravec (1988) and Dennett (1994) have of nurturing their mechanical creations from an artificial infancy until they develop a kind of 'adult' intelligence will, in all probability, never be realised.

The computer memory operates very differently from the memory of the human being, for the computer is not able to operate mimismologically but instead has its memory imposed on it, because the computer does not have the freedom of choice to experience its environment, in the form of 'mimism'.

5.2. Rhythmism

Man's ability to intelligize what is real arises out of his rhythmic interaction with the environment. Jousse (1997: 215) says, "We become conscious through meaning. Once the realisation of consciousness has been properly achieved, the living and

intelligent mechanism will play rhythmically." Jousse defines rhythm as "the return of an identical psycho-physiological phenomenon at biologically equivalent intervals" (Jousse 1997: 678). What is implied here is that these rhythms operate on a psychological as well as physiological level, for man is an interactionally miming, rhythmic complexus. Rhythmism and mimism, according to Jousse, occur **simultaneously**.

> Mimism and Rhythmism, however, always come into play, constantly and intelligently, interdependently and simultaneously. Rhythmism is the life force which, of necessity, distributes and sequences mimism (Jousse 1997:122).

For it is the breath that gives us the rhythm. The concept of growing stems from the notion of breathing. Before the word 'existence' was coined, people used the word 'grows' or 'breathes' (Jaynes 1976). Growth referred not just to physical growth, but mental growth as well. Breathing occurs rhythmically and one of the signs of a malfunctioning human biological system is erratic breathing. It is because all rhythm is ordered and logical that it assists in sequencing mimism.

The rhythm of human breathing is transmitted to the sensory-motor pathways in the brain which are all synchronised to the same rhythms. Therefore, there are "rhythmically recurring addresses input to the associative memory modules in the internal world model. These produce rhythmically recurring expectations to be compared with rhythmically recurring sensory experiences" (Albus 1981: 200).

There are rhythmic patterns that permeate the entire processing-generating hierarchy of the human being, which underscores the reason for Jousse saying that we should not look to the arts for rhythm but rather

> to the unfolding of life. Human geste, propelled by an explosion of nervous energy, beats in biological measure (...) Our bodies pulse successively and we are therefore rhythmed. Our bodies create the universal and perpetual flow of Rhythmism (Jousse 1997: 269).

For rhythm is intrinsic to the human being. Our hearts beat, our blood flows to a very specific rhythm. As Pert (1997: 242) says, "in the psychosomatic network, related events occur simultaneously in time and space, in spite of our perceptions of them as unconnected and independent." It is because the psychosomatic network operates within a specific order and logic that is related to its rhythm. Because of the rhythm, man is never motionless but has a continuous flow of thoughts, feelings, gestes. The rhythms also change depending on the stimuli from the environment.

The computer is dependent on a human being switching it on to activate the electrical pulses that would give rise to its internal rhythms. While the computer is not able to breathe, it will not be able to grow and experience life, therefore it will not be able to learn, which implies it would lack the capacity for intelligence, thinking, consciousness and memory.

Orr (n.d.) claims that the secret to developing an effective computer system is

> Rhythm. Human-scale rhythms—visual, auditory, and kinesthetic—can and should be incorporated into the design of effective computer systems, (...) [because] Both mechanical

> and electrical engineers say a system is in resonance when it vibrates at its natural frequency. Energy from a resonating system moves easily to another system of the same natural frequency (Orr n.d.).

Because the human being and the cosmos operate with a particular synchronicity, it implies the coincidence of their operation in time and space is more than chance: it stems from a cosmological order. This provides an interesting mechanical explanation for man's ability to interact with the universe, which was one of the areas of interest that Jousse studied —Human Mechanics. Jousse views Human Mechanics as devices for making a choice which "vibrates interactionally not fragmentarily (...) the vibrations which are outside us are never independent but *always interacting*. One vibration always acts on another vibration. In the Universe, everything interactivates everything" (Jousse 1997: 125). The Anthropos is able to conform to the rhythms of the universe at different levels because he is biologically rhythmed.

The Anthropos operates on a circadian system. This basically means that there is an intrinsic rhythm, which correlates with the day night cycles of the universe as well as the longer cycles of the phases of the moon and seasons of the year. The circadian system is lodged in the Suprachiasmatic neuron in the frontal section of the skull. While the control centre for the circadian system is lodged in this area, it does not preclude the anthropos from synchronising with the circadian rhythm. The two main functions of the system are to synchronise the body with the environment, and to synchronise all the physiological processes in the body, it also synchronises the physiological processes with environmental changes.

As Colwell (n.d.) states, if the circadian rhythms are disrupted, the functioning of the human being is slowed down, and there is a possibility that the human being could become quite dysfunctional. An example of this is the mediocre performance of a person who is suffering from sleep deprivation. The person will be able to perform certain tasks, but the performance will be below their normal standard.

> The atoms in the brain as much as those in the body constitute a mechanism, which ticks with the same orderly regularity, and abides by similar laws, as any other interlocking constellation of atoms. Men have uneasily pushed this thought out of their heads because they wanted to avoid the conflict with their rooted conviction that man is a free agent who follows only the promptings of his own will (Bronowski 1965: 8).

But the human being's will is embedded within his environment, for he is able to appropriate what he chooses from what is 'Real'. In Jousse's terms what has been intussuscepted through the geste is what is 'Real' (Jousse 1997:186).

The notion of rhythm has been tackled by a number of people (e.g., Orr, Bronowski, etc.) in many different fields. Turner and Poppel (n.d.) also say that "brain processing is essentially *rhythmic,*" which cements Jousse's view of man being a bilateral rhythmic being, for it is not just the body that pulses with rhythm, but the brain as well.

While the computer does operate within the rhythm of its electrical pulses, these are not the biological rhythms that Jousse (1997) discusses, and neither are they related to the rhythms of the universe. It is this lack of correlation with human rhythms that inspired Orr (n.d.) to discuss the negative interaction between man and

computer. His argument is based on 'anthropocybersynchronicity', which is the synchronicity of rhythm between the anthropos and the computer, which he feels could enhance the human being's interaction with the computer. This would lead one to presume that if a robot were designed in 'the image of man', it would still not be able to interact with the environment as successfully as the human being, for it would lack the intrinsic rhythm that forms an essential aspect of the human being's interaction within and with the environment, which originates in the vibrational energy of the breath.

5.3. Bilateralism

It is from the anthropology of mimism that the law of bilateralism of human expression derives for "The universe plays man, and man plays the universe" (Jousse 1997: 669). Which implies that man's interaction with the universe has an impact on the environment and the environment has an impact on man. Whatever man receives from the environment is re-ordered and re-patterned, and when he re-plays (cf. Chapter 6) he can re-create the environment. Man, whether he likes it or not,

> is a double-sided being, and when he expresses himself globally, he balances his expression following the conformity of his body. The law of Mimism can only be expressed in conformity with the human structure. Just as man walks in alternating balancings, so too he expresses himself in alternating balancings.
>
> If man expresses himself in balancings, it is because he has two symmetrical sides. This living law of the human organism is inescapable.

> Why is there this kind of universality of balancings? Because these balancings facilitate gestual expression. They play in alternating pulsations of tension and relaxation, facilitating successive and rhythmic energetic explosions.
>
> (...) Mimism is, one could say, consubstantial with Bilateralism. 'Man is an interactionally and bilaterally miming animal' (Jousse 1997: 269).

Jousse's interpretation of bilateralism is not restricted to the structure of the human being, but extends to every interaction in time and space. Because there is constant movement there is only the past and the future, nothing stands still long enough to belong to the present. The memory operates in a similar fashion. Cohen (1989) identifies retrospective memory which "involves remembering events experienced in the past," and prospective memory which is "memory for a future act." Prospective memory is "remembering a plan of action", remembering to carry it out, as well as when to perform the act. She further states that "prospective memory is almost continuously active" (Cohen 1989: 24). As soon as the act has been performed, it becomes a part of retrospective memory.

Bilateral balancing manifests in intelligent behaviour. Bruner (1974: 437) says, "the full evolution of intelligence comes as a result of bipedalism and tool using." Bruner's view is limited, but, it does support Jousse's view of bilateralism to an extent. Jousse's view of bilateralism and the manifestation of intelligence is more encompassing because Jousse does not see the human being as being intelligent because he has two feet, but rather, because he is a 'double-sided being'. So whether the human being is miming, running, walking, jumping or skipping, he is balanced because of his bilateral structure. The balance of the interactions that the human being

is involved in can manifest either microscopically or macroscopically and this leads to order. The capacity of the human being to use tools stem from his intelligent interaction with the environment. The human being varies his behaviour in response to variations in his environment. These variations in his behaviour stem from his knowledge of a set of associations, which would be appropriate to the context of a given situation.

Jousse (1997: 275) refers to intelligence as

> that aspect of life which brings itself into consciousness. Intelligence is gestual. Intelligence plays life bilaterally in all its modes, including the bilateral balancing between what is in front and what at the back, what is before and what after: the encapsulation simultaneously of the notions of time and priority.

When Jousse (1997) addresses the issue of 'bringing into consciousness', he is referring to the human being's ability to consciously re-organise information in order to appropriate the information to accommodate the context. He calls this intussusception which is "the grasping of the external world and the internalising thereof" (ibid: 661). This "grasping of the external world" arises from the Anthropos' interactions with the environment through the various senses. The information that is received from the environment is re-played within the Anthropos and re-organised in many different ways as associations are made with information that is present within. In order to make these associations the meaning of the information has to be understood. This understanding flows from the play and re-play that occurs within the Anthropos. He says that "...man alone 'intelligizes' the interactions of what is real"

(ibid: 123). He intelligizes what is real through the geste, for man is a 'complexus of gestes'. The geste refers to all movements that are executed by the Anthropos.

The human being balances his gestes in accordance with the structure of the human body. The human being is bilaterally balanced, therefore man interacts bilaterally in his gestual interactions with the environment. In expressing himself as well, the human being operates bilaterally. For in order to express he has to repress. It is this ability to identify what to repress and what to express that demonstrates the human being's capacity for intelligence.

> Human ex-pression obeys an extraordinarily logical discipline. Confronted with the cosmos, it is the Anthropos' whole body which receives what is real, and which balances that received reality with its structural bilateralism (Jousse 1997: 268-269).

Every interaction that the human being has with the environment is balanced according to his bilateral structure. When Jousse refers to the law of bilateralism, he is referring to any function of balance, which means that bilateralism is more than two-sided. The patterns of movement that the human being ex-presses occur in time and space. Everything in the cosmos operates in time and space, therefore there is order in the cosmos. Order arises out of balance. Everything in nature is ordered and therefore balanced. All activity has to be synchronised with the behaviour of the environment in order to serve its function.

The computer to a certain extent operates bilaterally in accordance with the switches that operate it, which have to be either 0 or 1. However, the physical structure, unlike that of the human being, is not necessarily balanced. The computer

does not operate as a balanced bilateral being, for it is not a balanced bilateral being. Robots, however, that are being designed presumptively in the 'image of man', are being designed as bilateral creatures. I use the word 'presumptively' because they are certainly not living, breathing beings that are able to interact dynamically with the environment in the same way that the human being does.

5.4. Formulism

The rhythmic geste that man plays, when "understood by another individual within the context of a social milieu" (Jousse 1997: 656), gives rise to formulas. One of the developments that has arisen out of the human being's use of formulas within an ethnic milieu is language. Formulas are therefore defined by a context and involve interaction with other human beings.

> The formulas which are characteristic of the formulaic oral style are the inspired, definitive, linguistic accomplishment of hundreds and perhaps thousands of generations. Succeeding generations have worked daily to fashion 'verbal tools', that were, simultaneously, essential and obligatory, usable and practical, for the dual purposes of the social expression of their own personal knowledge (...)
>
> Each individual, man or woman, of this ethnic milieu, was trained daily by the community from early childhood, to apply himself (...) depending on the extent of his aptitude, he trained himself to create personal combinations of these ethnic formulas. Thus he improvised, always with rhythmic melody, new, individual compositions which differed in literary value from his neighbour's accomplishments (...) 'the unit of measure' in expression (...) was the formula... (Jousse 1997: 425).

In our use of language, context is everything. It is the context that determines the meaning of whole sentences, which assist in removing ambiguities that are inherent in the language. It is the context that restricts the range of possible meanings without one having to consider the range of context-free alternatives (Dreyfus 1987).

The complexity of the human being's interaction with the environment lies in the fact that he constantly receives diverse stimuli from the environment. The stimuli that he receives are located within the environment as well as within other human beings and himself, which implies that they are context-based. All human interaction takes place within a particular context. The human being's intellectual capacity is reflected in his ability to re-order and re-pattern these formulas to accommodate the changing contexts within the environment.

The human being's ability to use language arises out of his ability to re-order and re-pattern formulas. His efficiency at manipulating these formulas culminates in him recognising the combinations of formulas as entities, not as sequences of letters or syllables (Aleksander & Burnett 1983). Human beings are guided by context in pattern recognition "in ways that cannot be duplicated by the computer using context-free features and precise rules for relating them" (Dreyfus 1987: 44). Roboticists have had great difficulty in finding algorithms to recognise patterns in language, etc (Aleksander & Burnett 1983), whereas human beings have the ability to recognise repeating patterns and to predict an outcome based on the repetition. Once the ability to recognise patterns has been learned, it becomes simple for the human being to recognise when deviations from the norm occur (Albus 1981).

The formation of patterns is fluid. It consists of formulas being taken apart and put together in new and creative ways. For Chalmers (cited in Franklin 1995: 34), the "beginnings of an answer to the problem of consciousness is his identification of pattern and information." The sequence of his argument is that, if pattern and information occur, then they always occur together. Patterns carry all information in the physical world. All patterns will carry some information, therefore, "patterns and information are two aspects of the same thing, PATTERN-INFORMATION."

In order for the human being to become conscious of what he is, he must remember what he was as well as what he was not, for volition and decision are very much a part of consciousness. He must also remember what his environment was, for he interacts with the environment. He must be able to recall what is no longer visible, for this is part of the learning process, losing the

> limitation of the animal,
>
> Out of sight, out of mind,
>
> and find[ing] the formula for human memory,
>
> Absence makes the heart grow fonder... (Bronowski 1965: 80).

It is memory that provides us with the capacity for vision. Memory makes it feasible for us to predict the future. Recurring events that are stored in the memory generate expectations (Klix 1987). We are therefore able to advance into the future with the impressions that are located in the past. Because of the human being's ability to consciously re-organise and re-order the impressions he is able to accomodate the context of the future. Consciousness in man therefore involves looking back as well

as looking into the future in order for him to function within a context-specific situation.

The issue of context is critical because human beings create context for the new text from all the texts that have been previously intussuscepted by them. While the computer's operation is based on the use of formulas, it does not operate formulaicly in the same way that the human being does for all that it receives is selectively captured through the intervention of the human being. The human being who is required to programme the computer devises the formula that will provide the input to the system. The programme that the human being devises is based on a pre-conceived understanding of what the programmer requires the computer to do.

The computer is unable to freely manipulate and randomly re-order and re-pattern the formulae to operate within particular contexts, but can only re-play the formulae in the order that has been pre-defined by the rules of the programme. The computer is not able, of its own volition, to identify or locate a text within a context because it is not conscious. The inability to identify context has therefore been recognised as one of the main areas that need to be addressed in aspiring to develop a machine that can exhibit the kind of intelligence exhibited by humans.

Douglas Lenat who masterminded the Cyc (derived from 'encyclopedia') project had this (the notion of context) particular concern in mind when he and his team attempted to create a knowledge-based system that contained "...a mind-ful of commonsense knowledge in the form of a single data base containing all the facts expressed—or tacitly presupposed—in an encyclopedia!" (Dennett 1988: 291). Basically what they are doing is keying hundreds of thousands of rules into a

knowledge-base in order for it to demonstrate the kind of common-sense that is demonstrated by a human being in its interaction with the environment. This project was initiated in the early 80's and has still not been completed. John De Oliveira (p.c. 2000) the Director of Marketing at Cycorp says,

> Many more things need to be done over the next several years to improve Cyc's ability for dealing with context....
>
> There is probably more to learn about Cyc then there is time to learn it.

The human being has been able to conserve the memory of his interaction with the universe within himself through the psycho-physiological laws, for, "The common factor of memory is the mnemonic factor. It affects all the traditional elements of bilateral expression, the whole of which constitutes the fabric of living and universal style" (Jousse 1997: 294). The human being constructs his memory from mimismological geste, which, through rhythmic re-ordering and re-patterning are played out as formulas. This entire process is played out through the characteristic balancing that is specific to the bilateral anthropos.

The computer is unable to operate as a bilaterally miming, rhythmic being that is able to randomly manipulate formulas to interact with the environment in the way that the anthropos does, as suggested by Jousse.

CHAPTER 6

THE UNIVERSE PLAYS IN AND THE ANTHROPOS RE-PLAYS

When the human being interacts with the cosmos, he receives and intussuscepts the vibrations that are inherent in the cosmos that are cosmic energy. It is the cosmic energy that is played and re-played within the human being, which he then ex-presses. Therefore all man's ex-pression is formulated from his interaction with the cosmos, and he in turn informs the cosmos. This chapter provides details of the human being's interaction with the universe, for what the universe plays in, the anthropos re-plays. The discussion is presented in two parts, the first is **Receive, Re-gister, Replay;** and the second is **Im-pression and Ex-pression.**

6.1. Receive, Re-gister, Re-play

As the human being interacts with the universe, he receives stimuli from the animate and inanimate beings around him "through the gestes of his whole instinctively miming body (...) The human composite (...) behaves like a strange, sculptural mirror, infinitely fluid and continuously remodelled" (Jousse 1997: 91). This 'fluid and continuous remodelling' occurs through the process of 're-gistering', for man is not a static entity operating in isolation, but a dynamic interactor with the environment. The process of 're-gistering' is man's ability to re-organise his inner world. When a new impression is received, the old impressions accommodate the new impression by simultaneously 're-gistering' themselves, which is an indication of

the dynamic nature of human memory. This re-organising, re-ordering and re-patterning that occurs, is a spontaneous reaction to the impressions that are received and manifests in human creativity.

> Without consciously realising it, he [man] becomes a complexity of mimemes or intussuscepted miming gestes, the richness of which increases with each new intussusception. The child *re-plays* the phases of each of the interactions of the universe mimically through the gestes of his whole body, and above all through the uncountable gestes of his hands. What is created physically and unconsciously in the universe is psycho-physiologically and consciously re-created in and through the child (Jousse 1997: 91-92).

The human being's ability to re-play these "corporeal and manual mimemes is neither scattered nor incoherent" but instead "is accomplished generally in the spontaneous, intelligent and logical form of a generally three-phase propositional geste:

An Acting One acting on an Acted upon" (Jousse, 1997: 92)(cf. Chapter 4 Section 4.1).

The human being becomes a complexity of 'mimemes or intussuscepted miming gestes' because of his ability to 're-gister' the old and the new impressions and store them, and repeat the process when new impressions are received. He is able to re-order and re-pattern these impressions both consciously and unconsciously. When required these gestes can be recognised or recalled with or without prompts. Recognition is recall with a number of prompts, and spontaneous recall is the ability to get information without external aids or prompts.

The key to retrieving any information lies in its organisation (Bruner 1974). All of the stored impressions can then be re-played as the need arises. The human being's ability to re-play in the absence of the object gives rise to memory. Jousse (1997) says that we do not know everything in our interactions, but rather, we know what has imprinted itself and this is what will be expressed. This is how re-play operates and this is what constitutes memory. We have "a memory bank of gestes" which consists of the intussuscepted gestes (Jousse 1997: 130). The particular combinations of the intussuscepted gestes that are re-played will be determined by the context of the situation in which man interacts. This ability to produce new combinations of stored impressions that are context-driven, highlights a considerable difference in the mode of operation in a human being and a computer.

The human being "can retain a web of relationships between arbitrary things. Computers typically store things in trees or tables, which rarely match the complexity of real life" (Berners-Lee 1997: 48). This web-like organisation enables the arbitrary retrieval of information as well as the ability "...to take things apart and put them back together again in new ways..." (Hofstadter cited in Gleick 1983). The computer does not have the capacity for fluidity, which is a human characteristic. "Concepts must be fluid to do the things humans do" (Hofstadter cited in Franklin 1995: 351). Computer operation is highly structured and dependent on logic. It operates in a linear fashion and is therefore not able to randomly make connections with various pieces of information.

Minsky (1982) states that some researchers are experimenting with programs that will be able to learn and reason by analogy in the hope that the programs will in the

future be able to "recognise which old experiences in memory are most analogous to new situations, so that they can 'remember' which methods worked best on similar problems in the past." However, the development of a machine that is capable of performing this task has not been achieved as yet.

> Machines do not act in plays, and animals do not pretend to be other animals; they do not know how. This is what cannot be mechanized, even in principle, by any procedure that we can yet foresee: that we can identify ourselves with the inner environment of others. We know what another man feels when he feels angry, because we have been angry ourselves. We know what tenderness feels like, and fear, and curiosity, and cruelty, and fun (Bronowski 1965: 77).

The reason why machines are not able to 'act in plays' or pretend to be what they are not, is because they do not have the ability to experience emotion, which stems from memory. "Memory is an act of 'Re-play'" (Jousse 1997: 289), which implies there is interaction with the environment which the computer does not experience. Therefore, the way in which memory operates in the human being and the computer is quite different.

Human memory has the capacity to order memory logically as does a computer in a linear network, but human memory goes beyond this capacity and also makes lateral and associated connections between strands of memory. Because normal human memory works both linearly and laterally at the same time, it is capable of innumerable creative configurations, which is the stuff of genius: the rhythmo-dynamism of the memory constitutes the intelligent creativity of the individual. "Memory is a 'conscious re-play of Mimemes'" (Jousse 1997: 141). Therefore, the

human being is able to act in plays and perform stories, because he has the ability to 're-play the mimemes' and to configure his memory in innumerable ways, which is 're-gistering'. It is this ability to 're-gister' that allows him to show empathy, for his interaction takes place formulaicly, which implies that it is context-specific. The process of 're-gistering' allows the human being to adapt to the situation at hand.

The ability to make random connections cannot be programmed into a rule-based system that operates on logic, which is how the computer operates. However, people did think that they could program intelligence into a machine. It is this notion that has led to the various theories about intelligence that have been expressed with regard to the AI debate. Some like Simon and Newell are fully supportive of the fact that it is possible to create an intelligent machine. They "say that a physical symbol system can be intelligent, and that any intelligent agent must be implemented via a physical symbol system" (Franklin 1995: 102). What Simon and Newell are referring to is a system that uses physical symbols or symbolic structures that would run on a machine and that would eventually start evolving an assortment of symbolic structures. When operated on, these symbols and/ or symbolic structures would be modified, though the operations would be restricted to the rules that have been coded into the machine that runs the system. In being able to manipulate these symbol structures and producing mutations, they claim, that the machine would be exhibiting a measure of intelligence. The Anthropos exhibits intelligence, which does not stem purely from his manipulation of symbol structures, but rather, in the way he operates within and influences his environment.

Dreyfus (1972) unlike Simon and Newell thinks that the behaviour of human experts is linked to the use of similarity recognition. He thinks that they (the human experts) do not employ rules when they are involved in problem solving.

> This directly contradicts the physical symbol hypothesis of Simon and Newell by denying its necessity. It also calls into question its sufficiency, since humans provide the only currently known example of general intelligence (Franklin 1995: 104).

Dreyfus supports the notion that intelligence in the human being is manifested by the associations that are made in its interactions with the environment. The indiscriminate nature of these associations would preclude the use of rule-based systems which implies that machines that operate entirely on a rule-based system would not be able to function intelligently.

The philosophers Horgan and Tienson approach the debate a little differently.

> Many activities requiring intelligence seem to involve the satisfaction of multiple soft constraints (...) Adding constraints makes the task harder for computers but easier for humans. For computers, every trial solution must be tested against all applicable constraints. But to decide which constraints are applicable means, essentially, to test against all constraints. For humans, having more constraints sometimes makes things easier (...) Humans deal well with multiple soft constraints but AI programs do not. This, they claim, suggests that human intelligence is different in kind from computer intelligence (Franklin 1995: 114-115).

What is implied in the above is that humans are able to deal with restrictions that present themselves because they are able to 're-gister', which implies re-ordering and re-patterning to make relevant associations.

What the computer lacks is the capacity to make associations that arises from the inability to re-gister what is received from the environment and which leads to a lack of understanding. This lack of understanding was visible to chess master Garry Kasparov when he first played Deep Blue in 1996. Even though he did sense a certain kind of intelligence in the machine, he still claims that

> If they (computers) "understood" the game, they might act differently, but they don't understand.... I had played a lot of computers but had never experienced anything like this. I could feel – I could *smell* – a new kind of intelligence across the table.... If the computer makes the same move that I would make for completely different reasons, has it made an "intelligent" move? Is the intelligence of an action dependent on who (or what) takes it? ... At one point, for example, I changed slightly the order of a well-known opening sequence. Because it was unable to compare this new position meaningfully with similar ones in its database, it had to start calculating away and was unable to find a good plan. A human would have simply wondered, "What's Garry up to?" judged the change to be meaningless and moved on (Kasparov 1996: 47).

It is the computer's inability to make these meaningful comparisons or connections that demonstrates its lack of understanding and compounds the great divide between the human being and computer. A human being's understanding varies with the complexity of the connections from the given concepts to other knowledge. The more connections one recognises, the greater the understanding. The

computer is not able to make connections from given concepts to other knowledge to increase its understanding. What it is able to do, however, is make comparisons and connections with information that is either given or stored, within pre-defined rules to find the correct match. And it has the ability to process given information according to certain pre-defined rules at incredible speeds. It is for this reason that there is a belief among many scientists that if a machine were sentient then the intelligence of that machine will far outstrip human intelligence because at present machines are able to process specific information at much higher speeds than the average human being.

While this is true when it comes to the processing speed for computers developed to perform limited functions (e.g., the chess player, mathematical calculations, medical programs, etc.), this is not true for all. For example if one had to consider the information processing that occurs in a human being when one places one's hand on a hot stove, immediately the heat is felt the hand reacts by pulling away. In that time period the hand has sensed the heat, transmitted the message to the brain and the brain has responded with the reaction that takes place.

An explanation for the reaction may lie in Dr Jacques Benveniste's (DigiBio 1998-1999) observations of "the memory of water" that derive from his studies of digital biology. From the perspective of digital biology, water is seen as the "vehicle for information". The human body contains billions of water molecules, which contribute to the transmission of information.

> Adding water is not enough to restore activity, it must be 'informed' (...) when molecules trigger a biological effect, they are not directly transmitting the signal. The final job is done by perimolecular water which relays and possibly amplifies the signal (ibid.).

The vibration of the water molecules plays an important role in the transmission of information within the human being, because as a molecule vibrates it triggers vibrations in other molecules that are in synchrony, which increases the speed at which information can be transmitted.

The computing power of the anthropos is far greater than is currently known, unlike the computer, because the information that the anthropos receives at any one time is not limited to just one stimulus, but is receptive to any number of stimuli from the environment.

The speed at which computers are able to process information is increasing all the time, however, the computer is not required to respond to the multiple inputs that a human is required to respond to at any one time. The computer is very limited in its performance outside of what it is designed to do, because it is not adaptive, and neither can it generalise, e.g., a chess program will only be able to play chess, it will not be able to play any other board game.

The value of the human memory system lies in its ability to abstract and generalise, and then specify. It can draw a particular instance from abstraction and generalisation, and when required, can store specific information, which is a sure sign of intelligence. "Generalisation allows us to apply the knowledge acquired from one experience to a new experience that is similar but not exactly the same" (Cohen 1989: 219). Therefore speed is not necessarily an indication of intelligence. Intelligence also requires a degree of efficiency. Therefore, the development of a computer that is able to process information at extremely high speeds is a moot point which is summed up really well in the following extract.

"What about processor speed? I mean, a ribosome can't be anywhere near as fast as a chip."

Oz smiled approvingly. "Don't be an idiot, Logan," he said. "Speed is irrelevant."

The student looked shocked, then quickly recovered with a look of smug scepticism. "Right. So now you're telling us that speed is irrelevant to computing power?"

"For number crunching, speed's relevant. For real intelligence, it's complexity that matters. Let's take a dog's brain, for example. How much would you have to speed it up before the dog was as smart as you, Logan?" (Fabi 1998:154).

Human beings cope efficiently with the complexity of the environment because they have the ability to apply knowledge from other situations in order to combine the mimemes in a multitude of ways to meet the needs of the current situation. This ability is a reflection of the complexity of the human being's behaviour, which reflects the complexity of the environment in which it operates.

The understanding of this complexity is what poses a challenge to scientists and has led to a change in thinking, so that they are now "...returning to an older notion of intelligence: that it's embodied and emerges through sensation and interaction with the world..." (Setton 2000).

Jousse says that this interaction with the world involves...

re-play, incessantly and continuously. And we will either have Rememoration – which is objective re-play – or Imagination – which is a combination of re-plays adjusted to a common form (...)

All human problems should be seen and solved as specific cases of general Human Mechanics. That is how I see all the questions posed by Memory, which is the indefatigable

> re-play of mimemes, and by Rhythm, which is the energetic and facilitating propulsion of the re-played mimemes. Man manifests an ephemeral convention of Mimism at play, just as humanity is an eternal convention or sum of such individual and indefinitely varied and adjusted play (Jousse 1997: 137).

The capacity of the anthropos to consistently re-play, re-order re-create and re-pattern manifests in creativity, inspiration and imagination which implies that it is able to adapt to the environment.

The computer does not have the ability to re-order, re-pattern and re-play because it

> follows the logic we have given it. That logic may lead to very different consequences than do mental processes contaminated by wishes to reach certain outcomes. Indeed, one of the most cogent reasons for using computers is to expose holes in our thinking (Weizenbaum 1987: 65).

When human beings are faced with a problem they will try different ways to solve it. If one way does not work, they will try to figure out why. Then they will turn things around and look at it from another perspective in order to try and solve it. This is a manifestation of thinking. The computer, which operates on a pre-defined logic, does not have the ability to think, which implies that it does not have an independent capacity for creativity and adaptability but merely exhibits the programmers capacity for creativity and adaptability. The computer does not have the capacity for turning things around and looking at it from different perspectives, which manifests its

inability to think. This inability to think emphasises the difference between the computer and the human being.

Thinking involves opinion and rational judgement, which means that it is influenced by and in turn, influences our reality. In *Exploring the Labyrinth of the Mind*, Gleick (1983) raises questions about the very issue of thinking as well as imagination and creativity.

> When you think about yourself, what is being thought about and what is doing the thinking? Can machines be taught the most human of human traits – creativity, inspiration, imagination? How does a brain of neurons and synapses come to be aware of itself as a mind? (ibid.).

The kind of action that the computer is capable of is different to the kind of action demonstrated by a human being. The computer has to be prompted to perform an action, which will stop at a point that is predefined in a program of human origin; whereas the human being, is constantly engaged in action through his **interaction** with the environment, and will stop at a particular action when he **chooses** to do so. He is creative because he can re-play the intussuscepted gestes in a variety of ways, which may not follow any prescribed order, because the human being's re-play is dynamic.

Jousse says that imagination arises out of memory. For "Memory is the free spontaneous, objective re-play of our mimemes. What we call imagination is the combination of such re-playings in a mirrored internal configuration which logically matches the external source" (Jousse 1997: 665). Imagination is therefore random combinations of intussuscepted gestes that correspond with the context of the

environment, and man has the capacity to re-play the 're-gistered' impressions that he has received from his environment in any number of different combinations.

6.2. Im-pression and Ex-pression

This section will look at the differences between man and machine with regard to how the memory operates during 'im-pression' and 'ex-pression'. 'Im-pression' and 'ex-pression' are closely linked to the processes of 'receive', 're-gister' and 're-play' for 'Im-pression' involves 'receiving' and 're-gistering', and 'ex-pression' involves 're-gistering' and 're-playing'. Before discussing 'im-pression' and 'ex-pression' an explanation of Jousse's perceptions of the evolution of human ex-pression needs to be discussed.

The evolution of human ex-pression stems from the corporeal-manual style, which then developed into the laryngo-buccal style. Jousse (1997:173) says that "language is, in fact, what expresses the whole being," because language is amplified by the Corporeal intussusceptions of the gestes of the cosmos. It is further expanded by the gesticulations of the hands (manual) and eventually transposed onto the Laryngo-buccal muscles. For the anthropos to ex-press itself holistically, incorporating the corporeal-manual and the laryngo-buccal requires a lot of energy. Therefore, the anthropos soon transposed his ex-pression in spite of the loss of "*ex-pressive-ness*" to "his oral mechanism" (Jousse 1997: 174).

When man receives and intussuscepts the gestes of the cosmos, Jousse calls this 'im-pression'. When what is real is no longer before us, Jousse (1997: 668) says we

"have the mimeme embedded in us as a sign." A mimeme is a "re-play of the gestes which were imposed upon us by an intussuscepted reality." Once the impression becomes a mimeme it is added to the repertoire of mimemes that the human being possesses. The formulation of mimemes is important for ex-pression, for it is through the medium of the gestual mimeme that man ex-presses himself, to himself as well as to others (Jousse 1997). The human being's ex-pression would consist of the playing, intelligising, and re-playing of selections of the repertoire of mimemes in order to present the best combination of mimemes for intelligent ex-pression. Ex-pression takes place, not only "with his mouth, but with his whole body" (Jousse 1997: 268), for "true human expression (...) is the expression of the entire being" (ibid: 58). The human being ex-presses what has been im-pressed through 'play', which is 'gestualised' within us (ibid.). Jousse (1997: 129) says that play is the most human thing. "Play is the interactional exterior" which imposes itself on us, is intussuscepted by us and is then ex-pressed. The re-play of the geste is fluid because the human being constantly receives impressions through the stimulation of the various senses of sight, sound, smell, taste and touch, in his interaction with the universe.

The computer on the other hand works with inputs and outputs. The inputs and outputs enable the computer to demonstrate a capacity for "simulating the mental processes of the human being" (Fetzer 1990: 279). Because these inputs are designed by human beings they yield outputs that are signs for the human being, however, these inputs and outputs do not function as signs for the computer. For the inputs to function as signs there has to be an appropriate connection between the information stored and the input used. In both the human being and the computer a connection

does exist between stored information and inputs, however, the computer does not have an understanding of these inputs or the connection because inputs and connections arise out of the human being's interaction with the environment.

Man, in his interactions with the environment is influenced by various stimuli, and accomodates them by the process of 're-gistering'. 'Re-gistering' plays an important role in im-pression and ex-pression for both im-pression and ex-pression are context-specific.

The effect that the various stimuli have on the human being's interactions with the environment were evident when Garry Kasparov was astonishingly defeated in the 1997 chess game against IBM's Deep Blue.

> Whether they (the sponsors) intended to or not, they created a hostile atmosphere that was very difficult for me to bear. There was something negative in the air. It was a Deep Blue show, and Deep Blue had to win. IBM's total control of the site and the playing conditions underscored the vulnerability of the human player. I was the only player in this competition influenced by any sort of negative or hostile atmosphere (Kasparov 1997).

Kasparov's discomfort during the chess game is underscored by the fact that he is a thinking human being, because "a thinking human being is an adaptive system" (Simon 1969 cited in Rasmussen 1986: 62-63). Because the thinking human being is an adaptive system, his behaviour will reflect characteristics of his external environment to a large extent, as well as a few characteristics of his inner environment. Kasparov's performance, therefore, would have been severely limited by the 'hostile environment' that had been created.

The machine is not influenced by the various stimuli for it can only receive what it has been programmed to receive because it is not an adaptive system, which implies that it does not have the capacity for thinking. The difference between the human being and the computer is highlighted by Bronowski (1965: 21) when he says,

> ...man is a self in some of his actions because his procedures for getting experience cannot all be formalized. The messages from the outside world and his inner world together do not all strike him like holes punched in a tape, or magnetic marks made on it. The total of his sense impressions, his stored reflections from the past, and the interplay of thought between them includes a mode of knowledge that cannot be written out in symbols as the new input for a machine.

This 'interplay of thought' that Bronowski writes about is the process of registering that Jousse discusses. It is this process of 're-gistering' that cannot be programmed into a computer for it is based on the ability to make associations which the computer is unable to do. Rubin (1995: 31) says, "Associations are certainly one of the oldest and most widespread ways of trying to account for the organization of memory." Associations are context and culture specific. Culture plays an important role in shaping the mind for the human being interacts within a particular cultural environment and it is the culture that provides the context. While the basic laws of human expression are anthropological, in their ex-pression they take take on an ethnic stance. Therefore in trying to understand the mind, one cannot disregard a study of culture. The growth of mind is assisted from the outside, for the growth of the

individual is dependent on the history of his species, which involves interaction with the environment. And the environment provides a context for his interaction.

Associations derive out of particular uses of words/ gestures used within certain cultures and contexts. Jaynes (1976) states that with the understanding of associative memory and learning, consciousness was established. The reasoning for consciousness was that if a human being could adapt his behaviour to different experiences, he must be conscious. Jousse's (1997: 115) explanation of consciousness goes a step further, for he says, "to know is to 'intussuscept', which leads to consciousness." The notion of intussusception is far more intense than that that of associative memory and learning for while it includes both, it is really a matter of making the gestes that flow into the human being from the universe a part of the human viscera. Once the geste is a part of the viscera, the human being can co-ordinate the gestes in order to ex-press them. For Jousse, it is a 'bringing-into-consciousness', which is a process that flows from his interactions, and not a static state that exists in the human being.

Computers are not able to make associations on their own unless they are specifically programmed to do so. But even then, the associations made would be limited by keywords or phrases that have already been programmed and are true for a programmed context, but cannot be adapted to other contexts. Because the computer cannot operate by association it is therefore not conscious. The computer cannot identify when it is having an experience, it cannot adapt its behaviour to accommodate the experience and therefore it is not able to learn. What it is able to do is produce an output from its memory within a pre-defined context that does not

operate in the same way as associative memory operates in the human being. The reason for this difference in operation may stem from Theall's (n.d.) explanation, which supports Rubin's (1995) perceptions of memory, when he says,

> Recent research into the classical and medieval "arts of memory," inspired by Frances Yates, have demonstrated that memory involves the body, a sense of the dramatic and theatrical, visual icons and movement, as well as the associative power of the oral itself (Theall: 12-13).

Theall's explanation supports Pert's (1997) notion that the body is responsible for memory, and Jousse's when he talks of 'movement' which links up with the Joussean notion of the geste. Both Jousse (1997) and Rubin (1995) have highlighted the associative memory of 'oral' people. Jousse (1997: 131) says that what is called the "'association of ideas' is in fact no more than a 'combination of mimemes'." Mimemes are the "re-play of the gestes which are imposed upon us by an intussuscepted reality" (ibid: 668).

In 'oral' traditions a single formula may bring to mind another formula or a set of formulas which aids recall. Sometimes this association can be explicit and sometimes not. Repeated pairings provide a local context for the associations in oral traditions (Rubin 1995). The more often associations are intussuscepted the greater the impression that is made, for that is memory.

> We memorize in order to comprehend. The more you memorize, the better you will comprehend because everything will be embedded within you for immediate and automatic recall. Memory is comprehension *from within* of the gestes that are repeated and re-played. Memorization that endures demands re-memorization repeated tirelessly (Jousse 1997: 665).

It is this constant repetition and re-play of associations that enhances the memory. This perception supports the constructivist view of memory, which has

> ...emphasised the role of elaboration, interpretation, and reconstruction based on prior experience and stored knowledge. On this view, memory is not a direct copy of the physical information received through the senses. Remembering is not just a process of passively receiving impressions, but of creatively constructing a representation. Of course, some memories are much closer to an exact copy and some rely to a greater extent on construction, but most externally derived memories contain some elements that are internally generated (Cohen 1989:30-31).

Memories are a combination of perceived and self-generated material. When we remember events or experiences, what we remember of the initial experience is embellished with what we have been told about the event/ experience as well as what the individual has imaginatively reconstructed for himself in order to fill in the missing pieces, which alters the event. The process of 're-mem-bering', which is creatively constructing a representation, implies that it is re-played over and over again and is therefore fluid and changing.

The process of 're-mem-bering' involves the process of 're-gistering' which is the re-ordering and re-patterning of internally generated as well as externally generated im-pressions. The computer is not capable of re-ordering and re-patterning in this way for even though it is capable of re-organising information, this re-organisation is based on a pre-defined logic and not arbitrary associations or a specific context.

What the human being and computer do share, is the capacity to store huge amounts of information although they differ in retrieving the information. Bruner (1974: 411) says,

> ...the principal problem of human memory is not storage, but retrieval. In spite of the biological unlikelihood of it, we seem to be able to store a huge quantity of information, a great sufficiency of impressions. We may infer this from the fact that recognition (that is, recall with the aid of maximum prompts) is so extraordinarily good in human beings — particularly in comparison with spontaneous recall where, so to speak, we must get out stored information without external aids or prompts. The key to retrieval is organization or, in even simpler terms, knowing where to find information and how to get there.

In human beings as well as computers there is a need for prompts and cues to aid recall. However, the types of prompts and cues differ. Once again it comes back to the discussion presented earlier (c.f. Pg. 78-79), that in human beings the prompts and cues are based on associations which could involve any of the senses, whereas the computer requires prompts that have been pre-defined by the logic and input of the programme designed in the first instance by man.

The kind of ex-pression that the computer is capable of is restricted to either the visual or aural modes, that is based on a structured programme. If for some reason the ex-pression is different to what has been programmed, it indicates a malfunction.

Jousse (1997: 225) says, "In human expression there must be an awareness of meaning." Man exhibits this understanding of meaning in his ability to make associations as well as to ex-press himself within particular contexts. The computer is not able to exhibit an understanding of meaning for it is unable to make associations

or understand context. In his interaction with the computer the human being has to be specific about what is required or else he will not get the desired information.

To a certain extent, the human being is able to know all the information that the computer stores for he was responsible for installing it. A human being, however, is not capable of knowing all the information stored in another human being.

> It is easy for you and me to exchange knowledge about nature, because we both observe her from similar places: you from where you stand and I from where I stand. But can we exchange knowledge about the mind of one of us? I observe my mind from the inside, and you observe it from the outside; I am conscious of my thoughts and feelings in myself, but you infer them from my behaviour (Bronowski 1965: 64).

The kind of re-gistering that occurs in each human being is different because of different experiences and associations. Based on his experiences and associations each human being therefore ex-presses himself differently to others and this is what creates differences in understanding amongst human beings, which underscores the complexity of life, which cannot be replicated by a machine.

CHAPTER 7

PERSONAL PERSPECTIVES AND FUTURE DIRECTIONS

This study has presented a discussion to support the argument that the computer will not be able to possess the general intelligence of the human being, for there are some fundamental differences in their functioning. Unless one can fully understand the complex operation of the human composite, the pursuit to develop a machine that can replicate the functioning of the human being is doomed.

I have shown that a study of the human brain is not enough to provide an understanding of memory, intelligence and consciousness. I have also presented an argument that illustrates the importance of the psycho-physiological laws of human expression, as identified by Jousse (1997), for understanding how the human being functions as a conscious, intelligent, emotional being. When the 'universe plays in and the anthropos re-plays', the importance of the environment for the development of the human capacities for learning, intelligence and consciousness are emphasised. I have illustrated this by citing the human being's ability to receive, re-gister and re-play, as well as commenting on the processes of im-pression and ex-pression.

There can be no finality to a study such as this, because the study of artificial intelligence is an ongoing one. What a study of this nature can do, is to provide ideas for further queries and provide questions for new directions. One of the major problems in trying to develop a machine that could replicate the cognitive functioning of the human being is that we do not have a proper understanding of how the human being functions cognitively. How can one create a machine to replicate human cognitive functioning,

when one does not understand the cognitive functioning of the human being? Is it at all possible that feelings and emotions can be programmed into a computer given that the computer does not interact with the universe and therefore does not have a dynamic memory?

In the 1970's and early 1980's, machines were distinguished from human beings because they (the machines) did not have a soul, spirit, feeling or emotions. This idea was considered a 'romantic notion' at the time, for it looked at the "*irrational* side of humans as an essential quality" (Sack 1997). Spirituality is an important aspect of the human being and is a profoundness that operates beyond our perceptions. Spirituality grapples with concepts that extend beyond scientific rationale. Is it possible then that the notion of AI is doomed because the computer does not have a spirit?

The etymology of the word 'spirit' is linked to 'breath' for 'spiritus' means 'breathing' and 'spirare' is 'breathe'. Breathing makes an important contribution to the human being's interpretation of the environment as well as in anticipating an involvement with the environment. We are able to smell and taste the air that we breathe, which provides us with cues for our behaviour. The computer is unable to receive these cues and therefore cannot adapt its behaviour to accommodate the cues. Therefore, would it be too far-fetched to suggest that AI will not be possible because the computer will not be able to 'breathe'?

The human being is a composite of body and spirit, which operates **simultaneously**. It is the body that intussuscepts the gestes, and the spirit that fixes the gestes in memory. Jousse (1997) discusses human mechanics as being necessary to allow memory to be durable and precise, for it is the constant re-play of gestes, which includes rhythmic

action and breath, that fixes the memory. Bronowski (1965) also discusses the dual nature of man, and draws attention to the idea that the mechanical aspect of man is as important as the spiritual nature of man, for they operate in tandem.

> It is the tragedy of our age that we fear the machine in man, though it is as noble as the self; and we have grown to doubt whether it will leave us a self. We will not believe that what the machine learns and teaches, a knowledge of science, can strengthen our ethic, which now languishes among our random loyalties. Yet the search for knowledge in nature generates values as rich as we get by reaching for the knowledge of self. When we pursue knowledge for action we learn (among other things) a special respect for a man's work. And when we look into another man for knowledge of our selves, we learn a more intimate respect for him as a man. Our pride in man and nature together, in the nature of man, grows by this junction into a single sense: the sense of human dignity. The ethics of science and of self are linked in this value, and more than all our partial loyalties it gives a place and a hope to the universal identity of man (Bronowski 1965: 106-107).

It is interesting that Bronowski writes about the 'machine in man', for it seems to be the point at which developers of AI stopped in their definition of man. But there is a 'self' to the human being as well, that can never be forgotten, for it is the 'self' that affords us our humanness. He also writes about the ethics of science, for current trends in scientific development indicate that ethics have been neglected. Both Bronowski and Jousse emphasise the importance of the two aspects of the human being. They also emphasise the fact that man is an interactional being and that his knowledge, memory and intelligence arise out of his interaction with the environment for the universe plays in and the anthropos re-plays. It is the interaction with the environment that fixes the human being's experiences and enables him to formulate an identity.

It is interesting to note that in trying to develop a machine that will outstrip human intellectual functioning, developers of AI are using the physical structure of the human being, which is bilateral, as the model. Why have they not considered developing a different physical structure that may be able to function more efficiently? The answer to this question may lie in Jousse's perception that human capacity is structured biologically and it is a reflection of a balanced cosmos – that we cannot go beyond what we are. We are biologically conformed and we can only create in our own image.

Man, in his quest for science and technology, has gradually allowed his abilities in utilising his perceptions to wane and erode as he discovered that machines would compensate for his **apparent** shortcomings. What initially was a quest to execute consistency, speed and precision, is now being lauded as the evolutionary future! This has culminated in an almost religious belief in the machine, rather than the mind that created it, that nurtured it and improved it. Sadly, instead of exploring the potential of the mind, he has opted for the consistency of the machine.

Man in his short-sighted arrogance believes that he is capable of creating a machine that can surpass human abilities, when the full potential of human abilities have not been realised. The way forward may lie in the eastern philosophical perspective of **freeing** the mind, before attempting to create an artificial mind. In freeing his mind, man's perspective will change.

It will be interesting to see what innovations spring forth in the next twenty years in the development of AI, for there have been periods when it flourished and periods of disillusion because of a lack of information. The periods when machines were rejected by the modern ecological movements and the Luddites, though for very different reasons,

created set-backs and raised questions about social and moral accountability and responsibility. While the questions about social and moral accountability and responsibility pertain to all scientific and technological endeavours, they are sometimes ignored, as evinced in cloning experiments, and at other times heeded.

If AI became a reality, what would its reference points be? Would its reference points lie outside of human culture? Or is it remotely possible that it may be 'spiritual'? Is the development of a 'spiritual' machine possible without an understanding of 'human spirituality'?

Current trends indicate that the environment of the future will incorporate machines to a greater extent, and the importance of the natural environment will fade. "The 21st century will be an era of man and information" (Matsumoto & Fujiwara 1991: 120). The amount of contact between human beings and computers will increase rapidly. Therefore, the computers of the future should be tools that will contribute to the balanced development of our society.

It is hoped that in raising questions about the spiritual nature of man, that the natural environment will predominate. If the 20th century was a time that saw the destruction and disruption of nature, then the 21st century should be a time for the restoration of balance and harmony between the human being and nature. "Technological developments must **serve** [emphasis added] human purposes and must contribute to the harmony between man and nature" (Matsumoto & Fujiwara 1991: 139).

NOTES

(figures in brackets refer to page numbers)

1. (1) The terms 'human' and 'man' have been used interchangeably depending on which one made for better reading. The term 'man' encompasses 'woman' as well. At times the term 'Anthropos' has been used, particularly when there was a need to emphasise holistic man.
2. (1) The term 'emotion' derives from e(x)-motion - 'ex'- out and 'motion' – movement, which is the moving out of movement that is within or externalising the internal rhythmic geste.
3. (2) 'Memorisation' as used here implies rote-learning, which is not necessarily a sign of intelligence. This must be differentiated from Jousse's understanding of the word, which is the "unconscious interactional montage which we bring wholly into our consciousness before releasing it in the gestual and rhythmic mechanisms" (Jousse 1997: 141). Jousse does not differentiate between 'memorisation' and 'intelligence', for he feels that because memorisation is visceral, it allows for greater flexibility in re-ordering and re-patterning which manifests intelligence.
4. (2) I have used the words 'he' and 'his' to incorporate the representation of both genders. To facilitate readability only the masculine pronouns are used.
5. (17) I am assuming that 'mind' is integral to thought, consciousness and feeling, and will therefore not discuss it as a separate entity.
6. (22) 'Gesture' refers to the mechanical movements of the limbs or body in order to express oneself. It has to be differentiated from the term 'geste', which is

intrinsic. 'Gestures' represent externally some of the 'gestes' that man has intussuscepted. 'Gestures' are consciously and macroscopically ex-pressed, whereas 'gestes' are continuous, conscious or unconscious, voluntary or involuntary, macroscopic or microscopic.

BIBLIOGRAPHY

(n.d.) Vibrational Breath Therapy. <http://www.ozemail.com.au/~ghubbard/vbt02.html>

Adam, D.

2000 Brain: Monkey see, robot do. *Nature Science update.* Macmillan Publishers Ltd.

Albus, J.S.

1981 *Brains, Behavior & Robotics.* Peterborough, New Hampshire: Byte Books.

Aleksander, I & Burnett, P.

1983 ***Reinventing Man**: The Robot becomes Reality.* Great Britain: Penguin Books.

Beardsley, T.

1997 Debunking the Digital Brain. *Scientific American.* <http://www.sciam.com/explorations>

Beardsley, T.

1997 The Machinery of Thought. *Scientific American, August 1997, Vol. 277 Issue 2, p78.* <Http://www.sciam.com/0897issue/0897trends.html>

Berners-Lee, T.

1997 Spinning the Web. *Data Communications October 21, 1997, Vol. 26, No. 14.*

Birkerts, S.

1994 Hypertext: Of Mouse and Man. *The Gutenberg Elegies,* pg. 151-164. Boston, London: Faber & Faber.

Bolt, R.A.

1984 *The Human Interface: Where People and Computers Meet.* Belmont, California: Lifetime Learning Publications.

Brody, H.

1996 Session with the Cybershrink: An Interview with Sherry Turkle. *Technology Review, February/March 1996.* <http://www.techreview.com/articles/Fm96/Turkle.htm>

Brody, H.

1996 The Web Maestro an Interview with Tim Berners-Lee. *Technology Review, July 1996, Vol. 99 Issue 5, p32.* <http://www.techreview.com/articles/july96/bernerslee.html>

Bronowski, J.

1965 *The Identity of Man.* Garden City, New York: The Natural History Press.

Brown, E.

(n.d.) New Choices for Healing Ourselves: Interview with Richard Gerber. *Share International Archives.* <http://www.shareintl.org/archives/health-healing/hh_ebnewch.html>

Bruner, J.S., Olver, R.R. & Greenfield, P.M.; et al

1967 *Studies in Cognitive Growth: A Collaboration at the centre for Cognitive Studies.* New York: John Wiley & Sons, Inc.

Bruner, J. S. (Edited by J.M. Anglin)

1974 *Beyond the Information Given.* Great Britain: George Allen & Unwin Ltd.

Bush, V.

1945 As we may Think. *The Atlantic Monthly 176: 101-108.*

Business Times

1997 Deep Blue's Computer Chess Victory creates deep puzzles about Humanity. *Business Times.* <http://www.btimes.co.za/97/0601/tech/tech9.htm>

Chase, V. D.

2000 Mind over Muscles. *Technology Review, March/April 2000, Vol. 103 Issue 2, p38.* <http://www.techreview.com/articles/ma00/chase.htm>

Cohen, G.

1989 *Memory in the Real World.* Hove and London: Lawrence Erlbaum Associates.

Cohen, J.

1998 Thinking about Thinking. *Scientific American, July 1998, Vol. 279 Issue 1, p113.* <http://www.sciam.com/1998/0798issue/0798review1.html>

Colby, B. & Cole, M. (Edited by R. Horton & R. Finnegan)

1973 Culture, Memory and Narrative. *Modes of thought.* London: Faber & Faber.

Colwell, C.S.

(n.d.) Circadian Rhythms.

<http://www.acnp.org/G4/GN4010000/4/CH0/4.html>

Coover, R.

1992 The End of Books. *The New York Times, June 21, 1992.*

Cowen, R.C.

1999 New Insights into the Mysteries of how Memory Works. *Christian Science Monitor, 11/26/99, Vol. 92 Issue 2, p2.*

Cowley, G. & Underwood, A.; et al

1998 Memory. *Newsweek, 06/15/98, Vol. 131 Issue 24, p48.*

Crawford, R. J.

1996 What's It All About, Alife? *Technology Review, April 1996, Vol. 99 Issue 3, p54.*

<http://www.techreview.com/articles/apr96/crawford.html>

Dennett, D.C. (Edited by Stephen Graubard).

1988 When Philosophers Encounter Artificial Intelligence. ***The Artificial Intelligence Debate****: False Starts, Real Foundations.* Cambridge, Massachusetts: The MIT Press.

Dennett, D.C.

1991 Review of McGinn, The Problem of Consciousness. *The Times Literary Supplement, May 10, 1991.*

Dennett, D.C.

1994 Consciousness in Human and Robot Minds. IIAS Symposium on Cognition, Computation and Consciousness, Kyoto, September 1-3, 1994.
<http://www.ase.tufts.edu/cogstud/papers/concrobt.htm>

Dennett, D.C.

1995 Cog as a Thought Experiment. *Robotics and Autonomous Systems.* Final Draft for Monte Verità issue.
<http://www.ase.tufts.edu/cogstud/papers/cogthogt.htm>

Dibbell, J.

1996 The Race to Build Intelligent Machines. *Time, April 1, 1996, Vol. 147, No. 14, p48.*

DigiBio

1998-1999 Overview of DigiBio. **From "Water Memory" effects To "Digital Biology"....** <http://www.digibio.com>

DigiBio

1998-1999 Understanding Digital Biology. **From "Water Memory" effects To "Digital Biology"....** <http://www.digibio.com>

Diorio, C. & Rao, R.P.N.

2000 Computational Neuroscience: Neural circuits in silicon. *Nature 405, 891-892.* Macmillan Publishers Ltd.

Discover

1999 Are We There Yet? *Discover the World of Science, October 1999, Vol. 20 Issue 10, p65.*

Dreyfus, H.L.

1972 ***What Computers Can't Do:*** *A Critique of Artificial Reason.* New York: Harper & Row.

Dreyfus, H.L. (Edited by Rainer Born)

1987 Misrepresenting Human Intelligence. ***Artificial Intelligence****: The Case Against*. London & Sydney: Croom Helm.

Dreyfus, H.L.

1993 ***What Computers Still Can't Do****: A Critique of Artificial Reason.* Cambridge, Massachusetts: The MIT Press.

Dreyfus, H.L. & Dreyfus, S.E.

(n.d.) From Socrates to Expert Systems: The Limits and Dangers of Calculative Rationality. <http://socrates.berkeley.edu/~hdreyfus/>

Dreyfus, H.L. & Dreyfus, S.E. (Edited by Stephen Graubard)

1988 Making a Mind Versus Modeling the Brain: Artificial Intelligence Back at a Branchpoint. ***The Artificial Intelligence Debate**: False Starts, Real Foundations.* Cambridge, Massachusetts: The MIT Press.

Drummond, T.

1999 Elixirs for your Memory. *Time, September 13, 1999, Vol. 154, No. 11, p54.*

Eco, U. (Translated by W. Weaver)

1989 *Foucault's Pendulum.* London: Secker & Warburg.

Fabi, M.

1998 *Wyrm.* New York: Bantam Books.

Fetzer, J. H.

1990 ***Artificial Intelligence**: Its Scope and Limits.* Dordrecht: Kluwer Academic Publishers.

Franklin, S.

1995 *Artificial Minds.* Cambridge Massachusetts: MIT Press.

Gärdenfors, P.

(n.d.) Cognitive science: from computers to anthills as models of human thought. <http://lucs.fil.lu.se/people/peter.gardenfors/articles/wssrtext.html>

Garman, A.

2000 New Hope for Sufferers of Brain Disease. *Mail and Guardian, April 7-20.*

Gerber, R.

(n.d.) Etherium Gold. <http://www.thefountainhead.co.za/etheriumgold.htm>

Gibbs, N.

1999 If we have it, Do we use it? *Time, September 13, 1999, Vol. 154, No. 11, p53.*

Gibson, W.

2000 Will We Plug Computers into Our Brains? *Time South Pacific, 06/26/2000 Issue 25, p112.*

Gleick, J.

1983 Exploring the Labyrinth of the Mind. *The New York Times Magazine, August 21, 1983.*

Golden, F.

2000 A Robot out of Cyberspace. *Time, 09/11/2000, Vol. 156 Issue 11, P47.*

Goody, J.

1987 *The Interface between the Written and the Oral.* London: Cambridge University Press.

Gorman, C.

1999 Will Robots Make House Calls? *Time, November 8, 1999, Vol. 154, No. 19, p58.*

Gould, S.J.

1999 Message from a Mouse. *Time, September 13, 1999, Vol. 154, No. 11, p56.*

Gray, P.

1999 Alan Turing. *Time, March 29, 1999.*

Hahnloser, R.H.R. & Sarpeshkar, R.; et al

2000 Digital selection and analogue amplification coexist in a cortex-inspired silicon circuit. *Nature 405, 947-951.* Macmillan Publishers Ltd.

Herbert, F.

1986 *Eye.* London: Victor Gollancz Ltd.

Hockey, S. (Edited by B. Sutton)

1994 ***Electronic Texts in the Humanities:*** *A Coming of Age.* University of Illinois at Urbana-Champaign: Graduate School of Library and Information Science.

Hoffman, P.

1999 Can I Grow a New Brain? *Time, November 8, 1999, Vol. 154, No. 19, P60.*

Jaynes, J.

1976 *The Origin of Consciousness in the Breakdown of the Bicameral Mind.* Boston: Houghton Mifflin Company.

Jousse, M. (Translated by E. Sienaert & R. Whitaker)

1990 (1924) *The Oral Style.* New York & London: Garland Publishing, inc.

Jousse, M. (Edited by E. Sienaert & Translated in collaboration with J. Conolly)

1997 (1974-78) *The Anthropology of Geste and Rhythm.* Natal, SA: UND Centre for Oral Studies.

Kaminuma, T. & Matsumoto, G. (Editors) (Translated by Norman Cook)

1991 ***Biocomputers:*** *The Next Generation from Japan.* London: Chapman and Hall.

Kasparov, G.

1996 The Day That I Sensed a New Kind of Intelligence. *Time, April 1, 1996, Vol. 147, No. 14, p47.*

Kasparov, G.

1997 "IBM Owes Mankind a Rematch". *Time, May 26, 1997.*

Klix, F. (Edited by Rainer Born)

1987 Parameters of Cognitive Efficiency — A New Approach to Measuring Human Intelligence. ***Artificial Intelligence****: The Case Against.* London & Sydney: Croom Helm.

Kolb, D. (Edited by G.P. Landon)

1994 "Socrates in the Labyrinth". *Hyper Text Theory.* Baltimore & London: The Johns Hopkins University Press.

Kurzweil, R.

1999 ***The Age of Spiritual Machines:*** *When Computers exceed Human Intelligence.* New York: Penguin Books.

Kurzweil, R.

2000 Will my PC be Smarter than I am? *Time, June 19, 2000.*

Lemonick, M.D.

1999 Smart Genes? *Time, September 13, 1999, Vol. 154, No. 11, p48.*

Lenat, D.

1998 The Dimensions of Context-Space. <http://www.cyc.com> Cycorp.

Lenat, D.B.

(n.d.) From 2001 to 2001: Common Sense and the Mind of Hal. <http://www.cyc.com> Cycorp.

Levy, S.

1992 *Artificial Life: The Quest for a New Creation.* London: Jonathan Cape.

Maddox, Sir J.

1999 The Unexpected Science to Come.... *Scientific American, December 1999, Vol. 281 Issue 6, p62.* <http://www.sciam.com/1999/1299issue/1299maddox.html>

Matsumoto, G. & Fujiwara, S. (Edited by T. Kaminuma & G. Matsumoto) (Translated by Norman Cook)

1991 Learning from the brain to build a computer. ***Biocomputers:*** *The Next Generation from Japan.* London: Chapman and Hall.

Mazlish, B.

1993 ***The Fourth Discontinuity:*** *The Co-evolution of Humans and Machines.* USA: Yale University Press.

McCarthy, J.

1983 The Little Thoughts of Thinking Machines. <http://www-formal.stanford.edu/jmc/>

McFarling, U. L.

2000 One Giant Leap for Machinekind? *Los Angeles Times, 08/31/2000.*

McGarry, K.J.

1981 ***The changing Context of Information:*** *An Introductory Analysis.* London: Clive Bingley Ltd.

McKibben, B.

1993 *The Age of Missing Information.* New York, USA: Plume.

Minsky, M.

1982 Why People Think Computers Can't. *AI Magazine, Vol. 3 no. 4, Fall 1982.*

Moravec, H.

1988 ***Mind Children:*** *The Future of Robot and Human Intelligence.* Cambridge Massachusetts: Harvard University Press.

Narayanan, A. (Edited by K.S. Gill)

1986 Why AI Cannot be Wrong. *Artificial Intelligence for Society.* Chichester: John Wiley & Sons.

Neethling, R.

1999 Armageddon in Cyberspace. *Mail & Guardian, April 21.* <http://www.mg.co.za/pc/games/1999/04/21apr-wyrmbook.htm>

Neumaier, O. (Edited by Rainer Born)

1987 A Wittgensteinian view of Artificial Intelligence. ***Artificial Intelligence**: The Case Against*. London & Sydney: Croom Helm.

Okrent, M.

1996 Why The Mind Isn't a Program (But Some Digital Computer Might Have a Mind). *The Electronic Journal of Analytic Philosophy, 4 (Spring 1996).*

Ong, W.J.

1987 Orality-Literacy Studies and The Unity of the Human Race. *Oral Tradition,* 2/1: 371-82.

Orr, J.N.

(n.d.) Anthropocybersynchronicity: Rhythm and Intimacy in VR. *Computer Graphics World.* <http://www.eff.org/pub/Net_culture/consciousness/cybersynchronicity.article>

Papert, S. (Edited by Stephen Graubard)

1988 One AI or Many? ***The Artificial Intelligence Debate**: False Starts, Real Foundations.* Cambridge, Massachusetts: The MIT Press.

Parker, J.

1983 **Neuropeptides:** Unlocking the Secrets of the Brain. *Newservice July-August 1983, p40.* <http://www.doitnow.org/pages/brain.html>

Pert, C.B.

1997 *Molecules of Emotion.* New York: Scribner.

Port, O.

2000 Thinking Machines. *Business Week, 08/07/2000 Issue 3693, p78.*

Quittner, J.

1996 Free Speech for the Net. *Time, June 24, 1996, Vol. 147, No. 26, p64.*

Rasmussen, J.

1986 ***Information Processing and Human-Machine Interaction:*** *An Approach to Cognitive Engineering.* New York: North-Holland.

Reeke, G.N. (Jr.) & Edelman, G.M. (Edited by Stephen Graubard)

1988 Real Brains and Artificial Intelligence. ***The Artificial Intelligence Debate****: False Starts, Real Foundations.* Cambridge, Massachusetts: The MIT Press.

Risan, L.

1993 **Artificial Life:** A Techno Science Leaving Modernity? An anthropology of subjects and objects. Oslo: Hovedfagsoppgave, Institutt og Museum for Anthropologi, Universitetet i Oslo. <http://www.uio.no/~lrisan/Thesis/thesis.html>

Rubin, D.C.

1995 ***Memory in Oral Traditions:*** *The Cognitive Psychology of Epic, Ballads, and Counting-out Rhymes.* New York, Oxford: Oxford University Press.

Sack, W.

1997 Artificial Human Nature. *Design Issues, Volume 13, (Summer 1997): 55-64.* <http://www.media.mit.edu/~wsack/design-issues.html>

Sampson, G.

1999 ***Educating Eve****: The 'Language Instinct' Debate.* New York: Cassell.

Searle, J.R. (Edited by Rainer Born)

1987 Minds, Brains and Programs. ***Artificial Intelligence****: The Case Against.* London & Sydney: Croom Helm.

Setton, D.

2000 Invasion of the Virbots. *Forbes, 09/11/2000, Vol. 166 Issue 7, p22* .

Shepard, S.

2000 Marco: Advancing computer intelligence. *Memphis Business Journal, 08/04/2000, Vol. 22 Issue 14, p20.*

Slouka, M.

1995 *War of the Worlds: The Assault on Reality.* Great Britain: Abacus.

Snyder, S.H.

1998 Neurotransmission, Second Messengers and Drug Action in the Nervous System.
<http://ww2.med.jhu.edu/gradweb/cmm/faculty/snyder.html>

Sokolowski, R. (Edited by Stephen Graubard)

1988 Natural and Artificial Intelligence. ***The Artificial Intelligence Debate****: False Starts, Real Foundations.* Cambridge, Massachusetts: The MIT Press.

Stone, A.R. (Edited by M. Benedikt)

1992 **Will the Real Body Please Stand Up?:** Boundary Stories about Virtual Cultures. *Cyberspace: First Steps.* Cambridge Massachusetts: MIT Press.

Theall, D.F.

(n.d.) Beyond the Orality/Literacy Dichotomy: James Joyce and the Pre-History of Cyberspace. <http://astro.ocis.temple.edu/~callahan/hjs/theall.htm>

Torrance, S. (Edited by K.S. Gill)

1986 Ethics, Mind and Artifice. *Artificial Intelligence for Society.* Chichester: John Wiley & Sons.

Tsien, J. Z.

2000 Building a Brainier Mouse. *Scientific American April 2000, Vol. 282 Issue 4, p62.* <http://www.sciam.com/2000/0400issue/0400tsienbox3.html>

Turkle, S. (Edited by Stephen Graubard)

1988 Artificial Intelligence and Psychoanalysis: A New Alliance. ***The Artificial Intelligence Debate**: False Starts, Real Foundations.* Cambridge, Massachusetts: The MIT Press.

Turner, F. & Ernst Poppel

(n.d.) The Neural Lyre: Poetic Meter, the Brain, and Time.
<http://www.joelorr.com/neural.htm>

Tyson, P.

1997 Trends: Artificial Societies. *Technology Review, April 1997, Vol. 100 Issue 3, p15.*<http://www.techreview.com/articles/apr97/tyson.html>

Weizenbaum, J.

1987 ***Computer Power and Human Reason:*** *From Judgement to Calculation.* Great Britain: Penguin Books.

White, E.B.

1944 "Removal". *One Man's Meat.* New York & London: Harper Brothers.

Wilson, E.O.

1998 ***Consilience****: The Unity of knowledge.* Great Britain: Abacus.

Wittmann, A.

2000 I Think, Therefore I am? *Network Computing, 06/26/2000, Vol. 11 Issue 12, p172.*

Wright, R.

1996 Can Machines Think? *Time April 1, 1996, Vol. 147, No. 14, p42.*

Zacks, R.

2000 The Story of the 21st Century. *Technology Review, January/February 2000, Vol. 103 Issue 1, p80.*