CHAPTER 1

THE HISTORY OF SCIENCE

Science is and always will be a dynamic cycle of acquiring knowledge which could potentially be used for the betterment of humankind and society as a whole. The development of science has progressed via a sequence of new and creative thoughts (Gregory, 2001), which is imperative for researchers to understand and the history of science is the tool required to achieve this. A historian can investigate why and how a scientific theory was shaped at a particular time by analysing the scientific discourse as well as social determinants during this period. Above all, the history of science, as Waller suggested, provides valuable insights:

> ... into the conduct of scientific debate, the securing of scientific immortality, and the complex interplay between the scientists and the worlds in which they operate (Waller, 2002, p.2).

The importance and relevance of the history of science has been debated for centuries. For example, Gottfried Wilhelm Leibniz (1646-1716), a German scientist and philosopher, highlighted the significance of the history of science in the late seventeenth century:

> It is of great advantage to get to know the real sources of great discoveries, in particular of those that were made not by chance but by reflection. The result of this is not only that the history of science acknowledges what each individual has contributed (i.e. the establishing of objective historical facts) and that others are thus encouraged to acquire a similar reputation (i.e. a great model serving as an incentive), but also that the art of discovery (*ars inveniendi*) expands when one finds the path of research in outstanding examples (Liebniz cited in Kragh, 1987, p.5).

Presently, the importance of the history of science is generally acknowledged and although for different reasons many scientists identify history as important for scientific research itself. Historical

analysis can function as an analytical instrument for the critical evaluation of methods and concepts that appear in modern science (Kragh, 1987). Analysis of past problems may play a vital role in understanding current scientific debates. History shows how science has contributed to the growth and well-being of society, and also how the use of science can be potentially dangerous to society. Anthropological disciplines for one shows how the study of humans stemmed into racial science and the eugenics movement. Jonathan Marks commented on the importance of history to anthropology:

> Anthropologists... are absorbed in their intellectual history – in learning from the mistakes of earlier generations of scholars. The more we understand those conceptual errors, which usually are visible only in hindsight, the more the science of the human species can grow - by the very process of proposal and disposal by which science functions (Marks, 1995, p.3).

History not only reveals the obstacles of the past but the persistent nature and creative ideas of our predecessors. With this in mind, one can only have respect for, and acknowledge the great pioneers of the past, the incipient thinkers whose contributions led to science as we know it. One should realise that our current knowledge and methodologies were mostly determined through past generations.

Additionally, the history of science considers the influence of external factors that might have affected scientists at the time they were working (Gregory, 2001). External factors include politics, culture, mysticism and religion. Religious dogma is often understood to be a major constraint during specific periods (Waller, 2002). The Dark Ages are an example of this religious totalitarian rule, where science was progressively hindered by Roman Catholic ideology. Kragh sums up this aspect by stating:

> One of the effects of, and perhaps the motivation behind, confining history to unique events is that one isolates historical from sociological, psychological, and economic view points; an isolation that admittedly

> will confer autonomy on history, but the price of that autonomy will be sterility (Kragh, 1987, p.22).

As mentioned Marks (1995) highlights the value of historical analyses from an anthropological point of view. Following Marks's observation this study attempts to provide an analysis of the anthropologically relevant research completed by the South African self-taught researcher Eugene Nielen Marais. The main focus of the study is on Marais's contributions to primatology and evolutionary studies. The study provides a critical analysis of the work Marais had completed by the latter portion of his life, 1927, pertaining to the psyche of the Chacma baboon (*Papio ursinus*) as compared to humans (*Homo sapiens*), (Marais, 2002). The reason for rekindling an interest in Marais and his original scientific work is primarily based on the fact that most of the published works on this enigmatic figure are either hagiographies or harsh criticisms which relegate him to the wash basket pseudoscience. This study will try to provide a more balanced approach and relate his contribution to the developments in two disciplines, primatology and Evolutionary Psychology.

PRIMATOLOGY

Chapter 2 of this thesis provides a brief history of primatology and particularly refers to the work of Solly Zuckerman and Robert Ardrey.

Two well-known examples of the polarised approach to Marais's work includes, the famous scientist, who was Marais's contemporary and rival Lord Solly Zuckerman and secondly, the writer Robert Ardrey who "rediscovered" Marais's forgotten work and presented it to the scientific and general public in the early 1960s.

Zuckerman was overtly critical when considering Marais's primatological work. Zuckerman went so far as to publicly denounce Marais as a drug using story teller who invented his own,

scientifically sterile, method of observation. This public denouncement was related to Robert Ardrey's introduction in Marais's posthumous work, entitled *The Soul of the Ape* (1969) in which Ardrey commends Marais as being the father of primatology. Zuckerman was obviously annoyed with Ardrey's positive comments concerning Marais's primatological work and hence lashed out in a public display. Ardrey's praise of Marais's work was tied to Marais's long term studies of non-captive baboons but more specifically his pioneership in terms of actually observing these species in their natural environment. For a full review of the above mentioned disagreement refer to Zuckerman's autobiography (Zuckerman, 1988, p.455) and also more specifically (Morris, 2009).

The first aim of the project was therefore to assess Marais's work and to decipher his historical placement between the two extreme views provided by Zuckerman and Ardrey. Zuckerman's work was also used as a base for a comparative analysis to test the validity of Marais's research in the context of the history of primatology. Zuckerman had a very similar interest in primates to Marais during the early twentieth century, but the method of application was different which led to different conclusions and interpretation of results.

EVOLUTIONARY PSYCHOLOGY

In the Evolutionary Psychology section (Chapter 3) the inferences made from Marais's observations were considered and discussed in an attempt to explain the evolution of consciousness. Therefore, this section begins with briefly outlining the histories of both psychology and evolutionary theory to gain a better understanding of the evolution of consciousness in this context.

Within this theoretical and historical framework a brief comparative study was done comparing the work of Charles Darwin and Marais. Marais shared similar ideas to Darwin in terms of the structure of

their theories in identifying and explaining the evolution of consciousness.

Hence, Darwinian theory was the ideal comparative model to constructively critique Marais's work on Evolutionary Psychology. Marais's inferences were examined in relation to their validity concerning the evolution of the mind.

Overall the aim of this thesis was to critically analyse the relevance of Marais's contribution to these two fields, primatology and Evolutionary Psychology in the context of what is known today, within the boundaries of scientific practicality. To achieve this I also provide a detailed history of the relevant scientific disciplines in order to make a better assessment of Marais's output against the background of intellectual and scientific climate and developments. In order to achieve this it was essential to firstly describe Marais as a person and his life history and biography allows one to identify the many different facets of his scientific and private life.

BIOGRAPHY OF EUGENE NIELEN MARAIS

Eugene Nielen Marais was born on 9 January 1871 in Pretoria, South Africa; he was the youngest of the twelve children of English speaking parents of Huguenot descent - Jan Christian Nielen and Catharina Marais (Rousseau, 1982). His primary and secondary schooling was in English and he attended schools within a wide a range of areas located in South Africa, due to his nomadic

upbringing.

Figure 1.

Eugene Nielen Marais (from Rousseau,1999)

In 1894 he married Aletta Beyers, but she died the following year during childbirth an event which left him devastated and is suspected to have influenced his lifelong opium addiction (Rousseau, 1982). He then moved to Europe to study law where he received his advocacy, but his stay in Europe was cut short as he was required to return to South Africa during the Anglo-Boer War in 1902. Whilst in Europe Marais was exposed to a multitude of scientific papers written by auspicious researchers during the late nineteenth century, such as Charles Darwin, Ernest Haeckel, Jean-Martin Charcot, Henri Bergson and Sigmund Freud (Rousseau, 2000). After the war he returned to Pretoria, where he practiced as an advocate and produced a book on deeds office practice. He spent most of the rest of his life writing for

the popular press and relied on a group of literary friends for financial support, particularly the historian Gustav Preller (Swart, 2004).

LITERARY INFLUENCE

As was common to many South Africans of Dutch and French descent, Marais's vernacular was Afrikaans and he was quite influential in the development of this language.

At the age of twelve, Marais had written his first poem, *The Soldier's Grave* (Swart, 2004). During his school days he won the prize for divinity andsubsequently published a poem in Afrikaans entitled *Winternag* (Roussea, 1982). He matriculated early due to his accelerated pace of learning on the recommendation of his Principal to the Department of Education (Rousseau, 1982). At the end of the 1880s he adopted journalism as a profession. He started off as a parliamentary reporter, and at the age of 19 became the editor of *Land en Volk* (Swart, 2004) and subeditor to *The Press* and *The Advertiser* (Rousseau, 1982), all of which were prominent newspapers at the time. During this period he used the *Land en Volk* as a means of exposing the political misconduct and propaganda dictated by the then South African president Paul Kruger. Marais was an opponent of Paul Kruger's regime and a supporter of the opposition 'Progressive' faction. Besides his political agendas he also used the *Land en Volk* to publicise the use and growth of the Afrikaans language. He did this by allowing Afrikaans articles to be published in this newspaper, many of which he wrote himself, as opposed to the more commonly spoken languages such as English and Dutch.

As mentioned Marais published his first poems from 1880 to 1890, during the First Afrikaans Language Movement which was led by Stephanus Jacobus du Toit, the purpose being to present Afrikaans as an independent language separate from Dutch (Swart, 2004). He

published poetry again in the years immediately after the Anglo-Boer war, during the early days of the Second Language Movement, and then again after 1919 up to his death (Swart, 2004). Some of the poems he published include *Piet van Snaar*, *Die Smit* (The Smith) and *Winternag* (Winter Night). *Winternag* particularly has come to be remembered as the first Afrikaans poem of any literary worth (Joyce, 1981).

The importance of Marais's poetry and literary skills was how he used these as a political tool to propagate the Afrikaans language. He did so under the alias "The Sandman" (*Klaas Vakie*) during the Anglo-Boer War. His poetry was most influential in liberating the Afrikaans language, and politicians such as Eugene Terreblance (murdered in 2010) have likened his own poetry to that of Marais's (Swart, 2004). Terreblance was the leader of the political grouping of extreme nationalists known as the AWB (Afrikaner Weerstandsbeweging) which was heavily involved in propagating the Afrikaner community and their cultural identity during the early twentieth century, established in 1973,(Welsh, 1995).

The Natal Mercury newspaper honoured Marais as one of the 100 people who developed South Africa, including a multitude of other awards and honorary praise for his poetry (Swart, 2004). He was also held in high regard with auspicious poets of his time such as Jan Celliers and Louis Leipoldt (Kannemeyer, 1984). Therefore, Marais could be considered a pioneer in the use of the popular vernacular (Afrikaans) and should be respected as one of the founding members of Afrikaans as a literary language. Marais's accomplished literary style seems to characterise his popular science writing style (this can be depicted from his infamous natural history manuscript, *My Friends the Baboons*, at which time he was probably at his best both mentally and physically).

MARAIS'S ROLE IN SCIENCE

Marais's move to the Waterberg Mountains located in the Northern Transvaal (Limpopo Province), was either in 1906 or 1907, and also that his move to isolate himself in this area was due to an increasing distaste for his work as an advocate and also the depression of losing his wife nine days after childbirth (Rousseau, 2000 and Ardrey, 1969). During this period he spent three years studying wild Chacma baboons (*Papio Ursinus*) (Rousseau, 2000), which led to him writing *My Friends, the Baboons* (1939) and the posthumously published book, *The Soul of the Ape* (1969).

Other than his clear interest in languages he had a love for animals that began in his childhood. He kept snakes, scorpions, birds, insects and later apes, as pets (Marais, 1969). He had a pet chimpanzee and a marmoset (Rousseua, 1982). This interest in animals at such an early stage is demonstrated by the understanding of animals and their behaviour in his writings. This could be the main stimulus behind his choice for studying animals in their natural environment for such a long period as well as observing animal behaviour in general. Overall, it would appear that Marais' love and sincere interest in animals were the prime motives for his involvement in ethology. It should be noted that Marais had no formal tertiary education in the biological sciences and most of his knowledge was self-taught. Marais was also a strong proponent of Darwinian theory. He was an open pantheist (pantheism is the view that the universe, or nature and God are equivalent) and maintained that he only entered churches for weddings (Swart, 2004).

Besides vertebrate species, he studied the behaviour of termites for ten years and published *The Soul of the White Ant* (1970). His ideas in this book were thought to be plagiarised by the Nobel Prize winner Maurice Maeterlinck in his book, *La vie des termites* (*The Life of the White Ant*) (1930), (Joyce, 1981). Marais had accused Maeterlinck of having used his concept of the 'organic unity' of the termite in the

above mentioned book. Marais had published his ideas on the termitary in both *Die Burger* (1923) and in *Die Huisgenoot* which featured a series of articles on termites under the title *Die Siel van die Mier* (*The Soul of the Ant*) from 1925 to 1926 (Swart, 2004). However, due to financial issues Marais could not afford an international law suit to vindicate his name. Ironically, through time, Marais became better known for his plagiarism scandal than he was for his award winning poetry (Swart, 2004). Rousseau does however, show that both Marais and Maeterlinck had predecessors who identified a similar theory and hence the plagiarism accusation was unsubstantiated (Rousseau, 1999).

Marais was a multifaceted creative personality, a poet, writer and scientist, but these achievements were not sufficient to sustain a happy life, and his depression, addiction and a series of unfortunate incidents led him to commit suicide on the 29th March in 1936 (Ardrey, 1969).

CHAPTER 2

PRIMATOLOGY

One of Marais's most defining contributions to science was his work in the field of primatology. Marais was a pioneer of animal behaviour studies and that apart from studying baboon's he researched other animals, namely his ten year study on termites for The Soul of the White Ant, (Marais, 1970).

In order to situate Marais's contribution within the emerging disciplinary framework, this chapter focuses on the history of primatology and the emergence of the discipline of ethology. Thereafter the assessment of Marais's contribution to the field is given. This assessment is largely accomplished through a comparative analysis of the primatological work of the primary figure in the field of primatology at the time - South African born, Solly Zuckerman. Special attention is paid to Zuckerman's vitriolic criticism of Marais and his scientific contributions. Solly Zuckerman was not considered a patriot of South Africa and his allegiance to the English was not hidden, his introduction to his autobiography clearly illustrates his desire to leave South Africa and also his pro-British sentiment (Zuckerman, 1988).

Primatology is defined as a discipline that studies the biology of the mammalian order Primates (Mai *et al.*, 2005). Although the subject matter is zoological, the membership of humans in the primate grouping has led to this discipline being subsumed under anthropology in many academic institutions. Practitioners (primatologists) are also found in biologically related disciplines such as anatomy, systematics, ecology, genetics, behavioural biology, physiology, paleoanthropology and paleontology.

Anthropologists originally became interested in primates for use as both models of early human behaviour and reference for understanding the evolutionary changes in human morphology,

whereas psychologists sought to understand human behaviours through behaviour exhibited in our closest relatives (Mai *et al.,* 2005). The history of primatology consists of major phases in the understanding and interpretation of non-human primates as more and more of these animals were discovered. These non-human primates became interesting to scientists because of their structural similarity to humans. Because of this similarity; primate anatomy was studied, usually as a substitute for human anatomy. As the anatomical similarity became more obvious, researchers ventured into physiological (medical) research and behavioural analysis (psychological research). Today these animals are researched at several different levels of organisation often in an integrated manner. The non-human primates were, therefore, used for centuries used as a proxy for studying humans, sometimes elucidating accounts on humans but also (as in the case of the study of human anatomy, based mainly on dissection of various primate species) obscuring the knowledge about our species.

THE BEGININGS OF PRIMATOLOGY

The history of primatology has been closely tied to global exploration and technological advancement (specifically in terms of transport), and both of these factors provided better access to study and understanding of primates. Initially, different species of monkeys were identified and as explorers discovered new and previously inaccessible areas apes were also described.

The primates were often seen as mythical creatures. One of the earliest paintings of monkeys dates from the Old Kingdom of Egypt (2575-2134 B.C.). It depicts a hamadryas baboon (*Papio hamadryas*) and several other monkey species on the wall of the tomb at Thebes (Schultz, 1971). The first documented encounter with apes (later identified as chimpanzee) began with the Carthaginians (Hartman, 1904). The Carthaginians were sea merchants and they hunted these

animals for their skins that were used as evidence that these primates were neither human nor animal, but rather mythical creatures resembling humans (Schultz, 1971). For a long time (up until the nineteenth century), before systematic observation began, explorers and hunters supplied half-fictional, sometimes fantastic stories, widely believed to be true, about the 'wild creatures of the woods' (Bingham, 1932).

The first systematic attempt to summarise what the ancient world knew of primates was made by Aristotle (384-322 B.C.) in the fourth century B.C. He divided primates into two groups, depending on whether they had a tail or not.

Figure2.

This image is a representation of Aristotle. (Wellcome Institute Library, London). (from Persuad,1984).

Aristotle's observations were supplemented by the Roman physician Galen (A.D.131-201), whose dissections of the Barbary ape (*Macaca inuus*) served as the basis for all anatomical learning in the medical schools of Europe until the 16th century (Persaud, 1984). The dissection of *Macaca inuus* and other primates conducted by Galen were used for human anatomical research based on the assumption

that their anatomy was similar to that of humans. Consequently, the legal limitations (dissection was considered pagan practice during this period) forced on Galen had led him to make a number of mistakes about the human body. For instance, he mistakenly thought a group of blood vessels near the back of the brain- the rete mirabile - was common to all primates excluding humans (Nutton, 1973). Galen's writings, though based on non-human primate anatomy, were accepted by the Christian church and for the next twelve centuries they were considered infallible.

Figure3.

Claudius Galen. (from, Persaud, 1984).

In the sixteenth century, Andreas Vesalius (A.D.1514-1564) meticulously illustrated descriptions of the human body in his book *De Humani Corporis Fabrica* (On the Structure of the Human Body), which was based on observations of the human body from dissection (Persaud, 1984). In fact, Vesalius was instrumental in demonstrating that Galen's anatomy was based on that of a monkey instead of human (Marks, 1995).

Figure4.

Andreas Vesalius (from, Persaud, 1984).

Contemporaneously to Vesalius, Konrad Gesner (A.D.1516-1565) published *History Animalium* in five volumes, which are considered to be the first illustrated books on zoology, wherein he described several kinds of monkeys and apes (McCown and Kennedy, 1972). He did not dissect or study these animals, rather, his descriptions were taken from other sources that frequently relied on travellers' stories, a common practice at the time.

In the seventeenth century, the Dutch physician and anatomist, Nicholas Tulp (1593-1674) described what he called *Homo sylvestris* or *Orang-outan* (Hartmann, 1904). In 1699, Tulp described another ape from Angola, on the west coast of Africa, which was thought to be a chimpanzee (Hartmann, 1904). Ashley-Montagu presents an English translation of a part of Tulp's text regarding the behaviour of this ape, undoubtedly taken from the ship captain or crew that had brought the animal from Angola. It reads as follows:

> In fact they are greatly inclined to venery that they are at all times wanton and lustful: so that the Indian women therefore avoid the woods and forests, worse than dog and serpent, where the shameless animals roam (Swindler, 1998, p.9).

These kinds of statements perpetuated the view of monkeys and apes as indolent and promiscuous creatures well into the nineteenth century.

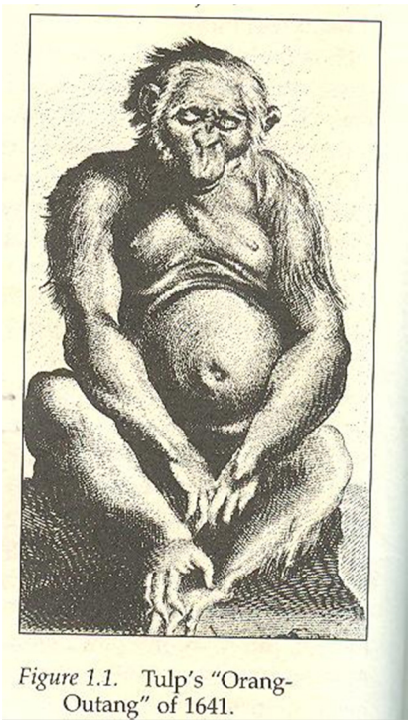

Figure 1.1. Tulp's "Orang-Outang" of 1641.

Figure5.

(from Swindler, 1998).

In 1699, Edward Tyson (A.D.1650-1708) published an influential work entitled, *The Anatomy of a Pygmy compared with that of a Monkey, an Ape, and a Man* (Swindler, 1998). This study made many authors consider Tyson as the founder of primatology. Tyson developed and applied a comparative approach where each anatomical feature was described during his dissections of the chimpanzee, monkey and human (Marks, 1995). This permitted him to make inferences about structural and functional comparisons within or between these species. He concluded that the chimpanzee has more in common with the humans than with monkeys, particularly with respect to the brain (Swindler, 1998). Ashley-Montagu, who was Tyson's biographer, considered Tyson's description of the

chimpanzee as the first scientific claim that an ape is more similar to human than any other animal (Marks, 1995).

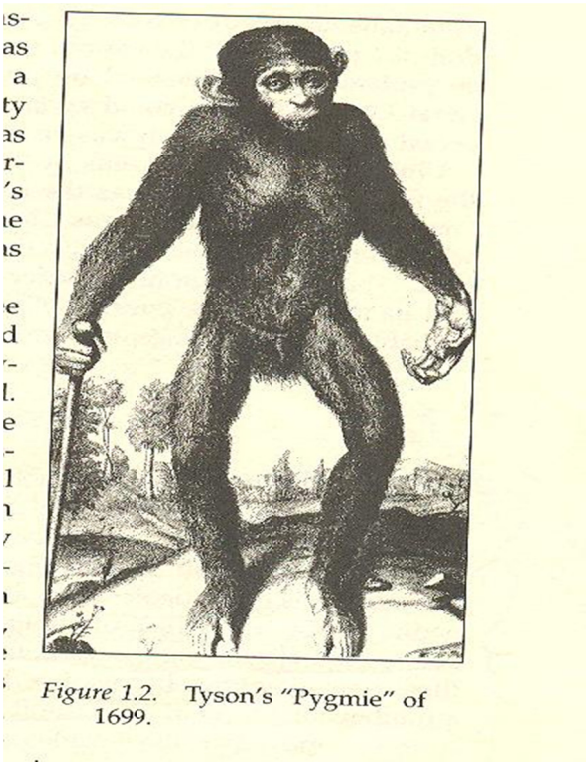

Figure 1.2. Tyson's "Pygmie" of 1699.

Figure6.

(From Marks, 1995, p.4).

In the eighteenth century a significant figure stands out, namely, Carolus Linnaeus (1707-1778). Linnaeus is best known for being the originator of the modern scientific system of biological classification that now bears his name. Linnaeus was responsible for the shift in the system or pattern we use to interpret nature. The shift involved a move from the old one dimensional ranking of species -'The Chain of Being', to the two dimensional pattern (Marks, 1995, p.7). Linnaeus therefore provided the Class, Order, Genus and Species as opposed to the Chain of Being, which provided species differentiation only. Linnaeus' system of classification identifies equal rank to taxa of the same level (none is higher or lower than the rest), for example the Rodent Order is not superior to the Primate Order, and *vice versa*. To Georges Buffon (1707-1788), however, there was no category higher

than the species as is required in the Great Chain of Being. In 1735, at the age of twenty-eight Linnaeus published the first edition of his book *Systema Naturae* whereby he classified humans in the same taxonomic grouping as other primates (Lewin, 1999) and introduced (in the tenth edition, published in 1758) the order primates (Fleagle, 1988).

Taxonomic placement in particular has established the context for studying both human and non-human primates. Linnaeus' analysis was predominantly based on anatomical comparisons. He characterised primates using specific anatomical features that he identified such as the four incisors, two clavicles, two mammary glands on the chest and two limb extremities that function as hands with opposable thumbs (Conroy, 1990).The common order of primates according to the 10th edition of *Systema Naturae*, included four genera *Homo* (humans), *Simia* (monkeys and apes), *Lemur* (lemurs) and *Verspetilio* (bats) (Conroy, 1990).

This classification was not accepted by many scholars during Linnaeus' period. Subsequently, several other classification systems developed within a few years of Linnaeus' that affirm his findings in terms of the differences between monkeys, apes and humans. The one unique phenotypic feature that many specialists agreed to during this time was that humans had only two hands instead of four. This position was further supported by the anthropologist, Johann Blumenbach (1752-1840), as well as the comparative anatomist, Georges Cuvier who proposed the two-group divisions, *Bimanus* (humans) and *Quadrumana* (lemurs, monkeys and apes) (Marks, 1995). While Linnaeus's system provided the basis for modern taxonomy the criteria were subsequently changed and refined, particularly with the advent of evolutionary theory which introduced emphasis on evolutionary relationships rather than simple morphological similarity. For example, Hennig states:

> Since the advent of the theory of evolution, one of the tasks of biology has been to investigate the phylogenetic relationship between species. This task is especially important because all of the differences which exist between species, whether in morphology, physiology, or ecology, in ways of behaviour, or even geographical distribution, have evolved, like the species themselves, in the course of phylogenesis. The present-day multiplicity of species and the structure of the differences between them, first become intelligible when it is recognised that the differences have evolved in the course of phylogenesis, in other words, when the phylogenetic relationship of the species is understood. (Hennig 1965, p97).

Additionally, during the eighteenth century the comparative anatomical relationship within the apes was also scrutinised and characterised. The Dutch anatomist, Pieter Camper (1722-1789) showed that the chimpanzee and orang-utan were different animals occupying very different parts of the world with very different environmental niches.

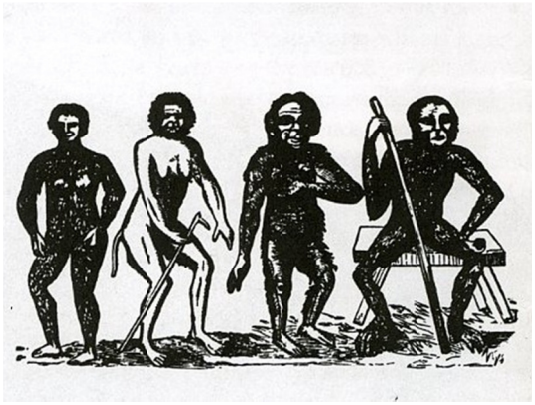

Figure7.

Hoppius, a student of Linneaus, published this representation of "manlike apes", based on scientific literature and travelers' tales, in the late 18th century; the two on the left represent "mythical" *Homo troglodytes* and *Lucifer aldrovandii* while the two on the right represent a chimpanzee and an orangutan (from Lewin, 1999, p.2).

Primatology in the nineteenth century begins to develop into a more complex, diverse discipline. For instance, the comparative anatomists devoted great effort to devising criteria with which to distinguish humans from apes. Also a shift in analysis at this stage included focused measurable anatomical characters such as bone and qualitative data on behavioural characteristics such as the human capacity for speech, reasoning and complex brain functions (McCowen and Kennedy, 1972).

Thomas Henry Huxley (1825-1895) was probably the most prominent student of primates during this period. He provided the first systematic review concerning primates; however, his studies were limited to morphological analysis (Fleagle, 1988).

Charles Darwin's (1809-1882) *Theory of Evolution by means of natural selection* (1859) and his own theory on how humans evolved from an ape ancestry (1871) were fundamental in terms of the progression of primatology. Darwin presented the evolutionary link between apes and human in the mid-nineteenth century. In *The Descent of Man* (1871) Darwin states:

> It is notorious that man is constructed on the same generalized type or model with the other mammals. All the bones in his skeleton can be compared with the corresponding bones in a monkey, bat or seal. So it is with his muscles, nerves, blood vessels and internal viscera. The brain, the most important of all the organs, follows the same law.... It is, in short, scarcely possible to exaggerate the close correspondence in general structure, in the minute structure of tissues, in chemical composition and in constitution, between man and the higher animals, especially the anthropomorphous apes (Darwin, 2010 p.4).

Additionally he states:

> ...in each great region of the world the living mammals are closely related to the extinct species of the same region. It is therefore probable that Africa was formerly inhabited by extinct apes closely allied to the gorilla and chimpanzee; and as these two species are now man's closest allies, it

> is somewhat more probable that our early progenitors lived on the African continent than elsewhere (Darwin, 2010p.121).

Darwin identifies the similarity between humans and the anthropomorphous apes (the term "ape" often denotes both monkeys and apes in this period, while "anthropomorphous" or "anthropoid ape" refers to apes that resemble human but not human-apes in the modern terminology) and characteristics that apparently make humans special, such as intelligence, manual dexterity, technology and bipedal uprightness. Darwin argued that an ape endowed with a miniscule of each of these qualities would have an advantage over other apes (Conroy, 1990).

As mentioned before, it was Huxley who summarised the anatomical details linking humans with apes and who essentially established the general pattern of Old World primate evolution. Huxley's conclusion was that human's share a close evolutionary relationship with the great apes. The African apes in particular were a key element in a major revolution in the history of Anglo-American thought. Humans were to be seen as being part of nature (i.e. humans were being identified as being animal) which can be identified in the current accepted phylogeny linking humans and African apes (Fleagle, 1988 and Tattersall, 2006). It should be noted that Huxley's conclusions were highly influenced by Darwin's interpretation of evolutionary change seen in naturalistic and materialistic terms.

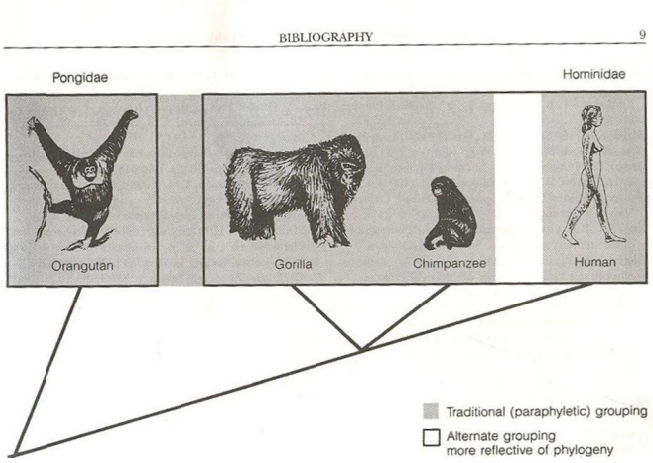

Figure8.

(from Fleagle, 1999, p.9).

MODERN PRIMATOLOGY

From the nineteenth century the anatomical observations became more focused and refined. Comparative morphological analyses were carried out on both extant primates and the remains of extinct primates were being increasingly recovered. The first primate fossils were recovered in the 1830's. Baker and Durand (1836) and Cautley and Falconer (1838), for example, discovered the first fossil monkeys. These palaeontological studies added information on the evolution of humans in line with the unfolding idea that humans are a part of nature.

Taxonomic classification of primates occurred more frequently during the mid-nineteenth century. The first scientific description of the lowland gorilla was provided at this stage. The gorilla (*Gorilla gorilla gorilla*) was discovered and described by Paul du Chaillu (1835-1903). Du Chaillu not only described the structural aspects of these animals but also inferred diet from their stomach content, expelling myths about these animals as monstrous, carnivorous creatures, when he recognised a herbivorous constituency in the guts of these animals. The first documented account of the mountain gorilla, (*Gorilla gorilla beringe*) in 1902 was provided by Captain "Oscar" Robert von Beringe (1865-1940) in two different African locations, which are part of what is today known as, the Republic of Rwanda and Uganda (Swindler, 1998). The last species of ape to be discovered was the bonobo (*Pan paniscus*), in the Congo rainforests by Ernest Schwarz (1889-1962) in 1929 (Swindler, 1998). The 1900s undoubtedly produced amazing discoveries within the primate order, other than the bonobo the uniquely characteristic marmoset came onto the scene. In fact, fifty-six commonly recognised primate genera, out

of the total 61 as we know it today, were discovered during this period (Schultz, 1971).

During the early twentieth century numerous studies on non-human primates were carried out in Western Europe, but mainly regarding taxonomy and anatomy. Comparative anatomists during the 1900s systematically described the bodily structures to demonstrate their diverging evolutionary specializations and their derivations. Under the influence of Darwin, Huxley, Haeckel and other pioneers of modern evolutionary theory, a sound foundation was rapidly produced for the general classification of primates, most of which is still used today (Fleagle, 1999).

During the 1920s and 1930s the systematic study of non-human behaviour commenced. Ethology is the study of behaviour and became an important field for animal behavioural science with particular reference to questions concerning causation, function, development and evolution (Sparks, 1982). The director of the aquarium at the Berlin Zoological Gardens, Oskar Heinroth, coined the word "ethology" (Sparks, 1982). He noted that one could compare behavioural features between species in a manner analogous to comparative anatomy.

The roots of ethology can be traced back to a 1937 paper by the biologists Konrad Lorenz and Nikolaus Tinbergen (Smail, 2008). One of the main factors behind the emergence of ethology was the proposal that behaviour has a genetic component but more significantly that a behavioural trait may be just as much an adaptation as a physical trait, in relation to some past environmental event (Smail, 2008). Richard Dawkins' study on the black headed gulls is frequently used to illustrate how natural selection arrived at a behavioural rather than a structural or metabolic adaptation as the solution (Dawkins, 1999). These behavioural techniques were implemented to better understand concepts such as learning, memory, social integration, intelligence, communication, marking territory and

creating dominance hierarchies, amongst others. At first, ethology focused on birds and insects. This was mainly because these species were easier to study in terms of location and abundance of individuals.

With the continued acceptance within the sciences that monkeys and apes are our closest relatives, research on these non-human primates became more popular not only for medical research but for ethology as well. It was realised that primate breeding facilities were necessary in order to have a continuous supply of healthy animals for the increasingly diverse studies and experiments that were on the horizon. Notably, Robert Mearns Yerkes (1876-1956) assembled the current knowledge of primates that include observations in the wild and experiments in captivity, during the late nineteenth and early twentieth century (Fedigan and Strum, 1999).

There was a further increase of publications on the anatomy and embryology of non-human primates in the twentieth century (Schultz, 1971), followed by a change in the analyses of primates from descriptive morphology to functional assessment of gross anatomy, embryology, histology and neurology (Schultz, 1971).

In 1931, the anthropologist Earnest Albert Hooton (1887-1954) published a book, entitled *Up from the Ape*, soon followed by his equally important volume on *Man's Poor Relations* (Shapiro, 1954). During the same period, Harold J Coolidge was involved in many expeditions including *Pan paniscus* as well as *Gorrilla gorrilla*. He was particularly concerned with descriptive, functional, comparative anatomy to discern taxonomic classification (Coolidge, 1933; 1982).

At Yale University the physiologist John Fulton (1899-1960) had begun his comparative neurological work with primates on a large scale (Fedigan and Strum, 1999). Under the influence of these and a number of other scholars of that period who concentrated their work on the study of primates, primatology became well established particularly in North America.

The central problem had continued to be human's place among the primates, revealed by the growing mass of evidence from palaeontology and comparative anatomy. The methodical exploration of the behaviour, social structure and organisation of non-human primates was to acquire a better understanding of human evolution. Having been initiated in Europe by scientists such as Ladygin Kohts (1890-1963), Wolfgang Kohler (1887-1967), Solly Zuckerman (1904-1993), it was soon followed in America by Yerkes and others. Yerkes had sent researchers like Clarence Ray Carpenter (1906-1975), Henry W. Nissen (1901-1958) and Harold C. Bingham (1888-1958) into the field for detailed observations on the life of monkeys and apes in their natural habitat.

These studies produced more insight into primate life history and research questions began incorporating social rules, such as play and its behavioural effects on adulthood and the understanding of hierarchy and social order (Gilmore, 1981).

Sherwood Washburn published in the early 1950s a motivation for the naturalistic study of primates as part of anthropology in his project of *New Physical Anthropology* (1951). Washburn argued that physical anthropology must be a holistic study of human evolution and behaviour. He believed that the analysis of animals should focus on the adaptive nature of both the anatomical and behavioural features. Also, within this analytical framework, the study of animal behaviour in their natural habitat was of great importance. Washburn himself carried out studies on non-human primates in their natural environments and established the value of observing primate behaviour in the wild (Marks, 1995).

The methodology and theoretical frameworks for the research of primate behaviour endured significant changes. From the mid-twentieth century the field of primatology was being practiced throughout the world and its recognition as a scientific discipline was well under way. From the 1960s onwards the development of

longitudinal studies accumulated quite rapidly, but the field of ethology took a different focus.

> Ethology in primatology during the later twentieth century produced longitudinal behavioural studies moving at the same time towards socio-biology. One of the earliest references to these longitudinal studies was that of Stuart A. Altman who observed two large groups of rhesus macaques for two years in their natural environment (Altman, 1962). Longitudinal studies like these demonstrated that primates had specific breeding or gestation periods, and their societies remained intact even when no sexual behaviour occurred (Lancaster and Lee, 1965). These discoveries began to change the idea that sex is the basis of the primate society which Zuckerman and Freud emphasised decades before. With the removal of sex as the focal theme for the social group the focus moved towards understanding the extent of variability in primate behaviour and society (Altman, 1967). Extensive fieldwork studies were being implemented, with volumes of literature being dedicated to this methodology and also primate social behaviour (Fedigan and Strum, 1999).

As mentioned, one of the avenues of change within ethology was the move to sociobiology. Ethology becomes socio-biology when it focuses on adaptive behaviours that contribute to the formation of animal societies (Smail, 2008).

Most of the early literature pertaining to sociobiology dealt with the biological perspectives on insect and animal society. With the emergence of sociobiology in the 1960s, the theory of the innate difference or instinct appears, however, this time it was analysed in terms of genes (Smail, 2008). The period of the 1970s and the 1980's was the heyday of sociobiology and one of the main considerations of the discipline was the shift in the evolutionary framework at the unit of selection from the group to the gene.

E.O. Wilson was the first to apply the principles of socio-biology to the study of humans (Wilson, 1953).He developed the modern evolutionary approach to human behaviour during the late twentieth century (Workman, 2004). Interestingly, the question of instinct (debunked in the earlier twentieth century because it became impossible to define) had re-emerged since its inception in classical ethology and sociobiologists focused on “innate differences”. Hence, the theoretical core of sociobiology at this stage considered whether there are innate differences. When applied to humans, these innate differences stimulated a few social scientists, biologists and psychologists to find value in reviving elements of social Darwinism, eugenics and racial science.

This caused much controversy within both the scientific and public circles. Wilson in particular was accused of being ‘the prophet of right wing patriarchy’ (Workman, 2004). Psychologists avoided Darwinism completely due to the racist ramifications from relating biology to human behaviour. The idea of instinct was debunked in the early twentieth century because it became impossible to define (Workman, 2004). The idea that certain population groups were innately more prone to violence; murder and rape were highly opposed and refuted on the basis of the White Paper hypothesis and also the Blank Slate theory (see Pinker, 2009). White Paper Hypothesis- Environmental influence in this regard refers to experiences and learnt behaviours that developed in relation to environmental stimuli. This would insinuate that violent, murdering rapists are not instinctually prone to this behaviour but largely a consequence of their environment Both these theories represent the same principle - all human beings are born free of instinct and the environment dictates the overall behaviour of the individual and not, specific population grouping.

This led to the development of the SSSM (Standard Social Science Model), the founder of which was Franz Boas (Workman, 2004). Boas demonstrated phenotypic pliability due to environmental factors and

in so doing was the first to challenge the race concept using the empirical method (Boas, 1912). Thereafter the work done by Shapiro was most significant in demonstrating phenotypic pliability from their environment (Shapiro, 1939). Whereas Boas used phenotypic characteristics, Montagu used genes to argue for the same model decades later (Montagu, 1941). This model sought to define human behaviour according to cultural attributes as opposed to biological attributes. This model affected the social sciences and minimised the influence of biology and evolutionary theory. Hence, psychologists during this period were limited to proximate questions predominantly pertaining to learning.

Instinct, however, could not be avoided and more and more researchers were identifying that specific species had specific instincts. Breland and Breland (1961, p.1) argued that: “There seems to be a continuing realization by psychologists that perhaps the white rat cannot reveal everything there is to know about behaviour”. Hence with the introduction of sociobiology by Wilson (1979), the SSSM was being challenged and the controversy ensued. It must be noted that Wilson inferred that if the brain controls behaviour then the biology of the brain should affect behaviour. Additionally, Wilson identifies that if biology affects behaviour in a predictable manner, genes should affect behaviour in a predicable manner, therefore natural selection would have an effect on shaping behaviour (under the premise that natural selection acts on the genes).

When sociobiologists focused on non-human primates they showed that the conditions were limited for group selection and focused adaptation questions on the individual and not the group or species (Fedigan and Strum, 1999). This shift led to theories such as Reciprocal Altruism (Trevors, 1971), The Selfish Gene Hypothesis (Dawkins, 1976) and Kin Selection Theory (Hamilton, 1964). Reciprocal altruism for example, tries to explain why two lower ranking males would form a pact to defeat the alpha male (Klein, 1999). These theories are based on the premise of better

understanding the social relationships in non-human primates, which appear to contribute to individual reproductive success and inclusive fitness. The outcome of these studies focus on how an individual's behaviour extends into group dynamics. For example social bonds, hierarchy and migration patterns, among others which culminate in the social organisation of the group. The main premises of these theories are driven, fundamentally at inclusive fitness and more specifically, maximised inclusive fitness of the individual. Overall findings indicate that non-human primates use sophisticated cognitive mechanisms to ensure that social relationships are maintained (Cheney *et al*., 1986).

Sociobiological theory includes an emphasis on female competitive strategies- longitudinal studies showed that female kin groups formed the core structure of many primate societies. The changing view of animal "mind" implied that both males and females made strategic decisions. Significantly as the research developed, the idea that there might be one basic nature of primate society had been abandoned. Both the habitat and the species were being considered when defining the social structure of primates.

From the 1980s to the present we find the advent of behavioural ecology in primatology. Like sociobiology its roots are in ethology but it differs from sociobiology in that less focus is attached to social behaviour. This period is best characterized as an era that moved away from a strongly reductionist application of sociobiological theory.

As mentioned earlier, sociobiology emphasized genetic determinism in the previous decade. By contrast, the behavioural–ecological models favoured the present by envisaging a more multi-causal view of adaptation. This view emphasizes the interaction of ecological and social processes.

Behavioural ecology is primarily concerned with the survival and reproductive strategies of primates. For example, how do primates

find food, avoid predators and balance the conflicting demands their environment places on them? Both proximate and ultimate questions are being asked about the ways that animals interact with their living and non-living environment. This broader perspective has placed greater emphasis on the idea that primates are part of larger communities, which contrasts with previous approaches that treated each species separately.

Research now focuses on phenomena such as alliances, coalitions, reconciliation, and how aggressive and non-aggressive strategies are integrated during an individual's lifetime (e.g. Strum 1994). Additionally, the origins and evolution of cognitive abilities in primates have been explored by a variety of investigators (Byrne and Whiten, 1988; Cheney and Seyfarth, 1990; Erwin *et al*., 1979; Shettleworth, 1998; De Waal, 2005; Galdikas, 1999 and Fossey, 1983).

EUGENE MARAIS AS A PRIMATOLOGIST

As mentioned in his biography, Marais's interest in biology came mainly from his pure love and enthusiasm for animals and a natural inclination towards nature (Rousseau, 1982). He had very little formal education in the natural sciences and was essentially self-educated. Although the focus of this study is Marais's work on the Chacma baboons, it should be noted that his life studies revolved around a spectrum of species ranging from ants, birds and primates to scorpions. Personally, it seems that to a large extent the death of his wife indirectly played a role in Marais's baboon studies. The tragedy of his wife's death was suspected to have driven him into solitude and isolation to the Waterberg Mountains in 1902. It is in these mountains that he decided to study baboons for approximately three years in their natural environment. From his observation and analyses of these baboons he developed a series of popular articles (later published as a book *My Friends the Baboons*) and the manuscript of

his most ambitious work – a posthumously published book *The Soul of the Ape* (1970). Marais only conducted one study on the Chacma Baboons; from this study two books were published. The first *'My Friends the Baboons'* is more focused on his actual methodology and observations of the Chacma. His second book which was posthumously published by Ardrey, *'The Soul of the Ape'* pertains more to the actual interpretation of his baboon observations and the introduction of his theory on the evolution of consciousness. Marais fundamentally studied the Chacma baboon in the wild for three years consecutively. His observations and methodology was unique in that his study was the longest observation of non-human primates in their natural setting or captive setting during his time. His choice for the Chacma baboon as his study sample was due to their closeness to humans and their similar mental development, from which he could derive his theory on the evolution of consciousness. Secondly his choice for the Chacma sample study was based on the readily available baboons for observation. From this study he shows that animals which have a high individual protection from natural selection are more dependent on individual causal memory than instincts. Within this premise he builds a hierarchy of sorts, defining his theory of the acquisition of this conscious mind in the animal kingdom, which he then identifies as the evolution of consciousness.

In these books, Marais clearly made it known that his study was well thought out in the sense that he premeditated the long term, non-captive methodology. Serendipity allowed for favourable environmental conditions as well as his choice of primate to analyse. This 'ideal' environment included a non-habituated troop consisting of 300 baboons that had not been in the proximity of humans for over four years during the period of the Anglo-Boer War (1899-1902). During his stay over three years with the baboons Marais was successful in habituating the troop. His success in habituating resides in the fact the he used food to entice the animals. However, these conditions did not extend throughout the three year period as people

began repopulating this area in the aftermath of the war, hence disturbing the natural balance, and possibly the behaviour, of these animals. This was not the only obstacle Marais had encountered during his research as several problems appeared due to the novelty of his research technique and the restrictions posed by the field work at this period.

In brief, Marais's methodology is scattered and he gives pockets of information alluding to how the study was carried out. So there is no clearly defined protocol that could be easily repeated. From these pockets of information the following could be deciphered:

- The study was conducted in the natural habitat of the Chacma baboon.
- The methods included habituation of the animals via food provisioning to the extent that they could peacefully walk amongst these animals within the group and also reduce their pace by detaining them at a given spot in time with food.
- Observations were carried out daily, literally from dusk to dawn. They had set up camp very close to the baboon home base with the use of straw huts and would track these animals from their home base at dusk until evening.
- Each adult animal was recognised by name and number which had been listed during observations.
- Conditions were unnatural due to complete isolation of this group for several years during the Boer War as well as the impressions made by humans as they slowly started repopulating the area.
- Marais also observed other wild troops of baboon under more natural conditions as well as the observation of captive baboons.
- He observed and made notes of each unique individuals behaviour.
- He claims that his observations were systematic according to the empirical method but what system he employed he does not mention.

- In many regards Marais had no set period of observation and it stopped when humans populating the area became increasingly higher in number leading to farms being destroyed and so forth.
- The novelty of his research method and study design was not recognised and clearly outlined. This could either be related to his target audience (public) and also his timing, Marais never managed to complete is final manuscript, The Soul of the Ape, possibly if he did, a clearer protocol would have come out of it.

(Marais, 1939, p.16)

Marais did not have access to libraries, literature and work specific to his research. Marais states:

> We approach this investigation without any preconceived ideas, and although inexperience at the beginning may have left much to be desired in one method, we had least no theories to verify. We tried under all circumstances to adhere to the empirical method and to avoid as far as possible the shadowy byways of metaphysical speculation and psychological abstractions, to which research in this direction seems inherently inclined (Marais, 1939 p.17).

This was important in terms of Marais's research as he had no scientific training other than his suspected medical education. At first glance this was a great disadvantage as the current and background information pertaining to any field forms the foundation of understanding and interpretation, which Marais lacked. However, this lack of training might have played a positive role as it allowed Marais the opportunity of presenting his own, novel method of interpretation and publicise his own ideas and thinking.

Marais was unique in the sense that his inquiring biological mind was naturally inclined towards a sound understanding of nature and its many secrets. He invested his thoughts into developing creative solutions to scientific enquiry. Individuals like this have an ability to subjugate the normal trends and define a mind-set so atypical that its

contributory value is only recognised years later and in Marais's case, posthumously.

As mentioned Marais was interested in animals and, more specifically, in their behaviour. The earlier ethologists, to which Marais unknowingly belonged, were primarily interested in the analysis of birds and insects but this was mainly due to species availability and access for observation. As the discipline developed a greater number and variety of species were being studied which included humans. Marais extended his research efforts to the study of humans, non-human primates, reptiles, insects, mammals, fish and birds. His methodology broadened and included hypnosis, captive observation, non-captive observation and short and long term studies.

Marais realised the need and significance for long term studies, which he mentioned in *My Friends the Baboons*: "unless one is able to watch animals for days on end uninterruptedly, it is not possible to discuss the secrets of their behaviour" (Marais, 1939, p.1). As mentioned, the first documented longitudinal primate studies were only conducted well into the second half of the twentieth century.

Marais believed that in captivity the animals acquired new habits and their general behaviour changed (Marais, 1939). In an attempt to harness the animal's natural biology and natural behaviour, observation of the subject's natural environment becomes a prerequisite. Recently, for example, Jones and Pillay (2004) demonstrate how sensitive the foraging style and social structure of the hamadryas baboons are in order to maintain normal behaviour. Clarence Carpenter was the first documented researcher to observe non-human primates in their natural environment in the 1930s, almost three decades after Marais's pioneering baboon study. Marais claimed that he was well aware of captive studies being practiced during his time namely at the Smithsonian Institute at Montecito in California (Marais, 1939); however, he argued that data from captive studies artificially mimic the animals' natural environment. He openly

displayed his disapproval for captive studies and his resistance to these "captive stations" were so strong that he stated that "these stations were merely to keep exotic apes alive and to ensure their propagation" (Marais, 1939 p.13).

Marais's most effective technique was his observation of a variety of different species; Rowell highlights this point perfectly in light of today's paradigm by stating:

> The comparative method is the standard approach of all non-experimental science, and that includes nearly all evolutionary studies. To be effective it requires the widest possible range of observation, of as many aspects of as many subjects or species possible (as cited in L. M. Fedigan and Strum, 1999, p.59-60).

Marais therefore had a grounded methodology, observing a variety of different species, for long periods in their natural environment. From his observations, Marais made the following conclusions about the chacma baboons and their behaviour.

LIFE HISTORY

Group size

The average group size of the chacma baboon usually peaks at 50 individuals (Fleagle, 1988); however, Marais claims that his group was constituted by 300 baboons (Marais, 1939, p.15). This could be related to the favourable conditions in the Waterberg Mountains, before the boer war when there was plentiful resources and a scarcity of humans.

Locomotion

Marais identified the early locomotory pattern of the baboon as being arboreal but then he identified them as quadrupedal. Marais states:

> Our baboon was of course, an arboreal animal originally, and it is frequently encountered as a true arboreal animal in our large woods and along river banks. But the greater part of the race has long since taken flight to the 'everlasting hills', whence it can in safety defy all its enemies, man included (Marais, 1939, p.2). Quadrupedalism is currently observed to be the main locomotory pattern of the baboon (Fleagle, 1988).

Diet

Marais confirms that the baboon diet is mainly plants and insects and occasionally carnivorous when resources are unavailable (Marais, 1939, p.3). Baboons have been identified as mainly frugivores (Fleagle, 1988). Tobias recollects some wonderful pictures depicting "a baboon clearing the innards out of a little baby buck, just as described by Eugene Marais." (Tobias, 2008, p.148). From this statement it could be suggested that some of Marais's exaggerated observations could actually be accurate and true and not just folk stories for public enticement.

Taxonomy

Marais identifies a few different types of baboon which he believes to be subspecies (Marais, 1939 p.8). He subdivides baboons into colour differentials, claiming that he identified a grey baboon (Chacma), a green baboon, a yellow baboon and a black baboon. He also claims that certain structural features have been noted such as the long headed and short headed baboon, all of which are geographically separated (Marais, 1939 p.19-21)

Natural Predators

These were identified as mountain leopard and python (Marais, 1939 p.34)

The Role of Males

Marais recognised the role of the male in the group with specific reference to the hierarchy in the group. He dedicated an entire chapter entitled "Law and Government among the Baboons" to this topic in *My Friends the Baboons*. In this chapter he identified and emphasised the protective attributes as well as the dominance factor in these males. He explained how the male would altruistically sacrifice his life for the protection of the group. For example he states:

> When the troop is in danger, the baboon exhibits, in the protection of the little ones, its highest degree of altruism. The large males will, with the greatest courage, sacrifice their lives-even with recklessness-in an effort to save the little ones. Never was our troop so dangerous-even towards us-as when a little one, for some reason or the other, took fright and gave a cry of alarm (Marais, 1939 p.42).

Altruism and empathy have been considered to be uniquely human qualities. However more recent research describes the observation of both empathy and altruism in non-human primates. Empathy and altruism has been shown in a number of great ape species, whereby individuals will relentlessly risk their lives to save or protect others. Frans De Waal in particular discusses the evolution as well as the connection between these behavioural traits (de Waal, 2008). Altruism can be defined as

> ... behaviour that benefits another organism, not closely related, while being apparently detrimental to the organism performing the behaviour, benefit and detriment being defined in terms of contribution to inclusive fitness. One human being leaping into water, at some danger to himself, to save another distantly related human from drowning may be said to display altruistic behaviour" (Trivers, 1971, p.35).

In fact de Waal describes an incident whereby a chimpanzee demonstrates this behaviour by pulling another chimp out of the water at the expense of it drowning, since Chimpanzees hate water as they cannot swim and would most likely drown (de Waal, 2008). These types of studies extend to the ideas of Darwin expressed in his publications: *The Descent of Man* and *Expressions of Emotions in*

Man and Animals. Darwin describes the progression of moral values, but more importantly the identification of social instincts that give rise to these morals. Darwin states

> The aid which we feel impelled to give to the helpless is mainly an incidental result of the instinct of sympathy, which was originally acquired as part of the social instincts, but subsequently rendered, in a manner previously indicated, more tender and more widely diffused. " (Darwin, 2010, p102).

Altruism could be identified as one of these social instincts and current research on non-human primates are closing the behavioural gap between humans and the great apes by showing the continuity of these social instincts shared amongst the great apes as well as humans. These 'social instincts' have been demonstrated confidently in the behaviour of great apes but new evidence shows this increasingly among monkeys and lower apes too. Both altruism and empathy have been observed in multiple studies in monkeys but these are species-specific and not shared among all monkeys. For example Povinelli tackled this problem within Rhesus monkeys (*Macaca mullata*) but found no signs of empathy (Povinelli, 1992; Hess, 1993). Conversely, Hamilton and others (1982), describe the adoption of an infant orphan Chacma baboon to an unfamiliar group. In terms of the lesser apes, Barelli *et al*., (2011) identify the White Handed Gibbons to be reciprocally altruistic in terms of exchanging sexual intercourse for grooming.

Studying animal behaviour can be a tedious process as every second of behaviour could infer a possible behavioural novelty; hence long-term, natural studies are ideal for this type of analysis. Marais carried out longitudinal studies but his short-term experimental studies on captive baboons assisted in his overall conclusions. It should be noted that these behaviours are all involved in co-operation as these animals are gregarious in that their survival and propagation is dependent on co-operation between members. These co-operating mechanisms include empathy, altruism, cheating, selfishness, many

theories developed out of this such as Theory of Mind, The Social Brain hypothesis and Machiavellian intelligence (Gigerenzer and Hug, 1992; Trivers, 1971; Cosmides 1989; Cheng and Holyoak, 1985; Caporael *et al.,* 1989) to mention a few.

Marais observed that the males are not just savage relentless rulers but are also the protectors of the troop. He states:

> But the behaviour of the male is even nobler as regards the other infants of the troop. He will, of course, always attempt to save his own child first, but after that he is always ready to offer his life in defence of the other little ones of the troop. If the alarm comes suddenly and the danger is pressing, every large male will grab the child nearest to him regardless of whether it his own or not (Marais, 1939 p.112-113).

Hierarchy and "Law"

Other than protection the males are quite assertive in terms of maintaining order within the group. A definite hierarchy exists in the social structure of the chacma baboons and this could be due to the highly competitive dominance hierarchy that exists in polygamous social groups. In terms of the hierarchy within his group, Marais identifies the leaders in the group and describes them as "...relentless leader in the maintenance of his supremacy over the troop..." (Marais, 1939, p.44). He then describes the behaviour of a younger male who stands his ground as his female partner is about to give birth,

> Under ordinary circumstances, he would never have dared to show the least resistance towards a single one of the leaders; and the leaders on the other hand, if such a thing happened, would simply have crushed the foolhardy one...". "...In this instance, the behaviour of the leader surprised us. As soon as they heard the groaning of the young female and saw the male on guard in the passage, they called a halt and took counsel" (Marais, 1939 p.44).

He also recognises that the right of possession is one of the "tribal laws" most rigidly respected by the baboons (Marais, 1939 p.62).

The Role of Females

Marais observed the female baboon and her role in the group and he states:

> The females have certain rights which are scrupulously upheld by the whole troop. The males must protect them in all circumstances. If danger threatens, the full-grown males form a vanguard and they will often sacrifice their lives to prevent an assault on the females and little ones. The wife is always entitled to a share of the food her husband gathers. If he discovers a tree or plant with ripe fruit, he will lead his wife to it, and though he himself does not eat, he keeps others away while she enjoys the discovered food. If he raids a land while she, from fear, remains in the mountain he will, on his return, hand over to her a share of the mealies or fruit, or rather will allow her to take it from him. Assistance given by the male to the female extends further, and in one respect it helps to place the character of the baboon in a better light and to make him more attractive. As soon as the baby of any pair is so big that it moves from its mother's breast to her back, it is the male who carries it in all difficult places. If there is a sudden alarm and the troop must flee, it is the husband who grabs the baby and carries it out of danger. The mother is so confident that she can trust her husband to the death in this respect that she often flees without troubling about her child (Marais, 1939 p.112).

Long term studies pertaining to baboons have been carried out at the Amboseli National Park in Kenya, for approximately 30 years and others for 16 years in the Moremi Game Reserve, Botswana. These have yielded a wealth of behavioural information concerning these animals (Busse, 1980). Social bonds and relationships amongst these non-human primates have shown interesting results, some of which Marais identified as well. From the above mentioned quote in question, Marais describes a social response from the males in the group whereby they protect the young and females and also provide food and comfort to the females. Seyfarth and Chenney, (2012, p.157) describe how friendships are developed within the group and states the following

> ...baboon males and lactating females also form strong friendships. These bonds are thought to have evolved as a response against the threat of

> infanticide by recent immigrant males....Like sexual consortship's without the sex, male-female friendships are characterised by high rates of proximity, grooming and mutual support....In many cases the male friend is the infants father but in all cases the male is a long term resident who was present in the group when the infant was conceived.

Palombit and others, (1997) describe in detail how the benefit of friendship to these lactating females is derived from the protection of their infants. Others suggest that these females are not developing friendships but rather short term benefits. For example Barret and Henzi (2002, p.274) state

> These results and our previous work therefore suggest that chacma female grooming interactions reflect the short-term exchange of commodities for a variable price, rather than the servicing of a friendship *per se*: females are 'business partners' not friends."

These friendships are bonding relations accommodated by support. Support in this context does not only refer to protection and food provisioning but quite significantly, grooming. Grooming has a few proposed benefits which includes ectoparasite and debris removal (Mooring *et al.*, 1996; Hawlena *et al.*, 2007) as well as to reduce tension through the release of β-endorphins or the "happy hormones" (Keverne *et al.*, 1989). Barelli, (2011) shows that increased male-female grooming occurs during female oestrus of the White-Handed Gibbons, *Hylobates Iar.* Colemenares and others (2002), identify males grooming females more frequently when females are swollen or receptive to mating amongst the hamadryas baboons.

Overall these studies clearly demonstrate altruism, reciprocal altruism and more recently biological markers whereby social behaviours such as grooming and food provisioning are valuable commodities that can be used to form or maintain partnerships.

The female non-human primate role was not fully understood until the late twentieth century. Before this period primates were observed by male researchers predominantly. This resulted in a skewed interpretation of female behaviour. Once more female observations were carried out by female researchers and over long periods of time, the role of the female individual changed in primatology. Researchers such as Jane Goodall and Diane Fossey applied themselves to longitudinal studies of primates, but focused more intensely on identifying the role of the female in these groups. As a result they were able to dismiss the associated stigma that females are subservient and of very little consequence in the group (Fossey 1983; Goodall, 1971). Researchers are discovering that female social relationships vary systematically across primate taxa, most of which include affiliative, sexual and aggressive components (Sterck *et al.*, 1997).

Communication

In terms of vocalisation and communication amongst the troop, Marais realises how important this attribute is within the group by stating:

> If you learn to know them (baboons), you realize more and more that the baboon leader seldom or never acts or makes a noise without a definite purpose (Marais, 1939 p.45).

He identified subtle cues in communication within his troop by stating:

> We finally learnt to know the baboons well enough to be able to distinguish all the noises they usually made. There was no possibility of making a mistake about the sounds which denoted pain and suffering (Marais, 1939 p.46).

Additionally in a separate chapter when referring to eating habits, he states:

> When it had satisfied itself that all was safe, it made a single sound that immediately called the troop down from the mountain and invited them to the feast. But as long as it did not give the command, the troop would not move (Marais, 1939 p.103).

Vocalisation is an integral part of communication pertaining to all mammals especially within gregarious groups. Communication is necessary to all animals providing vocal cues for awareness of danger, mating calls, and quite uniquely for social grooming (needed for development and maintenance of bonds within gregarious groupings). For highly social primates, precise communication of emotional states and information about the environment is critical, for example predation alarms, pain, mate recognition, aggression and dominance etc. Higher primates have the ability to produce a wide range of sounds, which they use in very subtle ways. For instance, when juvenile monkeys are threatened by an older opponent, they scream which usually brings help as Marais recorded in his observations. These sounds differ subtly depending on the intensity of the threat (see Lewin and Foley, 2004) and the dominance rank or kinship of the aggressor. Marais also identifies the change in tone and urgency depending on the type of predator (leopard, snake, etc.) and although the different calls are not words they definitely symbolise meaning.

Marais had a good understanding of the communicative ability of the Chacma baboon via vocalisation (barking) but more importantly he understood the relevance of communicative power, especially in the wild. His communication observations on the Chacma baboon were limited to vocalisation as he does not mention facial expression, body language and non-verbal gestures. Vocalisation and its analysis have become more detailed in terms of the methodology (quantitative and qualitative) as well as the technological advantage of defining sounds more accurately. For example, Kudo's study in 1987 quantified the number of groans, grunts, roars, yakking, growling, etc. for the Mandrill (*Mandrillus sphinx*) and compares his results to other

baboons, with different environmental niches, social structures, feeding and sleeping patterns.

Play

Marais makes note of the importance of play as the foundations of character and behaviour. Play not only promotes motor skill acquisition, problem solving, gender recognition and sex play but also communication or meta-communication (Dolhinow and Bishop, 1970; Berkoff, 1972; Latta *et al.,* 1967). The articles listed below clearly demonstrate the effects of play. They also distinguish different manifestations in play. Some animals play throughout their lives while other animals limit play to child learning. Some non-human primates play with the same sex (hormonal basis of sex-differences in primate play behaviour), age and rank more frequently than others. In some primates the females in the group play more and are found to be more creative as a consequence of this increased frequency. Play can also be related to stone tool handling (Huffman, 1986) which is reflective of stone tool manipulation and possibly the development of culture from our human ancestry. Play has also analysed the differences within a captive environment for baboons in relation to grooming, socio-sexual behaviour as well as aggression (Young *et al.*, 1982). This is a synopsis of a few studies carried out on the function and purpose of play within primates, however, this topic is quite broad and extends over a large range of social animals, in particular primates.

Marais comments that the baboon spends three quarters of its life in play and provides a lengthy description of the games the young play within the group; but as to how this play affects their growth and development he mentions very little (Marais, 1939 p.44-45). Play within primates has been identified by numerous authors as being an important behavioural adaptation. This adaptation allows for infant and parental bonding, social grooming, and preparation for sexual

competition, learning, imitating and predation (Young *et al.,* 1982; Coelho *et al.,* 1982; Shettleworth, 1998).

Sexual Behaviour

Concerning the sexual behaviour of the group, Marais seems to fluctuate between what is normally seen in a baboon troop (polygamy) and what he finds in his specific group (monogamy). , Robert Ardrey introduces Marais's *Soul of the Ape* by stating the following

> In Marais's day, only the most peculiar of circumstances could have made his observations possible. As he himself suggests, the condition was not quite natural. His troop was larger than any studied recently in the limited areas of African game reserves and its size was probably due to isolation and low mortality over so many years. The ruling oligarchy of dominant males was necessarily larger. Also, there was a high ratio of males to females than is normal, it is the irrepressible male who suffers the higher mortality at the hands of man. (Marais, 1969, p.25).

From this statement one could identify why he fluctuates between monogamy and polygamy as his troop numbers were not considered natural.

He also seems to be quite emotive in his descriptions of their sexual behaviour with a strong anthropocentric feeling in his writing. This can be noted in his chapter *Law and Government among the Baboons* in *My Friends the Baboons* (Marais, 1939 p.107). Marais states:

> Sexual rivalry is the usual cause of duels in all species of animals, but in our troop nothing of this sort occurred, though I have reason to believe that it is not so in all troops. This brings us to the consideration of that form of sexual behaviour which was the rule in our troop during our association with it. Usually males and females were equal in numbers. There were always a number of young males without mates. As soon as a female became sexually mature there was usually a certain amount of competition. Often, however, competition was completely absent. In such cases a sort of understanding arose between a young male and a female (before she had reached sexual maturity for the first time). For a week or two beforehand, the two were constantly together. The awakening of first

> love was clearly perceptible. The young male in most cases showed his love by constant and untiring search in the hair of his beloved. If he brought back more than one mealie from a raid he silently allowed her to take one from under his arm-an act which not another one in the troop would have dared. He would turn over stones for her and sit watching as she took away insects from in front of him. At night they slept together with their arms round each other. In such cases there was never competition from other males. When the female had in this way clearly indicated her choice, the marriage was accepted by the whole troop as an accomplished fact (Marais, 1939 p.107-108).

Marais was convinced that his troop had equal numbers of males to females and for that reason he believed that polygamy was not present in his troop. When he refers to other groups of baboons he states:

> In troops where there are more females than males, polygamy was the rule. With us this never occurred, or at least there was always a doubt whether what appeared to be a case of polygamy really was one. And this was due to the fact that conjugal infidelity often occurred (Marais, 1939, p.108-109).

Marais identifies polygamy within baboons but relates this social structure to 'conjugal infidelity', hence humanising the social structure. Marais does realise that his troop of baboons was displaying unnatural numbers so he was aware that what he was observing might not have been the norm. It could be claimed that Marais was being anthropocentric in his definition of polygamy, whereby he mentions "conjugal infidelity" is a controversial one as he could be referring to mate selection, which we now know encompasses a wide range of opportunistic mating's that do not follow normal expectation (one alpha male securing many females). What Marais describes as conjugal infidelity could possibly be described as mate choice in primates. Female mate choice for instance has been widely discussed regarding primates (Keddy-Hector, 1992; Keddy, 1986).The female, in this instance, would prefer certain behavioural traits in terms of mate choice. These

include social status (higher ranking females produce more offspring than subordinate females), familiarity, personality (refer to the friendships amongst baboons, also grooming frequency) and parental care abilities (such as males carrying infants as part of their courtship behaviour towards females, grooming of infants).

More specifically number of male to female ratio is important. Clarke and others, (2009, p.1218) state "... in situations where infanticide is committed by males not present at the time of conception , females may, in fact, favour a strategy aimed at manipulating the paternity estimates of multiple males , rather than one aimed at augmenting the estimate of a single male." Females can therefore minimize the risk of immigrant male infanticide by confusing paternity amongst the males. The best description of Marais's observation of conjugal infidelity is described in (Alberts, 2003). In this article Alberts identifies that the energy cost involved in guarding multiple lactating females becomes increasingly higher at the expense of lower ranking males securing his females as he cannot intermediate between these males or fight them off, hence allowing for subordinate male copulations to occur. A more potent observation would be Alberts' description of sneak copulations which refers to surreptitious mate, opportunistic mating. Alberts, (2003, p.823) states

> Sneak copulations are limited but not absent in species such as baboons, which tend to live in open habitats with high visibility, and in which males maintain close and continuous proximity to the females they are mate guarding.

A more recent study demonstrates these sneaky copulations in baboons (Crockford *et al.*, 2007, p.885), whereby she states

> To maximize their mating success, it behoves subordinate males to monitor the consort status of others, because the existence (or lack) of a consortship determines access to receptive females.

Moreover, today we know that this species of monkey is conformed to a polygamous social structure (Johnson, 2003; Altman and Alberts,

2003).We also know as Skinner states that baboon troop sizes reach a maximum of 130 individuals:

> Chacma baboons are gregarious and live in troops that may number up to 130 individuals in exceptional cases and under optimum conditions (Skinner, 2005, p.218)

Marais dedicates a substantial amount of work in this chapter trying to illustrate this behaviour but from a anthropocentric and almost fantastical point of view. He states:

> As far as my experience goes, I have never seen a male attempt to rob by force the acknowledged wife of another or to steal it by making love to it. But it often happened that an old female fell in love with a young male before the latter had acquired a wife. In such a case the old female always tried in the slyest way to lure the baboon Joseph to her immortal purposes, and her victim was never proof against the temptations of Potiphar's wife. The unfaithful female had to be very careful, for if her true husband caught her red-handed, he punished her and her lover with the utmost rigour of baboon law. After he had thoroughly trounced his wife, he would turn his attention to her gallant who usually took good care to flee before the punishment of the wife had been completed.... An unlawful love-affair lasted sometimes for months if the husband was unusually stupid and especially at ease. It was in such cases which during our early acquaintance with the troop we regarded as polygamy (Marais 1939, p.109).

Furthermore, he adds:

> The quiet wedding of two that had fallen in love before sexual maturity was not a regular rule among our troop. In just as many cases two or three young males simultaneously courted a young female that had reached maturity. If that happened, the female always pretended coyness and ran away with her lovers in a string behind her. There was never any violence or fighting... As soon as the female was so weary that she could continue no further, she immediately and clearly indicated her choice there is no appeal in baboon law. Without the least opposition the disappointed lovers accepted her decision. Quite calmly they walked home together to the sleeping-place which they reached in the pitch dark with the possibility that a leopard might crown the end of their race with

> slaughter. The married pair came home alone and from that moment their marriage was acknowledged and respected by the troop. It was not always the winner of the race who was chosen. Often the offer of the winner-perhaps a large strong male-was refused in favour of a week one far behind. That is why the competitors persisted to the end, no matter how far behind they might be left. It is a remarkable fact and one about which there cannot be the least doubt that the females can always run faster and keep up longer than the males. Every member of the council (leaders) had one wife, and among them, as also among the very old baboons of the troop, there was unbroken conjugal fidelity (Marais, 1939, p.110-111).

Marais's descriptions and observations seem to fluctuate between drama and romance, whereby the remaining factual remnants lack scientific objectivity. Based on this lack of scientific objectivity from his descriptive behavioural reports as well as his writing style which was somewhat romanticised and directed at public enticement, overall appraisal for his work is quite limiting in terms of scientific enquiry. However, it should be noted that what Marais was observing could possibly have been the natural behaviour of *Papionin* society. His descriptive translation of these observations is the point at which he became devoid from absolute objectivity. It is important to note that "objective science" has changed over the years, paradigms shift, and philosophical interpretation changes but significantly, Marais still conducted good science for his time.

Marais clearly recognises and acknowledges the bias in anthropocentric science from his book *Soul of the Ape*, but still falls in a trap of dramatising his observations of polygamy as 'adultery' and 'promiscuous wives'. As mentioned previously Marais's popular monograph was more for public entertainment than a scientific audience. For this reason I suspect that Marais was comfortably anthropocentric in his writings merely to capture the public's attention and also to relate his findings to the layman. Moreover, quoting an extract from Jane Goodall recounting her experience in describing primate behaviour. Goodall states

> One by one, over the years, many words once used to describe human behaviour have crept into scientific accounts of nonhuman animal behaviour. When, in the early 1960's, I brazenly used such words as 'childhood', 'adolescence',' motivation', 'excitement', and 'mood' I was much criticised. Even worse was my crime of suggesting that chimpanzees had 'personalities'. I was ascribing human characteristics to nonhuman animals and was thus guilty of that worst of ethological sins-anthropomorphism. Certainly anthropomorphism can be misleading, but it also happens that chimpanzees, our closest living relatives in the animal kingdom, do show many human characteristics. (Goodall, 1993, p.12).

From the above mentioned quote it is shown that due to our similarity, assigning human qualities to nonhuman primates is a facet of observation amongst researchers that cannot be avoided. Marais uses very strong anthropocentric terminology in his descriptions as pointed out several times in this study, however, his observations seems to be a true reflection of what he was observing. His interpretation of these observations might be skewed and emotive, but upon closer inspection one could actually filter out the natural observations from the emotive, personified descriptions. Also Marais is aware of the dangers involved in eliciting human qualities when observing animals. However he is also aware of the difficulty involved in avoiding these human descriptions altogether. Marais states

> On the other hand, outside these differences, the mental processes of the Chacma generally are so human-like that it proved impossible to submit them to a critical examination without accepting as a standard our common human experience. (Marais, 1939, p.17)

ADDICTION AND DEPRESSION

Marais's problems with his addiction and depression are seen as major motivating factors for writing about the baboons (Morris, 2009). This becomes clear in the chapter on *Addiction and Depression* in his *The Soul of the Ape*. In this text one can almost immediately recognise that Marais is relating to his own personal experience as an

opium addict and someone who suffered extreme depression. The loss of his wife was a direct cause of depression and possibly a reason for his addiction and also a possible reason for his retreat into isolation in the Waterberg Mountains (Rousseau, 1982). Furthermore, from the section described above on sexual behaviour, Marais seems to almost romanticise his observations and this could easily be related once again to his own life with particular reference to the loss of his wife.

In *Addiction and Depression* Marais highlights two important theories that are still being discussed today: the use of psychotropic effects to attain some sense of euphoria and the diurnal mood changes identified in human individuals.

Psychotropic effects

Marais suggests that many primates (humans in particular) suffer from "the pain of consciousness" which is remedied by the use of intoxicants. Marais considers this pain of consciousness as a feature specific to primates. He quotes the reports that the Chacma baboon has been observed consuming toxic plants from the family *Cycadacoa* (although he notes that he himself never observed this). Marais conducted studies on the Chacma baboon as well as other species such as the "vervet monkey (*Cercopithecus aethiops pygerythyrus*), warthog (*Phacochoerus aethiopicus aethiopicus*), saddle backed and maned jackal (*Proteles cristatus*), and klipspringer (*Oreotragus saltator*)" (Marais, 1970, p.130), whereby he administers alcohol to the animals to test for addiction and also depression. From these experiments Marais concludes that no other animal except for the baboon had shown signs and symptoms similar to that of humans when referring to the addictive properties of alcohol and tobacco. However, this conclusion was based on inconclusive experimental evidence making his argument rather weak.

When applied to humans, Marais clearly identifies the pain of consciousness as depression and concludes that even though humans have variable temperaments the pain of consciousness affects us all.

Marais claims that within humans, certain populations have a natural inclination towards this melancholy and hence induce more frequently and to a larger extent the use of intoxicants. Marais states:

> Proof that it is some type of mental gloom which induces the use of euphoric poisons is further afforded by the strength and universality of these habits among peoples in whom melancholy of temperament is a definite racial characteristic. The Russian peasantry and the Chinese might be cited as outstanding examples of nationalities whose pessimism and lack of joyousness are the first traits to engage the attention of a stranger, and there are few other races upon whom habits of intoxication have gained so strong a hold. (Marais, 1970, p.121).

This aspect of Marais's work has been considered in much detail across disciplines, including pop psychology, folk psychology and also Evolutionary Psychology. Today we understand that this temperamental melancholy is caused by decreased amounts of neurotransmitters such as serotonin and dopamine, which in excess levels have mood stabilizing and mood enhancing effects. Smail (2008) in his study of psychotropic mechanisms describes how humans manipulate their neurochemistry both intentionally and unintentionally to achieve an altered mood. This manipulation refers to the ingestion of not only alcohol and vegetative toxins (discussed by Marais) but also a wide range of narcotics, caffeine, cigarettes as well as sex and masturbation. Smail, of course, does not specify racial characteristics when explaining the use of psychotropics but rather utilizes a holistic approach including all humans with specific reference to cultural differentiation. In fact, Smail extends the above mentioned phenomena to all animals:

> All animals, after all, engage in mood-altering activities. They consume fermented fruit and nibble cat nip. They cuddle and groom and play. Some domestic and perhaps most golden retrievers have been bred to enjoy the sensation of being stroked and tickled behind the ears; they are in a sense, addicted to the wash of oxytocin or dopamine or whatever it is that is generated by patting. Like other primates, humans also enjoy being groomed, though, as with all such things, some like it more than others.

> Like bonobos, we engage in the pleasures and bonding experience of recreational sex. (Smail, 2008, p.160).

Furthermore, concerning humans Smail suggests:

> But to these behaviours Paleolithic human societies added a new range of mood-altering practices, including song, dance, ritual, and a variety of mood-altering substances, often consumed in the context of rituals (Smail, 2008, p160).

Marais could therefore be considered correct in his observation of psychotropic effects; however, the mechanism he uses to explain this type of phenomena was quite limited and some of its application is today considered to be racist. This pain of consciousness referred to earlier can easily be related to the chemical imbalances within the individual due to a range of different possibilities such as diet, genetic predisposition, trauma or even the death of a loved one.

Diurnal mood changes

Marais also discusses a very constant mood change amongst humans that occurs on a daily basis which he refers to as Hesperian depression.

This type of depression includes the cyclical depression experienced due to circadian rhythm changes in relation to seasonal changes (Miller, 2005). Marais noted that his baboons expressed this depression close to sunset on a daily basis. The entire group would quiet down, the juveniles were huddled together close to the females and a cloud of melancholy would subdue the group.

In modern times this depression encapsulates a wide variety of depressive states which was labelled Seasonal Affective Disorder (SAD). It was however, only formally identified and labelled as SAD in the 1980s, by Dr. Norman Rosenthal of the National Institute of Health (Rosenthal, 1993). As the name implies presentation of symptoms of SAD are directly related to the seasons (its symptoms appear during one season and go away with the next). Also, it is not

clear why, but more women suffer from SAD than men, and those who live in northern climates experience SAD symptoms to a higher degree than those who live in the southern climates (Miller, 2005). There are mainly four common types of SAD which includes traditional SAD, Sub-syndromal SAD (winter depression), Reverse SAD (summer depression) and Hesperian depression (Miller, 2005). Hesperian depression is the rarest of these depressive states and basically occurs when the sun goes down in the evening and the Hesperus star rises in the sky (Kogan, 2004). Marais therefore identified this form of SAD approximately six decades before it was formally accepted; however he was not the first to identify this type of depression.

Overall, what is most notable about this aspect of his work is that he uses an adaptive method of understanding behaviour. When relating to the pain of consciousness or hesperian depression or neurochemical imbalances, Marais identifies a trend in which humans and other animals adapted a method of self-induced mood alteration (usually euphoric in nature) which is defined today as the psychotropic mechanism.

SOLLY ZUCKERMAN

Solly Zuckerman was a South African born scientist and non-human primates were central to his research programme, especially in his early career. Hence both Marais and Zuckerman were scientifically close in terms of their interest in primate behaviour; however, they used very different methods of study had different research foci, and consequently came up with different results. Zuckerman is well recognised in anthropology for his baboon studies and his work was for a long time considered classical; he specialised in reproduction, physiology and social behaviour of baboons. Zuckerman's primatological research spread over three decades. In the 1920's he focused on male dominance, in the 1930's he was concerned with the

control and manipulation of female reproduction and in the 1940's he used monkeys as human analogues for military experiments. Zuckerman published two significant books on primatology, *The Social Life of Monkeys and Apes* (1932) and *Functional Affinities in Man, Monkeys and Apes* (1933).

In, *The Social Life of Monkeys and Apes* (1932), he concludes that primates follow the dictates of their reproductive physiologies to form male dominated families. His results were mainly based on the observations of captive baboons. He preferred the captive studies and believed that primatologists mistakenly looked to ethology rather than physiology as their foundation for theoretical models. Zuckerman was mainly concerned with physiology and functional similarities when considering primate research (Morrel, 1997). Hence, Zuckerman never ventured much into fieldwork observation; he preferred the captive study conditions which are controlled.

Zuckerman completed most of his research on primate behaviour at the Hill, a hamadryas (or yellow) baboon (*Papio hamadryas*) enclosure at the Regent's Park Zoo in London, which was opened in May 1925. Zuckerman's studies at the Hill led him to conclude that male dominance determined the way the colony was divided into families. In *The Social Life of Monkeys and Apes* he states:

> The continual sexual activity of the primate is probably the main reason underlying the permanent association of the two sexes, for unlike most mammals the sexes never separate (Zuckerman, 1932, p.39).

Other aspects concerned the passivity of females, the importance of the social unit and how the visual senses are used in primates as opposed to olfactory for the assessment of fertility in a female.

In 1930 he conducted a brief fieldwork in South Africa on wild baboons but his expeditions usually turned into baboon hunting trips for anatomical purposes. As mentioned earlier Zuckerman did not consider fieldwork as a serious science. He believed that mammals

should be taxonomically grouped according to their sexual mechanisms and as a secondary classification he considered self-defence, mother-child interactions or mutual learning as the best option (Fedigan and Strum, 1999). This is illustrated in his publication *Functional Affinities of Man, Monkeys and Apes* (1933), whereby he conducts a comparative study between behavioural and physiological characteristics across different species of primates and humans. He looks at the presence or absence of breeding seasons, reactions of the blood and blood types, facial movements, drinking methods, grooming and sexual skin. Zuckerman, however, never realised that his colony of hamadrayas baboons had a shortage of female individuals in the zoo which led to constant conflict between males trying to set up unimale harems. This was what led Zuckerman to hypothesise that sex was the major motivator in primate social organisation to the detriment of self-defence, mother-infant bonding or mutual learning (Burt, 2006).

Upon his return to England from the USA, Zuckerman focused his attention on endocrinology. His work was focused mainly at the study of the reproductive cycle. Zuckerman joined up with Allan Parkes (biologist and leading figure of endocrinology in the 1930's) and they investigated the menstrual cycle of primates and the effects of administering hormones to animals. They were concerned with "sexual skin" and administered a variety of hormones in an attempt to ascertain certain visual effects that they believed demonstrated the phase in the ovary at that specific time. He then applied his knowledge and research to the development of contraceptives. Thereafter he started his laboratory based concussion studies of the 1940's. His aim was to test the relationship between what is seen on the surface of the primate body and what happens internally. His laboratory based studies on non-human primates was aimed at testing protective gear for the purpose of war whereby these animals would serve as human analogues.

Zuckerman had a successful career in primatology and he made his reputation on the study of baboon reproduction, physiology and social behaviour. He was most recognised for his thorough work done on primates up until the mid-1930's. This work was published in two books, namely his *The Social Life of Monkeys Apes* and *Functional Affinities of Man, Monkeys and Apes* as mentioned previously. Zuckerman focused his research on social behaviour of primates but more specifically on the hamadryas baboon but never observed these animals for a long duration in their natural environment.

DISCUSSION

Marais has had a considerable contribution to the history of primatology, predominantly in his novel methodology which is most notable in terms of the non-captive, long-term observation of wild primates in the wild.

It should be mentioned that Marais's overall interpretations and findings are not as reliable as Ardrey argues. Marais's descriptions were too anthropocentric, occasionally suggestive of emotional projection and subjective interpretation of the behaviour he observed in these animals. An unavoidable concern lies within the fact that Marais was intoxicating himself with opium and how this could have affected his interpretation consequently; his understanding of primate observations will always be questionable. Conversely, one should be mindful that what Marais was observing could have been the actual behaviour of these baboons and that his interpretation and translation of these observations could have been skewed by personal subjectivity. What I am suggesting is that what Marais could have been observing could have happened within his specific baboon troop. For example Marais describes both tool use and manipulation to procure fruits and excavation of trenches to cool, hot spring water from his group of Chacmas (Marais, 1969, p.53-55). This trench excavation has not been observed other than in a group of Ethiopian

baboons (*Papio cynecephalus)* that excavate channels in the sand next to free running water as a means of quenching their thirst (Hamilton, 1985, p.454), (also refer to Huffman, 1986 and Fragaszy, 2004), tool use in non-human primates. Hence Marais might have observed natural phenomena that has not been observed or described as yet but could actually be exactly what happened. His descriptions and interpretations of behavioural phenomena in the Chacma could be exaggerated or anthropocentric but the actual observations seem to be accurate.

Marais's overall observations and conjectures did highlight certain aspects that Zuckerman could not achieve in an "unnatural" captive environment. Zuckerman, it would appear, was too strongly focused on controlled settings in an experimental situation and did not have much understanding for any other method, specifically to the unstructured observation such as those Marais applied. Zuckerman's own research, his approach and results are now generally abandoned, but he is still considered as important in the history of primatology as he was one of the first researchers to provide a comprehensive interpretation of simian society and his seminal studies provided a starting point and reference for many subsequent projects on primate behaviour (Penniman, 1952).

The baboon colony studied by Zuckerman had been created in 1925 with a hundred males. By 1927 fifty-six males remained as the rest had died from injuries incurred because of the high aggression rate. In the same year thirty two females joined the group. Today we know that Zuckerman's colony contained too many foreigners in a confined space and the sex ratio was inappropriate for that specific species of baboon. More recent studies have documented that haymadryas baboons live in polygamous societies (single male – multi-female) and the neighbouring mates established relationships with one another subsides aggression over females (Kummar, 1971).

Zuckerman was under the impression that his colony of baboons at the Regents Park Zoo was expressing normal behaviour and that the social grouping he was observing was related to sexual competition as the basis of baboon social life (Zuckerman, 1932). He concluded that since female primates were continually receptive and since males fought so vigorously over access to females, sex has to be the driving force behind primate society (Fedigan and Strum, 1999). Male dominance is therefore described by Zuckerman linking sex, aggression and competition all of which is directed towards the male hierarchy. The belief that this male hierarchy was shared amongst primates was not as obvious as Zuckerman and his contemporaries would have us believe. For example, Garltan's (1976) study showed that the success of Patas monkeys (*Erythrocebus patas*) on the savannah was not based on aggressive males but on other specialisations in anatomy, such as group organisation and sexual division of roles. Marais, like Zuckerman, noticed a hierarchy and law amongst the baboons but unlike Zuckerman he shows the organisational and protective attributes to these phenomena as opposed to dominance and aggression that Zuckerman stresses from his results.

As mentioned, Marais's non-captive method was only applied a decade later by a recognised researcher, Clarence Ray Carpenter in the 1930s. Carpenter (1934) conducted his study of Howler monkeys at Barro Colorado Island in Panama (Fedigan and Strum, 1999). Carpenter insisted that data from captive animals could not be interpreted properly without background knowledge of the species' natural way of life. Marais shared this position. Carpenter carried out a naturalistic study of Howler monkeys (*Aloutta*) and suggested a well organised and coordinated society that resulted from a network of mutualistic social relationships. Sexual relationships were basically communal, with females more assertive and sexually motivated during mating than males. Through multiple mating, females and males became conditioned to many partners and thus

established important social and emotional ties essential to group cohesion.

Marais found this as well in his research of the Chacma baboon but his interpretation was too anthropocentric in the sense that he considered these to be acts of adultery. Zuckerman's observations on sexual behaviour was erroneous in the sense that he never identified breeding seasons and was mistakenly under the impression that the primary reason for their year round social bonds was due to sexual attraction. Marais's description of sexual behaviour was anthropocentric, but he correctly identified (within the natural habitat) the normal breeding patterns. For example, what Marais describes as natural breeding patterns in his group (monogamy) is not shared among other Chacma baboons from more recent data, he does however realise that what he might be observing in his group is not necessarily the norm as discussed previously. It should be noted that Marais does actually identify polygamy within his group but he resolves it to be adultery, disloyalty etc..., my point is that based on the different styles of mate choice, depending on matriarchal lineages, number of males to females, energy costs, rank, hierarchy as well consort formation and sneak copulations, Marais could very well be noticing actual baboon sexual behaviour but his interpretation is what categorised his meaning into such dramatically human qualities as adultery, promiscuity and so forth, all of which are completely natural behaviours for baboons.

He also identified the dynamic social interplay of male to female interaction under the construct of polygamy and inter-sexual competition as a consequence of this behavioural pattern. Also Marais at no point mentions that the social structure of his troop was jeopardised during periods outside of the sexual season, hence debunking Zuckerman's claim that sex is the structural core within the primate social cohesion; however, he does not give enough scientific detail as to these observations.

Competition or aggression between group's males was identified but not these sharp gradients of dominance and submission amongst either males or females identified by Zuckerman. This is the natural way of life of these baboons, submission and dominance is quite obvious in the group but not to the extent that Zuckerman's group of baboons was displaying. Marais's non-captive approach in his study could possibly be why he noticed the protective role in males as opposed to dominance and aggression and why he could recognise the significant role of the female in the group as opposed to the anecdotal view that the females were subservient to the males and of no significant value other than for reproductive output.

Marais's interpretation of what he observed was not always strictly correct according to modern conventional science, particularly his anthropocentric descriptions and deductions. Over the three years, the Waterberg Mountains became populated by humans, which negatively impacted the baboon population to the extent that a bounty of 10 shillings per baboon scalp was ordered by the government (culling due to the increased number of baboon population that accumulated over the Anglo-Boer war, farmers crops were threatened). Also, Marais seems to uncritically accept (and report in his work) farmer's tales with a blind eye without any confirmation in *My Friends the Baboons* (Marais, 1939). These farmers' tales include the belief that there existed a short headed baboon and a long headed baboon with the prior being smarter. The idea of two separate species of baboon is still widely believed to be a myth amongst farming circles today (Morris, 2009). Other folk tales included baboons killing young lambs for the milk in their stomachs and children being raised by baboons (Marais, 1939).

Also the baboons were enticed with mealies (corn cobs) to habituate the animals, hence Marais utilised a provisioning technique, a practice that was much criticised when used by later researchers to draw wild primates into study sites (Rees, 2006). It is easy to find flaws in Marais's work with the benefit of hindsight; however it

should not be forgotten that some later researchers used the same habituation techniques. Some primatologists, for example, have suggested flaws in Jane Goodall's methodology by pointing out that her feeding stations to attract the Gombe chimpanzees could have altered normal foraging and feeding patterns as well as social relationships (Power, 1991).

Additionally, Marais had no access to literature and a very modest understanding of contemporaneous theories and information specific to his research. This might have impeded his work and progress, but alternatively it might have had the positive influence of allowing him the freedom to develop his own creative, novel ideas which includes his pioneering non- captive methodology that was not the norm at the time.

Marais could recognise the life history of these animals and emphasises the importance of play, communication, the female role and the protective attribute of the hierarchy from observing these animals in their natural environment. Zuckerman's captive approach to observation would not have allowed him to identify these phenomena properly, because his troop of baboons needed no protection from the outside within the confines of captivity and he did not observe these baboons for a long duration in their natural environment. If Zuckerman had utilised Marais's methodology in terms of field work and spent a longer duration of time observing his troop of baboons, his results and conclusions would have been more accurate. Ironically, in this history it was suggested that Zuckerman's work was respected by fellow scientists and recognised during the early twentieth century, but not anymore. Marais at the other spectrum of investigation was disregarded during the early part of the twentieth century but has picked up much momentum in terms of his recognition as we enter the twenty first century. This could be due to his posthumously published manuscript *The Soul of the Ape* becoming more popular in public circles with Robert Ardrey and Leon Rousseau popularising his ideas and theories.

In conclusion, Marais was not a professional scientist. He never had the appropriate training and has published very little in scientific journals. This is one of the reasons why his observations and ideas were neglected for a long period of time and attracted little positive reaction. However, his methodology, although still relatively crude and simple, is now generally recognised as pioneering and his place in the history of primatology acknowledged. Although his effort was to study primate behaviour in an objective manner this was still very crude, ethograms (catalogue of animal behaviour), for example, will be introduced much later in the history of primatology. From a historical perspective this is important. Zuckerman criticised Marais because he thought no useful data could be collected under conditions that are not controlled experimentally and modern primatology proved Zuckerman incorrect. Therefore, one can identify the significance of Marais's specific approach even though it might seem anecdotal in comparison to current science.

Marais did have different questions he wanted to answer compared to Zuckerman (as discussed in the next chapter), the actual relevance and inferences he made from his observations: the evolution of consciousness.

CHAPTER 3

INTRODUCTION

The history of the evolution of consciousness is a complex of different disciplines, opinions and ideas that were largely shaped by a variety of external factors. One of the main debates that persist within this history is the nature-nurture debate with specific reference to instinct. The external influence is comprised largely of social, political, religious and economics factors. These induce beliefs in a mental hierarchy applied to all species with humans dominating, and also within humans whereby certain population groupings are considered to be more advanced. Overall this history is a conflicting one with many open ends and very little agreement. The following section therefore aims to briefly highlight some of the more significant points in the history of Evolutionary Psychology and contextualising the work of Marais within that history. This history therefore acts as a template to understand how and where Marais fits in and also to identify what the scientific value of Marais's work was in comparison to his contemporaries pertaining to the evolution of consciousness.

ANTIQUITY TO THE TWENTY-FIRST CENTURY

The origin and development of ideas relating to the evolution of consciousness have been a difficult subject to comprehend and has been given much thought by philosophers and scientists spanning all the way from antiquity to the 21st century. Consciousness as a concept is difficult to define and a variety of different opinions and disciplines have been used to interpret its meaning.

Socrates (470-390B.C.) and Plato (428-347B.C.) believed in the rationalisation of the soul. Plato in particular was a mind-body dualist who claimed that a person is defined by the rational mind, the

body being an embodiment in which the soul operates like a puppet (Leahey, 1992). Plato's student Aristotle (427-347 B.C.) distinguishes 3 levels of soul appropriate to his classification of the mind. Aristotle unlike Plato does not believe in the mind-body dualism as being separate, instead he believes that there is a level of integration between mind and body. One of Aristotle's most influential findings is that of the *Scala Naturae*. In this work Aristotle drives a hierarchical system of cataloguing different animals. This *Scala Naturae* was later incorporated into religious theory and is best known as the *Great Chain of Being*. The *Scala Naturae*, and its implementation to the mind is quite obvious in Aristotle's philosophy. He divides the soul into three levels. The nutritive soul (plants), the sensitive soul (animals) and the rational soul (humans). These three levels of soul are all equipped with their own meaning but the rational soul, the autonomous soul which humans only possess, has the ability to think. Aristotelian thought and his reliance on logic and empirical facts have been richly used throughout the history of Western science and philosophy.

The Dark Ages was a period in which religious dogma became the centre of human thought within western civilization. All enquiring minds were expected to seek solutions in terms of Christian theology and understanding the human mind was no exception. Two distinguished philosophers, St Augustine (354-430 B.C.) and St Thomas Aquinas (1225-1274) tried explaining the human mind in terms of theology but used different methods, coalescing ideas. The former was dependant on Platonic principles in his theory and the latter on Aristotelian. Augustine utilised Plato in the sense that both philosophers detached the pain and turmoil from the body and focused on the heavens and the soul. The method of understanding the mind or soul was to introspectively analyse the self to get closer to God. Hence this strong mind-body dualist theory was being further emphasised in the works of Augustine. Augustine was also a firm

believer in the idea of instinctive behaviour (refer to *The Original Sin Hypothesis,* Stone, 1977).

Thomas Aquinas's though was based in Aristotelian philosophy. Aquinas rejected the radical dualism of soul and body from the Platonic-Augustinian theology. The main factor Aquinas contributed to understanding of the mind was partitioning faith from reason. Additionally, and equally important was his concern with distinguishing persons, who have souls, from animals. According to Aquinas an animal knows only pleasure and pain, humans know right from wrong. This religious influence lasted from 400 to 1600A.D. during the Middle Ages. From the 1600s onwards, with the rise of Renaissance, the influence of Christian theology declined and while broader religious framework was not questioned new ideas and empirical data started to shape the study of the mind more prominently.

William of Ockham (1290-1349) was mentioned as one of the early empiricists who believed that what made us different from animals mentally was our ability to derive mental concepts from habitual learned experiences. Animals were thought to be reduced to simple responses to external stimuli. Roger Bacon (1214-1292) shared Ockham's belief in terms of empirical thinking and the significance of mathematics in reaching an understanding of nature. Hence, combined with his mathematical emphasis, Bacon anticipated the Newtonian future, in which the universe was perceived as a rationally comprehensible, divinely crafted machine. The brain was beginning to be recognised as the seat to the soul. The mechanical view of the universe was applied to humanity and in the eighteenth century it was ultimately embodied in the behaviourism and information processing theories of behaviour. (Leahey, 1992).

Rene Descartes (1596-1650) started with the subjective experiences in his analysis and for him these experiences of oneself were the basis of certainty and ultimately of all knowledge. Descartes believed

that introspection was the key to knowing truth and reality. The aim of understanding true self from introspection was the premise in his theory on rationalism, hence the statement *cogito ergo sum* (I think therefore I am). He distinguished between two levels of existence, philosophically. The two levels are divided into the physical world (observable entities) and the mental world (non-observable entities). This was therefore a distinctly dualism system. Descartes as the rationalist and Bacon as the empiricist were to perpetuate a divided paradigm in terms of consciousness, namely between the natural sciences and the humanities. (Lowry, 1971)

An important philosopher in the late sixteenth century who expressed his views on the limitations of humans was Michel de Montaigne (1533-1592). Montaigne denied humans a special place in nature given to them by Renaissance thinkers such as Descartes. This view continued to grow, culminating in Darwin, Freud and Spencer to mention a few. The human centred ideology was shattered in the seventeenth century and brushed away in the eighteenth century whereby nature (and humans as part of it) becomes the topic of concern. Francis Bacon suggested that nature is to be investigated by experiment and explained mechanistically, which is how science changed well into the era of Darwin and up to today.

History shows competing views pertaining to the soul (mind) and body. They are either separate entities or integrate; however, the mind over time is understood to reside in the brain and not to exist as a separate entity outside of the brain (body). Concurrently the idea of the soul (mind) being a unique human quality loses general acceptance and all animals are believed to possess a soul (mind). Both these concepts are key factors in the history of the understanding of the mind and consciousness. Leading into the nineteenth century, Darwin's theory of evolution by natural selection changes the entire paradigm in terms of thinking and understanding the mind.

EVOLUTIONARY THEORY

The word evolution has been applied to different concepts of change (Bowler, 1975).

> The Latin word *evolutio* means "to unroll" implying no more than the unpacking of a structure already present in a more compact form and prior to the late 1800's was confined to referring to goal directed, pre-programmed processes such as embryological development (Bowler, 2003, p.8)

Hence, its first use in biology was to describe the development of the embryo.

In the late seventeenth century a worldview started to emerge that has a compromise between the demands of the new science and the traditions of the old religion based worldview. The predominant belief considered nature as a largely material system, but designed by God in the fairly recent past. In the following century many aspects of this belief came under threat. Developments in geology and physics, in the study of the earth's crust, had already suggested that the planet had been significantly modified since its origin. It became increasingly difficult to believe that these changes could be accommodated within the old time scale which was approximately 6000 years. James Ussher's (1581-1656) work, *Annales veteris testamenti, a prima mundi origine deducti* (Annals of the Old Testament, deduced from the first origins of the world), included the theological age of the earth at 4000 B.C. (Bowler, 1989). This was a major concern for many Christian scholars but a more serious consideration was the increasing numbers of radical thinkers willing to challenge not only the biblical story of creation, but also the very foundations of the Christian religion. As mentioned, one of the earlier ideas, namely a medieval conception of *The Chain of Being* was questioned with the rise of the materialism philosophy and the

changing worldview. *The Chain of Being* was the belief that humans perceive themselves as the highest form of life on earth and assume that a hierarchical category be applied throughout the animal kingdom. It was a complete system: every link in the chain, from amoeba to human, God had displayed his perfection by creating every link (Bowler, 1989).

An important aspect of *The Chain of Being* was that humans were thought to be both physically mortal as those below them, but also possessing the spirit (soul). In this dichotomy, the struggle between flesh and spirit becomes a moral one. The way of the spirit is higher and nobler- it brings one closer to God and the desires of the flesh drag one down.

During the eighteenth century, naturalists such as George Buffon, Erasmus Darwin and Jean Baptiste Lamarck presented, in various ways, evolutionary ideas and have been depicted as early evolutionists. These early ideas may have played a role in shaping the opinion in which Darwinism emerged. Darwin himself never presented his theory to a public that never considered the possibility of evolution. He proposed a more sophisticated explanation of evolution, but even he had to present his theory in a way that would take into account the concerns that had already been raised in earlier debates, such as heredity and the age of the earth. From the history of evolutionary theory it becomes clear that Darwinism had fluctuated between acceptance and popularity throughout the late nineteenth century. A plethora of different theories were being used as a means of explaining evolution, but most were tending towards a progressionist theme.

These alternative theories of evolution that were being developed from the late eighteenth century included the following: Saltationism, Orthogenesis, and Lamarckism. In biology, saltation is a sudden change from one generation to the next that is radically different

from the usual variation of an organism (Bowler, 2003). Saltationism was mainly used as the spring board to modern genetics.

According to the theory of Orthogenesis variation was not random, something in the genetic or physical make-up of organisms guides variation along certain predetermined, directed lineages (Bowler, 2003).

Lamarckism is based on the idea that characters acquired by the organism in the course of its life can be transmitted to future generations. Acquired characters include the effects of use and disuse on organs (Smail, 2008), for example, the weightlifters robust muscles will be inherited by his children.

These theories were not independent from each other, and in some cases were interchanged and used in conjunction to better understand different aspects of the evolutionary process. The main factors that characterise Darwin's theory include the concept of adaptation, natural selection, gradualism and no progression (all adaptations are considered to be random in the strictest definition of Darwinism). In many regards Darwin utilises the naturalistic approach in the sense that he sought explanations of life originating on earth without the dependency on supernatural intervention.

More significantly though, life must have originated by a natural process and species might be subject to change over time (Bowler, 2003). Darwin suggested that we came to be by random, heritable and gradual changes (today we know that these random episodes refer to mutations of the genotype that eventually affect the phenotype) which are shaped by natural selection and to a limited extent, by Lamarckian principles of 'use and disuse'. The general public and many scientists were not prepared to accept all implications of Darwin's theory, primarily its questioning the belief that we are not here due to God's divine intervention, but came into being by transmutation from an animal ancestor through a process of natural

selection. Furthermore this type of thinking would then define us as one of the animals, without the hierarchically privileged position as implied by *The Chain of Being*. Darwinism negates the belief in humanity's special place over nature.

As mentioned, in the nineteenth century empirical science was often seen as evidence that reason and objectivity might throw off ancient superstitions and allow humanity to come to a new understanding of both the natural world and human nature. More specifically the materialist philosophers and scientists during this age sought explanations of how life originated on the earth that did not depend on supernatural intervention. Life according to them must have originated by a natural process (spontaneous generation), and since there was no divine guarantee of stability, species might be subject to change through time. This was an erratic period in terms of Darwin's theory and its acceptance within society. "The Eclipse of Darwinism" is a phrase Julian Huxley (1942) used in his survey of evolutionary theory to describe this period before the "Modern Synthesis" of genetics and the selection theory (Bowler, 2003). Evolutionism became popular despite the fact that natural selection was widely rejected until the synthesis with Mendelian genetics in the early twentieth century. During this eclipse natural selection was questioned in terms of two significant inconsistencies - heredity and the time scale.

Heredity posed a problem in that it was perceived as being a weakness in the theory and a key component of the new developments (e.g. Mendelian genetics) was strongly influenced by the anti-Darwinian theory of evolution by saltations. Darwin could not resolve the hereditary issue but Lamarck's theory was an alternative that was applied in the absence of Mendelian genetics. In the nineteenth century the most popular alternative to natural selection was a revival of Lamarck's concept of the inheritance of acquired characters. In the earlier part of the century this theory had been rejected as too

materialistic. But natural selection was far worse in this respect and biologists soon realized that the inheritance of acquired characteristics might allow evolutionism to take on a less harsh and more believable aspect. In the simplest form Lamarckism supposed the changes of structure produced by the activity of the adult organism (the acquired characters) might be transmitted, at least in part, to the offspring (Ghiselin, 1969). When the organism changed its habits and used its body in different ways, the effects of use and disuse would be obvious. If the new habit were kept up over many generations and if the effect were transmitted from parent to offspring then the modification would accumulate over time and eventually produce a permanent change. If the new habit were a useful one taken up by the whole population, then by definition the change would be adaptive or purposeful. In this regard variation within the species would be directed, not random, and hence there would be no unfit individuals.

A strong proponent for Darwin, who not only provided the impetus towards modern Mendelian genetics but also provides evidence to discredit Lamarck's theory of inheritance of acquired traits, was August Weismann (1834-1914), (Bowler, 2003). Weismann and Neo-Darwinism emerged from his initiative to try and resolve issues concerning the study of heredity and variation (Haig, 2006). Weismann developed the concept of the germ plasm which was thought to be the maternal substance responsible for transmitting characters from one generation to the next. Weismann attacked the problem of heredity in Darwinism, in which the study of generation (i.e. reproduction) was an integral part of evolutionary theory (Bowler, 2003). He created a model of heredity in which the transmission of characters occurred independently of the process by which those characters were produced in the developing embryo. In Weismann's mature theory, the germ plasm was totally isolated from the somatoplasm, which was the material constituting the rest of the cell body. Significantly, the flow of information was uni-directional

only, from germ plasm to soma (the body). Once the soma was formed, it acted as a host to preserve the germinal material so that it could be passed on unchanged to the next generation. This claim identifies what was once known as hard heredity, the belief that heredity cannot incorporate the responses the body or soma makes to its environment (Bowler, 2003).

Darwin's theory of Pangenesis reflected the alternative, soft heredity, and according to this theory the body actually manufactures the gemmules which transmit its characters to its offspring. This suggests that changes to the adult body might be reflected in the gemmules it produces and thus could be inherited, which were first implied in his book *The Variation of Animals and Plants under Domestication* (1868) (Ghiselin, 1969). It should be noted that Darwin's theory of Pangenesis could not provide the adequate basis for the explanation of natural selection. In Weismann's theory of the germ plasm, the body develops from the germ plasm inherited from the parent but then merely transmits it to the next generation. In this regard, since the body does not produce the germ plasm but merely stores it, characters acquired by the adult body cannot be reflected in the germ plasm and thus cannot be inherited (Bowler, 2003). In other words it suggests that a gene's determination was limited and sealed, and each of its offspring received fewer and fewer genes from what he called the "germ plasm." Hence there is only a set "amount" of germ plasm (what we know as genes) and that it was gradually divided amongst the offspring. Another significant factor that arose from Weismann's concept of the germ plasm was that it disclaimed Lamarckism. Since the body merely transmitted its germ plasm to the next generation, and did not actually produce it, there would be no logical way in which changes in the body due to use or disuse could be reflected in the process of heredity. Furthermore, in a famous experiment, Weismann tried proving that cutting off tails of a group of mice and continuing the process in their offspring for several generations would result in the shortening or loss of the tail (Weismann, 1891).

The result showed no indication that the amputation of tails produced any shorter tails than normal. The point of this result is that it illustrates that whatever was responsible for building the tails in embryonic mice was not produced by the tails of their parents. Hence, Lamarck could be rejected according to this premise.

Apart from the work done by the biometricians such as Francis Galton and Karl Pearson a significant figure who paved the way for the introduction of Mendelian genetics is William Bateson (1861-1926) (Bowler, 2003). Bateson claimed that saltations were the real cause of evolution and not gradualism as suggested by Darwin. When Mendel's laws were rediscovered in the 1900s, they fitted neatly into Bateson's program, and he became the leading British supporter of genetics.

As mentioned previously, early geneticists were strongly influenced by the rival theory of saltative evolution. The first use of the term mutation was in the context of transformations (Bowler, 2003). These transformations were so drastic that they believed it might create new species instantaneously. These geneticists thus continued the tradition of assuming that the internal processes governing the production of discrete new characters were all that was needed to determine the course of evolution. Adaptation and selection were irrelevant. The new model of heredity reinvigorated the anti-Darwinian theory of saltative evolution. The indifference of the Mendelians to adaptation was a product of their desire to work with small breeding populations kept under controlled conditions.

Gregor Mendel's work on the inheritance of discreet characters in peas, performed in the 1860s was crucial for the understanding of modern genetics (Ghiselin, 1969). The laws of inheritance which now bear his name were rediscovered independently in 1900, and they led to the creation of Mendelian genetics, providing Mendel with posthumous fame. Only in the 1920s did a new approach to the genetics of whole populations allow merging of a genetics theory

with that of natural selection. Far from undermining Darwinism, genetics had destroyed all the alternatives, leaving the mechanism of natural selection as the only agent in evolution (Bowler, 1989).

Since Ussher the age of the earth estimates were based on physics and geology as opposed to theology. Physics had initially been a source of major difficulty for Darwinian theory. The physicist William Thompson (Lord Kelvin) used thermodynamics to undermine the credibility of Lyell's steady state view of earth history also known as Uniformitarianism (Smith and Wise, 1989). Since Darwin assumed that natural selection was a slow gradual process, his theory required the vast amounts of geological time postulated by Lyell. Darwin had his education on the voyage of the Beagle as he took with him the first volume of Charles Lyell's (1789-1875) book, *Principles of Geology*, and a second volume reached him en route in Montevideo (Ghiselin, 1969). Hence one finds a strong dependency on Lyell's, Uniformitarianism in Darwin's selection theory. By showing that the latest physical theories during this period would not permit the earth to remain geologically active for an indefinite period of time, Kelvin shortened the age of the earth (approximately less than 10^8 year BP) to such an extent which made the selection theory untenable (Richter, 1986). Evolution was still possible, but it needed to function much more rapidly than allowed by natural selection.

Kelvin's position was strengthened by its direct relation to the fundamental laws of physics. One of these fundamental laws refers to Thermodynamics which was based on the principle that energy always becomes less available, and hence that hot bodies always cool down. A steady state earth becomes impossible because it's always cooling down. Kelvin then tried to calculate exactly how long it would take a body the size of the earth to cool down from the molten state. By 1868 he was arguing that the total age of the earth could not be much more than 100 million years, only a tiny fraction of what Darwin's theory required (Bowler, 1989). Kelvin eventually reduced his

estimates to such an extent that the geologists were sceptical and began to protest. But within this environment biologists began to explore other evolutionary mechanisms, including Lamarckism and saltationism that might plausibly be argued to proceed faster than natural selection.

Kelvin's estimate of the age of the earth was undermined by the revolution which took place in physics around the 1900s (Dalrymple, 1991). The discovery of radioactivity introduced an entirely new factor. In 1903 Pierre Curie (1859-1906) announced that the radioactive decay of elements such as radium liberated a slow but steady supply of heat (Mould, 2007). Apparently these elements are present in small quantities throughout the earth's crust and, presumably, in its core. The rate of decay of some of these radioactive elements is so slow that a steady balance could be maintained over billions of years. Geologists such as Arthur Holmes (1890 – 1965) were using the rates of decay to produce new estimates of the age of the earth, which soon reached figures of the same order of magnitude as the ones accepted today, that is, over four billion years (Lewis, 2001).

In conclusion, the early twentieth century witnessed one of the most significant events in the history of evolutionary theory - the development of the modern synthesis (the synthetic theory of evolution). Its origin was motivated by the almost synchronous developments in both genetics and radioactive dating to support the evidence needed to authenticate Darwinism and gradualism. Darwin, at this stage had already achieved his first goal which was establishing the fact of evolution but his theory of natural selection did not achieve orthodoxy until long after his death.

Natural selection depends on four conditions. The first of them suggests that all members of a species differ from one another (variation) and second that this variation is heritable (heritability). The third condition stipulates that all offspring should produce more

offspring than can survive (reproduction). Fourth, given that not all offspring survive, those that do are, on average, likely to have an anatomy, physiology, and behaviour that best prepares them for the demands of the prevailing environment and competition (Lewin and Foley, 2005). From the above explanation, natural selection would then entail differential reproductive success, with heritable, favourable traits bestowing a survival advantage on those individuals that possess them. These favourable traits will become ever more prominent in the population, generation by generation causing a micro-evolutionary change in the species (Klein, 1999); however, such traits will only remain favourable if the environment does not change.

Evolutionary theory begins with the identification of change in a specific species over time. The principal rationale is that species are not immutable; they are constantly changing, transforming or adapting. Darwinism then implies that this change is caused by natural selection and the synthetic theory assumes that this change by natural selection works through Mendelian genetics. As mentioned, although the rules of inheritance were discovered by the Austrian monk Gregor Mendel in the early 1860s, the results of his work remained generally unknown until the turn of the century, two decades after Darwin's death (Lewin and Foley, 2005). From observations on the progeny from experimental crossing of pea plants, Mendel discovered that physical traits are determined by stable inheritance factors (genes). He also found that each plant has two genes for each trait, one from the female parent and one from the male. The variants of each gene, known as alleles, may be identical (homozygous) or different (heterozygous). When the two alleles differ, one form may be dominant and the other recessive. This means that the allele that will actually determine the phenotype (the morphological trait) is the dominant one, while the recessive one will only affect the phenotype when it is in a homozygous condition (that is, both alleles from each parent are recessive, this is the case with

many rare, genetically determined diseases, for example Albinism (Klein, 1999). Mendel's experiments were very simple from a genetic standpoint, with one or two genes affecting one trait. This choice was fortunate, because the outcome of the crosses would have been far too complex to be understood at the time. Thanks to the simplicity of the system, Mendel's insights were able to lay the foundation for the new science of genetics. Eventually it became apparent that most traits are influenced by many genes, not just one or two.

Mendel's system was open to mathematical analysis, and the selection of favoured traits (the phenotype) could be studied in terms of the selection of genes that underlay them (the genotype). This was what formed the foundation of modern genetics or population genetics. The change in frequency of particular alleles within a population as a result of natural selection acting on them provides the basis of microevolution, which in turn is the central theme of the Modern Synthesis. If the range of alleles available within a species' population remains constant, the scope of evolution will necessarily remain limited. From time to time, however, the sequence of chemicals on the DNA strand (the molecule on which genetic information is coded) changes, often when a mistake occurs as the gene is copied within the germ line. Such a mutation introduces the potential for further genetic variation within the population.

Importantly, however, one should realise that no simple relationship exists between a mutation and the degree of phenotypic change it might produce. Hence, the magnitude of the phenotypic change produced has clear consequences for the ability to infer genetic distance from the degree of morphological difference (Smail, 2008). The fate of mutations, and therefore their importance, was the topic of intense debate in the early years of population genetics. Initially the process of mutation itself was suspected to fuel evolutionary change with the role of natural selection envisioned as simply the removal of deleterious alleles. Consequently evolutionary change was

viewed as the outcome of mutation pressure, an internal force that drove evolution constantly forward. This concept was not what Darwin had described. In Darwinian evolution, natural selection acted to retain beneficial traits (alleles) and was therefore a creative process, not just a cleaning-up process that eliminated disadvantageous traits (alleles). This Darwinian resurgence developed quite modestly in the 1930s but gained momentum and solidified in the 1950s (Gould, 1982). During the 1920s genetics slowly began to undermine the teleological theories such as Lamarckism and Orthogenesis by showing that there was no process by which acquired characters could be incorporated into the fixed units of heredity. Additionally, and equally important, genetics showed that mutations were not directed along a predetermined path. As Darwin had suggested variation was effectively random and studies of whole populations suggested that the extreme saltationism was invalid. Mutations simply provide more random variation, not new species created by a single character difference. Most significantly was that field naturalists accepted that the Lamarckian effects they once had favoured could be explained by a genetics based model of natural selection. Until the mid-1940s, evolutionary theory remained distinctly at odds with strict Darwinism, and many different views were put forth to explain how the pattern of life was shaped. Following the creative amalgamation of natural history, population genetics and palaeontology a consensus of sorts appeared, known as the Modern Synthesis as coined by Julian Huxley. This theory encompasses the three principal facets: (1) evolution proceeds in a gradual manner, with the accumulation of small changes over long periods of time; (2) this change results from natural selection, with the differential reproductive success founded on favourable traits as described earlier; and (3) these processes explain not only changes within a species but also higher-level processes, such as the origin of new species that produces the great diversity of life, both extant and extinct. In essence these developments were what led to the formation of the modern synthesis and Darwinism as we know it today.

THE HISTORY OF EVOLUTIONARY PSYCHOLOGY

The history of Evolutionary Psychology began as a result of a combination of different societal and scientific factors. One of the main issues was the question of instinct and the identification of its existence amongst both human and animal. The question of heredity was not only a controversial topic for Darwin but also for the understanding of instinct and hence a strong dependency on Lamarckian theory was the solution. This is also the period in which Marais developed intellectually and these earlier thinkers might have influenced his pursuit of the evolution of consciousness. The subsequent section aims to briefly describe and highlight some of the issues relating to the development of Evolutionary Psychology.

Humans' place in nature

In developing his theory of evolution, Darwin argues for natural selection and the naturalistic approach and hints, at first only in the *The Origin of the Species* (1859), of his belief that the origin of the human race was no exception to this rule (Darwin, 1859). Darwin then reiterates the same belief much later in his publication *The Descent of Man* (1872), that man should not be excluded from natural selection and hence had to make a strong case for mental continuity between human and animal (Darwin, 1872). What is of interest at this stage is the reaction of his contemporary counterpart, Alfred Wallace (1823-1913). Wallace co-discovered natural selection using an entirely different approach but paralleling in a sense his ideas and eventually achieving the same conclusions as Darwin (Ghiselin, 1969); however, Wallace and Darwin seem to diverge on the issue of psychology. For Wallace, natural selection remained the only process of evolution and since he failed to see how various human characteristics, particularly the human mind could have evolved in such a fashion, he inevitably came to believe that some non-natural

influence had intervened in the course of human evolution. The idea that humans form a part of nature and that we are biologically animals dates back centuries before Darwin but due to social barriers this view was only accepted much later and is even now a sensitive issue. Animals were thought to rely fully on instinct which made them the ideal comparative to identify to what extent humans possess instinct, if at all. Once humans were perceived in a naturalistic context and accepted in the order Primates, they could be studied and compared to other living animals. As mentioned in the primatology section non-human primates were compared to humans anatomically for a multitude of different reasons. Once the similarity in structure became more apparent to researchers they then ventured into comparing behavioural aspects of these animals. This behaviour was split into instinctual and learnt behaviour and the quest was to establish whether particular species retained higher levels of learning or of instinct or a combination of the two?

Instinct versus Learning

One of the longstanding scientific and philosophical issues has been nature-nurture debate. Charles Darwin conceptualised inherited instinct as the cornerstone of his theory in evolution (Beach, 1965). Ironically his grandfather, Erasmus Darwin (1731-1802) argued that behaviour is the product of experience and not instinct. (Ghiselin, 1969). At the root of this debate innate and learned behaviour is scrutinised across species and the degree and the manner in which each of these was bestowed upon individuals becomes a contentious issue. This debate has separated animal from human and also human from human and its application within society was often used to rationalise puritanical, racist or religious propaganda. St Augustine was quite adamant in terms of applying heredity to religion and according to his prophecy we were all born sinful (instinct) and humans need to overcome this sin with punishment (nurturing) from the parents (Stone, 1977). John Locke (1632-1704) however, rejected

this claim and suggested that all children are born as white paper painted upon by experience (Cunningham, 1995). St Aquinas' claimed that humans were born 'tabula rasa'- free of instinct and all behaviour was learnt but animals were driven by their natural instinct only.

Researchers were applying themselves to unique experiments to authenticate their belief in what was innate and what was learnt. The likes of John Stuart Mill (1806-1873), Alexander Baine (1818-1903), Douglas Spalding (1841-1877) and Herbert Spencer focused their research on developing ideas to tackle the definition of instinct and the influence of the environment on human behaviour. Researchers during this period applied their techniques to many different animals and their interpretations were polarised, with very little integration. Non-human animal behaviour became a pertinent tool in terms of defining instinct because they were seen as fully instinctual beings and that humans had no instinct.

Up until the late nineteenth century the manner in which instinct was applied to human behaviour was as a habit that can occur without "conscious reflection". William James (1842–1910) in particular realises this point and stipulates "Nothing is commoner than the remark that man differs from lower creatures by the almost total absence of instincts" (James, 1890 p.389). Experiments proved invaluable. Spalding's experiments showed that chicks have no signs of innate visual recognition of water (Boakes, 1984) and hence no instinct for the visual recognition of water. The definition for instinct was not agreed upon during the later 19th century and Loyd Morgan summed up the confusion on the topic:

> Instinctive activities are unconscious (Claus), incipiently conscious (Spencer), distinguished by the presence of consciosness (Romanes), accompanied by emotions in the mind (Wundt), involve connate ideas and inherited knowledge (Spalding), synonymous with impulsive activities (James), not yet voluntary (Spencer), no longer voluntary (Lewes), due to natural selection only (Weissman), to lapsed intelligence (Lewes,

> Schneider and Wundt), to both (Darwin and Romanes), at a minimum in man (James) and inclusive of individually-acquired modifications through intelligence (Darwin, Romanes, Wallace) (Hernstein, 1972, p.257-259).

It is important to note that at this time no experimental studies were being carried out that were directly concerned with the nature of learning.

Heredity

Instinct could be described as a behaviour that has been passed on genetically and the instinctual behaviour is carried out without any prior experience or exposure. Instinct therefore is understood as inherited behaviour. Around the turn of the nineteenth century, crucial changes in understanding of heritability led to the rapid acceptance of Weissman's argument against Lamarckian inheritance and the subsequent rediscovery of Mendel's laws in 1900, which together laid the foundations of modern genetics and Neo-Darwinism. In less than 15 years, T.H Morgan (1866-1945), his colleagues and students had explained all of the major phenomena of Mendelian genetics by chromosome mechanics (Morgan *et al.*, 1915).

One major consequence was derived from the establishment of genetics, the need to clarify the distinction between learned and innate behaviour (Boakes, 1984). In the latter part of the eighteenth century, particularly in France, and also in early Victorian England the idea that we are nurtured into behaviour was the popular theme.

Some thinkers, however, thought that an individual's potential was severely constrained by a set of factors called 'human nature' and differences between individuals are largely a result of differences existing at birth. Following this position it was common thought to assume that variations in characteristic patterns of action across cultures, classes or sexes reflect inherent constitutional variation. This inherent variation of behaviour was explained in terms of Lamarck's principle of habitually acquired inheritance. The belief

was that a learned behaviour of benefit was utilised and depending on how successful its application was to survival, eventually became habitual to the species and hence incorporated as instinct.

George Romanes (1848-1894) was a major proponent of Lamarckian principle. The main reason for his choice for Lamarck was due to the ever decreasing age estimate of the earth. The decreasing time range for the evolutionary process meant that there was also a rapid mental evolution. Lamarckian principle fits perfectly to accommodate this rapid evolution.

Herbert Spencer (1820-1903) was another proponent of Lamarckian theory and used Lamarckian principles as a central model in his earlier writings, namely in his book *Principles of Psychology* published in 1865 (Boakes, 1984). Furthermore, during 1870 when he published the first volume of a revised version of the book, he had also accepted from Darwin and Wallace the idea of natural selection as a mechanism of evolution (Boakes, 1984). For Spencer instinct was simply an innate reaction pattern more complicated than a reflex, but better understood as a chain of reflex action (compound reflex). Spencer differed from Darwinism in the sense that he believed in a linear progression of evolution with extant species and subspecies providing evidence of continuity in his theory of the consciousness. The views of both Spencer and Darwin on the evolution of "intelligence" provided the main basis for the subsequent development of comparative psychology, which made a further impact on psychology as a whole. Both Darwin and Spencer perceived instincts as learned actions that have become habitual through the Lamarckian principles. Therefore the task of separating instinct from habit remained a significant one until the end of the century.

Racial Science and Social Darwinism

Many of these thinkers of the early nineteenth and early twentieth century assumed that behaviour and social order are biological. Such

beliefs provided a justification for the rigid social stratification within many Western countries and the vast colonial empires that many European nations had acquired during the nineteenth century. Significantly, during this period individuals of outstanding intellectual reputation, like James, claimed that humans possessed a great many inherited tendencies to act in certain ways.

Spencer established the doctrine of Social Darwinism (or as it ought to be called, Social Spencerism, as Darwin wanted no part in it) attracted spokesman such as John D. Rockefeller and Andrew Canergie (Gould, 1981). Additionally, Darwin's cousin Francis Galton (1822-1911) had suggested that human evolution should be given a helping hand by discouraging the less fit from breeding, a policy he called eugenics (Gould, 1981). He claimed that human achievements were mainly the result of good selective breeding, with the stamp of scientific authority on the hereditary outlook (Hirsch, 1971). Galton believed that instincts existed amongst humans and that these instincts were predisposed to some behaviour. His focus was mainly based on intelligence and he used statistical analysis to show instinctual variation within and between populations. The idea that intelligence was a general innate, intellectual capacity best endowed by certain population groupings (e.g. IQ: Intelligence Quotient) led to many racial implications. The acknowledgement from the global scientific community of these ideas motivated prejudice amongst human beings (White, 2007). An extract from Galton's original paper clearly demonstrate his thoughts pertaining to 'race improvement' he states:

> Men differ as much as dogs in inborn dispositions and faculties. Some dogs are savage, others gentle; some endure fatigue, others are soon exhausted; some are loyal, others are self-regarding. They differ no less widely in specialities, as in herding sheep, retrieving, pointing at game, and following, trails by scent. So it is with men in respect to the qualities that go towards forming civic worth, while it is not necessary at this moment to define particularly, especially as it may be a blend of many alternative qualities. High civic worth includes a high level of character,

> intellect, energy, and physique, and this would disqualify the vast majority of persons from that distinction. We may conceive that a committee might be entrusted to select the worthiest of the remaining candidates, much as they select for fellowships, honours, or official posts. (Galton, 1901, p.161).

William McDougall (1871-1938) claims in his book *Social Psychology*:

> The human mind has certain innate or inherited tendencies which are the essential springs or motive powers of all thought and action.... These primary innate tendencies have different relative strengths in the native constitutions of the individuals of different races, and they are favoured or checked in very different degrees by the very different social circumstances of men in different stages of culture; but they are common to the men of every race and every age (McDougall, 1908, p.211).

McDougall also discusses a list of seven primary instincts in his *Social Psychology* of 1908, but they looked exceedingly modest compared with the suggestions of later instinct theorists. Karl Pearson (1857-1936) and Charles Spearman (1863-1945) designed statistical techniques specifically to analyze the inheritance of mental abilities (Gould, 1981). The results of heredity analysis led to laws being passed on topics such as compulsory sterilization of delinquents in Canada, the Scandinavian countries, thirty American states and Germany. The Nazi ideology of inferior races was later used to justify the murder of millions of Jews, Gypsies and homosexuals (Pinker, 2002 and Gould, 1981).

Twentieth Century instinct controversy

The early twentieth century was a period of controversy concerning the understanding of instinct and nearly six thousand different classes of instincts were reported during this period (Boakes, 1984). Examples used to illustrate the vagueness on the topic include explaining that a man jumped off a cliff because he had a suicidal

instinct or Wilfred Trotter's (1872-1939) claim that wolves behave the way they do because they possess the lupine form of the herd instinct (Boakes, 1984).

Additionally researchers were increasingly finding inconsistencies within Lamarckism. Morgan's studies of the behaviour of newly hatched birds led him to disclaim any belief in the Lamarckian principle of hereditary. His doubts about the inheritance of acquired habits perhaps grew with his realisation that the quality of evidence in its favour was no better than that for higher mental processes in animals. Morgan's understanding of this topic concludes that as birds had been drinking water for millions of years and the appearance of water had presumably not changed during this time, an instinctive tendency to drink at the sight of water should have become established given that Lamarckian principle is a factor in heredity. Why then should a chick not show any innate recognition, but have to depend on accidental contact between its beak and water, which is what his results inferred. According to Lamarckian theory these chicks should innately have recognised water because this trait has been adopted over millions of years and should have been habitually absorbed into its instinctive actions (Morgan, 1896 and Simpson, 1953).

Consequently, there was a general swing towards environmentalism and it was easy for psychologists to accept implicitly the fallacious logic whereby, since instinct is an unscientific concept and since it implies hereditary beliefs which are unscientific, there are no instincts. The use of instinct was scorned upon to justify the repressive aspects of rigid child rearing, to justify the social inequalities of Social Darwinism (Spencer, 1884) and the religious aversion to the acceptance of natural selection(i.e. the concept of immutability of species is inconsistent with a literal reading of genesis). The prevailing theories of mind were refashioned to make racism and sexism as untenable as possible.

Standard Social Science Model

The doctrine of the blank slate became entrenched in intellectual life in a form that has been called the 'Standard Social Science Model' (SSMS) (Tooby and Cosmides, 1992). Locke's intellectual heir Mill was perhaps the first to apply his blank slate psychology to the socio-political aspect, some of which we recognise today. He was an early supporter of women's suffrage, compulsory education, and the improvement of the conditions of the lower classes (Tooby and Cosmides, 1992). He tried to explain human intelligence without granting it any innate organisation. According to this theory, the blank slate is inscribed with sensations which Locke called 'ideas' and modern psychologists call 'features'. Ideas that repeatedly appear in succession (such as redness, roundness and sweetness of an apple) become associated so that any one of them can call to mind the others (Tooby and Cosmides, 1992). It became the core of most models of learning especially in the approach called behaviourism, which dominated psychology from the 1920s to the 1960s.

Two main schools of animal behaviour studies developed in the west in the early twentieth century, the first was behaviourism and the second was ethology. The first consisted largely of American experimental psychologists who could claim descent from J. B. Watson whose book *Behaviorism*, published in 1924, was a landmark in the modern experimental approach to behaviour. The second school, which was largely European, was founded in the 1930s by Konrad Lorenz (Manning, 1967).

Watson and Behaviourism

By the 20th century in the absence of any real scientific knowledge of the development of the nervous system or of behaviour, tabula rasa

had evolved into extreme behaviour. The psychologist John Watson (1878-1958) who established behaviourism in 1913, argued that:

> Everything we have been in the habit of calling an 'instinct' today is a result largely of training – belonging to man's *unlearned behaviour* .....There is no such thing as an inheritance of capacity, talent, temperament, mental constitution, and characteristics (Watson, 1925, p.5)

To a behaviourist the only legitimate topic for psychology is overt behaviour and it is controlled by the present and past environment. Locke's 'ideas' had been replaced by stimuli and response. Watson wrote an influential childbearing manual recommending a minimum of attention and love. If you comfort a crying child, he wrote, you will reward him for crying and thereby increase the frequency of crying behaviour (Pinker, 2002). And a response could be associated with a reward, as when a cat in a box eventually learned that pulling a string opened a door and allowed it to escape. In these cases an experimenter set up a contingency between a stimulus and another stimulus or between a response and a reward. The behaviourist B. F. Skinner (1904-1990) wrote several bestsellers arguing that harmful behaviour is neither instinctive nor freely chosen but inadvertently conditioned (Pinker, 2002).

Psychologist J. R. Kantor wrote in 1923:

> Brief is the answer to the questions to what is the relationship between social psychology and instincts. Plainly there is no relationship (Degler, 1991 p.139).

Furthermore the psychologist Zing Yang Kou wrote in 1929:

> Behaviour is not a manifestation of hereditary factors, nor can it be expressed in terms of heredity. [It is] a passive and forced movement mechanically and solely determined by the structural pattern of the organism and the nature of the environmental forces.....All our sexual appetites are the result of social stimulation. The organism possesses no

> ready-made reaction to the other sex, any more than it possesses innate ideas (Degler, 1991 p. 58-159).

Behaviourists believed that behaviour could be understood independently of the rest of biology, without attention to the genetic makeup of the animal or the evolutionary history of the species. Psychology came to consist of the study of learning in the laboratory and as mentioned focused on proximate questions and solutions.

Early in the 20th century, zoologists and physiologists, using early electrophysiological techniques had worked out the rudiments of mechanism for the simplest of behaviours: reflexes. Theory now predicted that more complex behaviour was a reflex chain – each small piece of the behaviour acted sequentially as a stimulus to the next reflex piece and hence no need for instincts. By 1920, the concept of "instinct" was considered disreputable and the word was almost completely abandoned (Thorpe, 1956).

EVOLUTIONARY PSYCHOLOGY

William James believed that we possessed many instincts which were described in detail in his book, *Principles of Psychology* (James, 1890). James' idea of instincts was radical in the sense that he argued that humans have more instincts than other animals and this is what allows us an almost malleable intelligence. In contradistinction to James's views it was generally accepted at the time that humans had less instincts than any other animal and also that these instincts were suppressed. James concludes that because these instincts are so automated within our behaviour we are blind to its existence. It is this natural automated response that seems so normal and assumed to be 'human nature' that James believes should be investigated.

Tooby and Cosmides (1992) are firm believers in James' philosophy and they are the first to formally introduce the discipline Evolutionary Psychology. They believe that researchers have become blind to instincts namely due to the SSSM which developed in relation to the negative attributes attached to the study of instinct. They maintain that an evolutionary approach would be best understood in terms of highlighting this instinct blindness. Tooby and Cosmides suggest that an evolutionary approach:

> allows one to recognize what natural competences exist and, most importantly, it provides positive theories of their designs……Theories of adaptive problems can guide the search for the cognitive programs that solve them; knowing what cognitive programs exist can in turn guide the search for their neural basis (Tooby and Cosmides, 1992, p.2).

They also argue that the SSSM assumes that the mechanisms that govern reasoning, learning and memory operate in a uniform fashion that is not content specific. According to the SSSM the underlying mechanisms that process behaviour have no specialised features and operate in a general content-independent manner. The Behaviourist paradigm carried with it into the cognitive revolution – equipotential assumption of domain generality. Evolutionary Psychology assumes that all normal human minds reliably develop a standard collection of reasoning and regularity circuits that are functionally specialized and, frequently, domain specific. These circuits organise the way in which we interpret our experiences and ascribe recurrent concepts and motivations into our psyche, and provide 'universals' (Brown, 1991) that allow us to understand the actions and intentions of others:

> Beneath the level of surface variability, all humans share certain views and assumptions about the nature of the world and human action by virtue of these human universal reasoning circuits (Tooby and Cosmides, 1992, p.3).

Evolutionary Psychology revolves around four fundamental questions:

1. Why is the mind designed the way it is – what causal mechanisms created or shaped the human mind to its current form (adaptations)
2. How is the human mind designed – what mechanisms and component parts are involved (how are they are organised)? (neural circuits –instincts – domain specific)
3. What is the function of these organised mechanisms, component parts - what is the mind designed to do? (problem based solutions)
4. How does input from the social environment interact with design to produce observable behaviour? (Environment creates problem – mind designed to find solutions).

(Buss, 1999, p.4)

The fundamentals of Evolutionary Psychology were broken down into five principles according to Tooby and Cosmides. These include the following: (1) the brain is understood to be a physical system analogous to a "wet computer"; (2) our evolutionary history consists of periods whereby neural circuits were designed to deal with environmental problems our ancestors might have faced; (3) our conscious psyche could mislead us into believing that our circuitry is simpler than what it really is; (4) different neural circuits are specialised for solving different adaptive problems; and (5) our modern brains house primitive minds.

As mentioned, Evolutionary Psychology was aimed at integrating the fragmented historical theoretical concerns that have separated the discipline into its many distinctions such as the comparative psychologists, the neuro-psychologists, the social psychologisst and the genetics psychologists to mention a few (Cravens and Burnham, 1971). The actual synthesis and development of the discipline could include several different fields such as ethology, evolutionary biology, cognitive psychology, anthropology and developmental, environmental psychology to mention a few (Kenrick *et al.*, 2003) A more detailed description provided by Buss:

> This discipline pulls together findings from all disciplines of the mind, including those of brain imaging; learning and memory; attention, emotion, and passion; attraction jealousy and sex; self-esteem, status and self – sacrifice; parenting, persuasion, and perception; kinship, warfare and aggression; cooperation, altruism, and helping; ethics, morality, and medicine; commitment, culture and consciousness." (Buss, 1999, p.4)

Overall the basic premise of Evolutionary Psychology is that our neural structure and complimentary specialised behaviour evolved in response to our ancestors' needs. Each neural structure was adapted in a content specific manner and grouped into modules that manifested as specialised behaviour specific to our ancestral needs. It should also be noted that Evolutionary Psychology claims that because the process of natural selection is gradual, our mind has not played catch-up with the post-industrial day-to-day world that we live in. This is a contentious issue as the above mentioned, is one of the counter-arguments used against the idea of Evolutionary Psychology. The essence of the matter is that Darwin's notion of gradualism has been shown to occur in the hominid fossil lineage (e.g. the gradual adaptation of *Australopithecus Anamensis* into *Australopithecus Afarensis*) (Klein, 1999). However, Elredge and Gould (Gould *et al.*, 1993) identify punctuated equilibrium as an alternate to phyletic gradualism, which suggests that we find periods of stasis, followed by periods of rapid change and speciation. Evolutionary Psychology does not consider this aspect of change and transmission. Secondly, behaviour and culture have been shown to be transmitted rapidly via Neo-Lamarckism (Smail, 2008) as well as memes (Ghiselin, 1973), hence transmission of new traits (behaviours) is almost immediate and not the gradual phenotypic change that Darwin's phyletic gradualism suggests. Therefore, I would conclude that it does not fit well with the rapid socio-technological shifts which punctuate the past 80 000 years of our own species.

Evolutionary psychologists therefore explain the mind in terms of past events. The direct premise of the discipline infers that genes shape behaviour but not directly, rather from the above mentioned cognitive modules that they build in the brain. These modules were basically produced by the process of natural selection acting on humans in their ancestral past. An important aspect of Evolutionary Psychology is the belief that these modules have developed in the past but have remained constant for some 100 000 years. Smail highlights this by stating "Like fossils, modules were laid down in the strata of the brain a long time ago and preserved against the ravages of time" (Smail, 2008, p.139) The core idea of Evolutionary Psychology is the assumption that the human mind has species-specific architecture that contains a degree of variability and plasticity depending on environmental influences but it is not infinitely malleable.

In line with more current research pertaining to Marais's findings for his troop of baboons showing causal reasoning within their behavioural abilities. Cheney and Seyfarth, (1995) clearly recognise the act of causal reasoning in their study of female baboons (*Papio cynocephalus ursinus*) with the use of vocal playback recordings recognising submissive fear barks. However, these reasoning capabilities are not unique to humans and baboons as Marais suggested but extends across monkey species, for example the use of stone tools to obtain fruit has been discovered in the Japanese macaques (*Macaca fuscata*) (Tokida *et al.,* 1994), more recent ambitious studies have been directed at showing that non-human primates can learn to use joysticks to track spatial events on computer screens (Andrews, 1993; Leighty & Fragaszy, 2003; and Hopkins *et al.,* 1996). In this regard Marais was correct in the assumption that baboons could express causal reasoning within their behaviour but he was incorrect in terms of his limitations he asserted for other monkeys and animals which he believed never

acquired the reasoning capabilities of the baboon and hence biased in that sense.

Research has moved beyond Marais's causal memory and behavioural patterns amongst these non-human primates and are now directed at theoretical claims such as Theory of Mind. Theory of mind in particular infers the ability to predict other's behaviour by attributing to them independent mental sates, such as beliefs, opinions and desires (Gallagher *et al*., 2003). Theory of mind has been considered a human ability and more research has been directed at identifying this phenomenon in non-human primates to establish its development and evolution from the biological functions that underpin it. Research in this field has also showed increasing evidence towards the continuity of humans and nonhuman primates.

Theory of mind includes social cognitive mechanisms such as deception, cooperation, empathy, rational causation and the interpretation of others body language to mention a few. These are believed to be innate cognitive mechanisms which tie into Evolutionary Psychology as content-domain specific, innate cognitive mechanisms. Research in this field has led to studies aimed at specifically identifying where in the brain these innate cognitive mechanisms (hardwired functions) reside. Studies have included the identification of certain neural areas that could be responsible for theory of mind from brain lesions (Rowe *et al.,* 2001 and Stuss *et al.,* 2001). Both studies confirm that these patients had difficulty in metalizing tasks. Metalizing is synonymous with theory of mind and in a nut shell suggests that the ability to understand the behaviour of others in terms of their goals and beliefs whether or not the belief is the reality (false belief). From this memory based perception of predicted behaviour, scripts are developed, these scripts allows us to infer expectations from others. For instance, "the traffic newspaper vendor script". Individual A is in his car in traffic, Individual B is standing in the

road selling newspapers. Individual A would like to purchase a newspaper, he does so by nodding his head in the direction of Individual B who then responds in expectation of this script and presents the newspaper with the expectation of monetary exchange. This simple head nod from Individual A could represent many different scenarios he could be self-reflecting and acknowledging his own thoughts or could be stretching his neck but because these scripts have been generated within human society an expected outcome has been achieved depending on the script. This process underlines the basic function of theory of mind.

Theory of mind is believed to have evolved in relation to past ancestral obstacles within humans. Researchers believe that it is just as important if not more significant as other human unique features such as bipedalism and language. Bipedalism for instance allowed us to free our upper limbs which enabled us to manipulate objects and create the world we live in; it also allowed us the advantage to migrate distances and hence explore the planet. In much the same way the theory of mind has assisted us in terms of expressing intentions, imaginations, imitations, learning, projection and perception all of which supposedly constitutes modern human behaviour. Studies involved in testing theory of mind in extant non-human primates allow us to make predictions in terms of its development. These studies include the Social Brain Hypothesis (Dunbar, 1998) and Machiavellian intelligence (Byrne and Whiten, 1988) to mention a few.

Examples of the application of Evolutionary Psychology extend over a wide spectrum of behaviour and its adaptive explanation. The more popular studies focus on language and its evolutionary history and as such explains language universals (Kurby and Hurford, 2002), how the human vocal tract had evolved (Fitch, 2000) and social communicative behaviour (Dunbar, 1997).Universal language organs are one of the three pre-requisites of the cognitive

revolution (Chomsky, 1957), the other two includes exploring the psychology underlying the behaviour and information processing (Buss, 1999).

Other studies include research on the evolution of humour, (Barret *et al.*, 2002 and Jung, 2003) self-awareness and the search for consciousness (De Veer *et al.*, 1999, Gallup, 1970, Heyes, 1998, Keenan *et al.*, 2001, Wynne, 2001 and Kircher, 2001) to mention a few. The discipline now encapsulates a broad spectrum of developmental as well as comparative psychologies directing questions at both ultimate as well as proximate solutions. For example, one can determine how behaviour enhances survival and reproduction (ultimate cause – functional in nature) and one can identify the variants involved in eliciting a particular behavioural response (proximate cause – motivational nature), these form part of Tinbergen's four why's (Buss, 1999).

Evolutionary Psychology has been challenged by many researchers and these challenges were directed at basic fundamental issues within the interpretation of data in this field. However, it must be noted that it was largely a reaction to the previously mentioned E.O. Wilson's Socio-biology Synthesis published in the late 1970's (von Sydow, 2012) with specific reference to his final short chapter on humans.

For instance, Jerry Fodor (1983) questions how we prove that the modules mentioned above exist and if they do are they genetically or culturally developed. The basic argument suggests that the observer identifies a trait, (for example fear of darkness) and then attempts to envision the evolutionary context in which this might have been adaptive (e.g. nocturnal predation). Hawkes (2005) asserts that certain ancestral populations do not represent this universal mentality suggested by Evolutionary Psychology, inferring that what we believed to be an ancient adaptation could have been developed within a much shorter time frame.

Buller (2005) concludes that Evolutionary Psychology attacks the notion that the human brain was programmed in response to stable environmental challenges in the deep past. However, the social intelligence hypothesis, assumes that the majority of adaptive problems that drove human psychological evolution were posed by other humans and not the needs of the hunt or of tool making (Smail, 2008). The point is that if intelligence evolved so as to compete with other evolving intelligences, then it is impossible to speak of stable adaptive problems that generated fixed solutions. The human brain and hence mind did not just adapt at some fixed moment in the past, it is continuously adapting. As mentioned previously one of the basic fundamentals in Evolutionary Psychology posits that the human brain hasn't undergone any significant change in the last 100 000 years. In denial of this argument, there is now considerable hard evidence showing that certain human genes could and did change over the past 10 000 years, e.g. sickle cell anaemia (Buller, 2005). Also, it is argued that the Paleolithic environment acts as the benchmark of behavioural adaptation, is both directional and anthropocentric (Smail, 2008)

The empiricists assert that we cannot evaluate claims that are unobservable entities or processes (Haig, 2000). Lakatos and the hypothetico-deductive method of observation is another popular argument that challenges the very fundamentals of Evolutionary Psychology claiming that it is based on predictive science (Holcomb, 2000).

Synapomorphies, autapomorphies, exaptations and the Panglossian paradigm (e.g. noses were designed to hold spectacles) are all morphological factors that become more compounded and complex when applied to behaviour (Lewontin 1990, Richardson 1996). Research conducted by Gould and others is reflective of the move towards a new understanding of evolution different from the suggested Modern Synthesis (Neo-Darwinism). In this extrapolation

of evolutionary trends Gould in particular mentions that speciation is not necessarily the "gradual, adaptive allelic substitution to greater effect" (Gould, 1980). Gould illustrates with the use of a wide range of examples pertaining to both culture and biology as to how non adaptive mechanisms and constraints on adaptations (Clutton-Brock and Harvey, 1979; Gould and Lewontin, 1979) might be involved in evolutionary forces. He explains how aptations and expatations (Vrba and Gould, 1982) could be useful in understanding evolutionary processes without the use of strict Darwinian adaptationist principles. Not all structures are adaptations: "An exaptation is a trait, like the large cognitive brain, that evolved to serve some function but subsequently became available for entirely different purposes" identified by Gould, Lewontin and Vrba (Smail, 2008, p.127). An example of this could be related to sexual desire as an adaptive force for procreation, however many non-human primates discovered non-procreative play to act as an important social function. Hence, sex is exaptive with regards to its ability to create as well as maintain social bonds. Similarly, Clay *et al.*, (2011) show that female bonobos use copulation calls as social signals. From a morphological point of view, Manger (2006) demonstrates how the large brain did not evolve directly for higher cognition in the dolphin; rather it evolved in direct response to thermal pressures. More specifically pertaining to humans and their large brains Aiello and Wheeler (1995) discuss the expensive tissue hypothesis in which they claim that certain structures are more energy expensive than others, namely the gut and the brain. The idea is that a trade-off occurred during our human evolutionary story whereby the gut was reduced drastically in size with the addition of a higher nutritional diet (namely proteins) which could have allowed for the metabolic energy supplementation of a bigger brain. Hence, strict Darwinian adaptationist views are highly represented in Evolutionary Psychology.

MARAIS AND THE HISTORY OF EVOLUTIONARY PSYCHOLOGY

The history of studies of human consciousness as described above denotes the fluctuating ideas, differing methods and application of new techniques to derive solutions to the questions surrounding consciousness and its evolution. For the purpose of this section Marais's approach and methodology are of the utmost importance. Marais's major theme throughout his discussion of the evolution of consciousness stems from the nature versus nurture debate, which seems to be a constant theme in the history of psychology, particularly within the framework of evolutionary theory. He was correct in his application of using non-human primate analogues to understanding the complex study of instinct and learning. He too, like Morgan's canon, thought that the demystification of the animal mind might remove the mystery of the human mind. His long term study of non-captive baboons played in his favour, as this provided a true reflection of the animal's behaviour. Hence, he could make more confident inferences about his results.

Additionally, Marais never limited his research to only baboons, and used a variety of different species (from birds to wildebeest) to understand the degree of instinct and learning present in these populations. In terms of his approach to understanding his results, he used both an experimental as well as a non – captive longitudinal approach that was only used in combination long after Marais's time. As mentioned previously, his choice of Darwinism as his functional paradigm really placed him with the front runners in terms of research during his time (when Darwinism was in its "eclipse"), and also his insistence on trying to accommodate the empirical method allowed for a sense of objectivity in his work.

Marais was also interested in hypnosis and its effects on consciousness and carried out quite a few studies on human subjects,

testing their instinctual senses during a state of hypnosis. Unlike Sigmund Freud (1856-1939), his work never revolved around psychoanalysis or psychopathology but on the evolution of consciousness. Marais was primarily an ethologist, meaning his main interest concerned observable behaviour.

EUGENE MARAIS

Eugene Marais's major contribution was to the study of primatology. His pioneership in this field was established due to his non-captive method and the overall research time spent in the field. From the observations obtained from his baboon research Marais developed his theory of the evolution consciousness. This behavioural study provided a model for the development of the discipline of ethology and provided a good comparative model for human behaviour studies. The previous chapter covers Marais in relation to his actual methodology and contribution towards primatology. The following section focuses on the inferences that were made from his observations on the Chacma baboon and his interpretation of the focal theme of the study: the evolution of consciousness.

In essence, Marais identified and applied Darwinian principles to morphology and subsequently to psychology which made it a likely possibility that he anticipated certain concepts in Evolutionary Psychology (Rousseau, 2000).

For the purpose of this section, Eugene Marais's *The Soul of the Ape* was analysed. In this book Marais uses his observations from his baboon research and from a multitude of other animal studies to discuss his ideas on how he believes the mind to have evolved. His introduction to the topic emphasises an important factor, instinct, which has been neglected by psychologists but in Marais's work becomes an obvious constituent in the understanding of consciousness. Wheeler (1917) identified this problem and wrote:

> After pursuing during the past twenty years a small library of rose-water psychologies of the academic type and noticing how their authors ignore or merely hint at the existence of such stupendous and fundamental biological phenomena as those of hunger, sex and fear, I should not agree with, let us say an imaginary critic recently arrived from Mars who should express the opinion that many of these works read as if they had been composed by a being that had been born and bred in a belfry, castrated in early infancy , and fed continually for fifty years through a tube fed with a stream of liquid nutriment of constant chemical composition (Evans and Evans, 1970, p. 226-227).

Marais identifies instincts as the sexual sense (reproduction and care of young), fear of death (counteracting common environmental dangers) and procurement of food. He names instinct the "phyletic memory" or "individual memory" and believes that they are nearly always correlated to specific somatic modifications, as in the case of insects. An example of this can be related to the ant eater, *Tamandua tetradactyla,* (Marais, 2000, p. 61). The anteater has an instinctual need to procure food, as most species do, but it has a specialized somatic modification related to this, namely it's most characteristic feature, the elongated snout. Furthermore not only does Marais identify instinct but also describes how disadvantageous it might be in light of specific adaptation. For example, if the anteater was relocated to a specific area that is devoid of its resource (ants) the ant eater would become extinct because its snout is so specialized in terms of its dietary adaptation and also its instinctive behaviour confines the animal to specific types of food, food that is now impossible to procure. Marais also notes that specific species of game birds retain the urgency to drop to the ground and crouch, which was an important adaptation to avoid danger from air born predators and ensure its survival (Marais, 1969). The disadvantage however, is that when game hunters fire gunshots in the air, they render these birds helpless to its natural instinctual response of dropping and crouching, hence the game hunter and hunting dogs anticipate their arrival. The phyletic memory is thus, although key in animals' survival in environments for which it is adaptive, also too specific and shows

very little plasticity to equip the species for survival in the changing and unstable environments it encountered. Baboons do not show this specialised dependency on structural modifications as the ant eater and would be considered a generalist. In fact Marais mentions that baboons could spatially migrate to a wide range of differing environments based on their ability to easily acquire new dietary habits. He shows how the baboon not only eats plants and insects but how in times of limited resources certain groups have developed a taste for meat, this in relation to their quadrupedal gait liberated them from the trees to expand and migrate to sparse new areas (Marais, 1939, p.2-4) in terms of the causal memory that Marais describes.

Many studies have highlighted and described accounts of imitative and emulative learning as well as problem solving. As mentioned previously Marais's hierarchical acquisition of the causal memory might be biased, he grades the baboon with humans but downgrades the ververts. Inferring that baboons have a greater ability to learn or recognise causality in their actions. Current research identifies that the greatest ability for imitative learning and problem solving resides with the great apes such as the termite fishing displayed by the Chimpanzees (*Pan Troglodytes*), (Goodall, 1970, Tomasello *et al.*, 1994) and social learning of tool use by Orangutans (*Pongo Pygmaeus*) (Call *et al.,* 1994). However, none of these studies are indicative of imitative learning or problem-solving that extends beyond human children abilities (Tennie, 2006). Similarly the monkeys do express these behaviours but not to the extent that we observe in the great apes. In terms of the monkeys, Macaque monkeys have shown to be active imitative learners as well as good problem solvers, the Japanese Macaques (*Macaca fuscata*) have been observed utilising stone tools (Beck, 1976), washing of sweet potatoes, wheat washing, snatching behaviour, bathing behaviour and so forth (Kawai, 1965). All of these behaviours have been documented to have spread through the troop via learning and teaching and is not an individual once off observation. This demonstrates a greater efficiency of the

macaque compared to the baboon when applying principles of learning and problem solving. (Beck, 1976, p.309) states:

> While spontaneous tool behaviour is reported only slightly more often among macaques than baboons (though decidedly less often than among chimpanzees), it is critical to note that in every macaque report the behaviour is exhibited by more than one group member. This is the case in only one (Marais's) baboon report. This supports the present conclusion that macaques have a greater capacity for observation learning for tool use.

Marais discusses a similar grading system based on how well these Old World monkeys rationalise causality (i.e. problem solving and learning) by suggesting that ververt monkeys are not as capable as baboons of causal rationalisation. Carpenter had also shown that macaques use rocks to penetrate the hard shell of a crab to get to the fleshy bits (Carpenter, 1887). And Marais discusses how his troop of baboons irrigated hot springs with small channels to cool water for drinking during times of scarcity. These types of causal, learning observations have not been confined to the macaque and baboon research only but many other non-human primates such as in the tamarin (*Saginus Oedipus Oedipus)* (Hauser *et al.,* 1999), rhesus monkeys (*Macaca mulatta)* (Stephenson, 1967), gibbons (*Hylobates lar lar* and *Hylobates pileatus*) (Beck, 1967) and mangabeys (*Cerocebus torquatus toquatas*) (Coussi, 1994) among others. An important aspect that Marais did recognise from his studies, even though it might have been biased, is the hierarchy of learning, problem - solving or causal behaviour. Today, research indicates that human children are better equipped for novel problem solving compared to the great apes, the apes more endowed than the monkeys and within monkeys, some species more advanced than others.

The instinctual disadvantageous points are the basis for why Marais believes the opportunity existed for the evolution of a new conscious experience to develop in relation to instinct. This new conscious

experience according to Marais has not only acquired memories in relation to locality but more so the relation between cause and effect and hence named it the "causal memory". This cause and effect relationship, such as response to stimuli, has been identified as consciousness today. Marais was well aware of this and hence entitled his manuscript *The Soul of the Ape* (i.e. The Mind of the Ape). This translation of soul and mind was not unique to Marais as Watson suggests:

> It was the boast of Wundt's students, in 1879, when the first psychological laboratory was established, that psychology had at last become a science without a soul. For fifty years we have kept this pseudoscience, exactly as Wundt laid it down. All that Wundt and his students really accomplished was to substitute for the word "soul" the word "consciousness" (Watson, 1925, p.5)

Most significantly, this causal memory possesses a degree of plasticity, which enables the individual to adapt to environmental changes without having to adapt its morphology. A very basic example could be demonstrated when considering climate change. If an individual living in warm conditions had an extreme climatic change towards much colder weather, the individual possessing the causal memory would respond by either using an animal's skin for warmth (fur coat), find a warm sheltered area, or manipulate the use of fire to provide heat. The individual that is entirely dependent on the phyletic memory, however, does not possess this cause and effect mentality and is entirely dependent on morphological adaptation to account for this extreme climatic change (i.e. it would have to develop fur or increase its adipose tissue to retain more heat or hibernation might be considered as a physiological adaptation).

This morphological adaptation would take generations to develop and occurs purely by chance which could possibly result in extinction. Hence, Marais believes that this causal memory acts as a protective umbrella against the remorselessness of natural selection. A different

analogy applied to feeding instead of climatic change, would include the ability to manipulate stone tools. As discussed, in Marais's troop of baboons, he observes them travelling great distances to get access to a specific fruit produced by the baobab tree *Adansonia digitata*. The fruit, has a very hard external tissue covering which protects the nutritional juices on the inside. Marais states "They would pick the fruit and carry it for great distances to the foot of the hills, where the nearest stones were situated. The fruit is about the size of a small coconut, and the means the chacma adopted it for carrying it to the hills was very interesting"..."On reaching the hills, the fruit was placed on a flat rock and smashed with stones. My colleague noticed that in many instances, particularly among the younger individuals, great efforts were first made to break the fruit by hammering it on the rock by hand before a stone was used as a tool." (Marais, 2002, p.55-56.). This is a good example of how the causal memory functions. The baboon has not been equipped with a specialised beak, or bony apparatus to break open the fruit of the boabab tree but due to its causal memory, through trial and error they manage to manipulate a stone as a tool to get to the nutritious pulp of the fruit. Hence these animals were not dependent on somatic modification or adaptation due to changing environment or lack of resources to procure its food resource but rather from the manipulation of an external object which was then passed on through learning to the rest of the troop, which are the effects of Marais's causal memory.

Once this causal memory has been established during the evolution of a lineage it does not replace the phyletic memory (instinct) but instead suggests that both the causal and phyletic memory reside in the neural circuitry. Significantly it should be understood that according to Marais's theory both these memories use different pathways to achieve the desired effect. Most researchers during Marais's time believed that instinct was diminished and that the 'causal memory' dominates behaviour in humans. Marais believes that we retain the phyletic memory but it is submerged deep within our psyche with the causal memory being most active. Marais, like Freud, believed that once hypnotised the causal memory is paralysed and the

phyletic is allowed to surface and for this reason his human subjects were expressing heightened sense perception during hypnosis.

Marais strengthened his argument by describing the development of this new causal memory by grading it in relation to the phyletic. This hierarchical grading system reminds one of the ideas of Aristotle, namely his *scala naturae* and St Augustine's, *Chain of Being*. Indeed elements of this pre-evolutionary mode of thinking were preserved in some early evolutionary theories, even in those with an apparent Darwinian bent. In anthropology, specifically, they were argued to be an impediment for the development of the modern field of human evolution studies (Gundling, 2006). Marais, for example, defines three evolutionary stages: (1) an organism whose behaviour is entirely dependent on the phyletic memory and depleted of any causal memory; (2) an organism whose behaviour is predominantly reliant on the phyletic memory but also has the causal memory; and (3) an organism whose behaviour is predominantly reliant on the causal memory but still retains the phyletic memory in a submerged form. All three of these stages are related to insects, birds and primates respectively. Insects according to Marais are entirely dependent on instinct. Birds have a predominantly instinctual psyche and only display a minute aspect of this newly developed conscious psyche (causal memory). In the case of the primate the new conscious psyche is autonomous and inhibits the instinctual psyche at the cost of inactivity, rendering the control of behaviour to the causal psyche. *Papio* according to this statement would therefore be closer to humans in terms of their mental evolution. Primates in this regard are perceived as mentally superior in accordance to other animals in the animal kingdom and hence the hierarchy is established. In a way, Marais develops his own general outlook of the phylogenetic stages based on his gradation of available phyletic and causal memory. This newly developed consciousness is more adaptive and flexible compared to the specialised, fixed behaviour observed in instinct, hence

providing an increase in fitness and survival of the species endowed with the new causal memory. Today these concepts are understood differently and consciousness in particular has been demonstrated in a few insects (Gould, 1977; Paulk *et al*., 2008 and Ramon, 2004).

Marais does, however, provide important insights during his time. Firstly, he identifies humans as part of the animal kingdom, an idea that only gained momentum in the sixteenth century through the ideas of Michel de Montaigne, but took centuries to be more broadly accepted. In line with contemporary thought, public opinion is still sceptical concerning human's place in nature (personal assumption). Furthermore, Marais does not confine his study to primates only and uses a variety of differing species to establish his argument. He applies comparative analysis, as discussed in Chapter 2, which was not a novel practice amongst researchers at the turn of the twentieth century, but only few realised the efficiency of its application to the understanding of human nature both morphologically and behaviourally. Marais studied a wide range of species, but he believed that primates were human's closest relatives and thus most valuable in research on human behaviour:

> the first step towards acquiring the necessary knowledge to arm man for his last struggle for existence is a thorough study of the animal species most nearly related to man - the apes and anthropoid apes (Marais, 1939, p11).

Comparative analysis is currently considered an essential tool to the better understanding of behaviour. The comparative analysis that Marais conducted on a variety of species was what allowed him to start elucidating processes behind the evolution of human consciousness.

It should be noted from the onset that Marais never worked systematically (e.g. he never had a research programme set up and he was opportunistic in his approach to observation)

to achieve his results; he also never finished his manuscript on the *Soul of the Ape*, which was posthumously published by Robert Ardrey. As mentioned, Marais's observations seem to be fairly accurate, as much of his observations have been identified from more recent primate studies. However, his interpretations and conclusions are less trustworthy in the sense that he might have been biased towards his study animal the Chacma baboon and too anthropocentric all of which gives the impression of personal projection in terms of interpreting primate behaviour.

MARAIS AND HIS APPLICATION OF DARWIN

Marais was influenced by Charles Darwin's theory of evolution and this was quite evident in his writings (Marais, 1939, p.66) on the theory of the evolution of consciousness. As mentioned, Marais's life history shows a strong passion for nature and animals, his interests had a structural biological aspect and also a strong behavioural inclination. Furthermore, it would appear that Marais only periodically had access to literature pertaining to evolutionary theory as well as psychology or behavioural science and had good but only general knowledge of some key developments in these areas. Hence this combination of limited theoretical background and application thereof in the ideal environment (Waterberg Mountains) yielded the fruits of Marais's results.

Marais's affinity to Darwinism is obvious in his writing, whereby he shows a clear understanding of the fundamental principles and application of this theory. For example in his book, *My Friends the Baboons*, he states:

> It is contended sometimes that purpose and reason are apparent in the evolution of man, that he is the perfect product, the goal towards which organic evolution has been striving through all these millions of years. This notion arises from the erroneous idea that evolution always strives

> towards a condition of absolute perfection. All that evolution always can bring out in an organism is to fit it, by selection, for one or other definite natural environment (Marais, 1939, p. 5.).

That no progression can be assumed in evolution is one of Darwin's fundamental points which differentiate it from the alternative evolutionary theories (Lamarckism, Saltationism and Orthogenesis). This misconception in terms of directional evolution is apparent even nowadays as highlighted by Richard Dawkins in his *The Ancestor's Tale: A Pilgrimage to the Dawn of Life*(2004, p.4):

> I also believe, though this is more controversial today than it once was that there are senses in which evolution may be said to be directional, progressive and even predictable. But progress is emphatically not the same thing as progress towards humanity, and we must live with a weak and unflattering sense of the predictable. The historian must beware of stringing together a narrative that seems, even to the smallest degree, to be homing in on a human climax (Dawkins, 2004)

Marais has a good understanding of the natural selection process, the variability within a species and adaptation. Hence randomness, natural selection and adaptation form the theoretical framework of Marais's theory of the evolution of consciousness (Marais, 2002, p.59).

In his books the *Soul of the Ape* and *My Friends the Baboons*, Marais discusses the typology of baboons. He explains how environmental change can lead to changes in phenotype within a species and how this change can lead to speciation events under the influence of natural selection.

In his book *My Friends the Baboons* (in a chapter entitled Habits of Baboons), Marais provides a substantial amount of information and a rather lengthy discussion on the subject of variation from type (adaptive optimum). He describes morphological variation from type using an array of animal, insect and plant species. Additionally he identifies that:

> In many instances it has been proved experimentally that those individuals of a race which vary furthest from type are the first to perish when a sudden change in environment takes place...On the other hand, also, all animals which enjoy a high degree of protection show a correspondingly high degree of individual variation from type (Marais, 1939, p.6-7).

Marais identifies that certain animals that have a high level of protection from natural selection would incur a high level of individual variation from type. What he is suggesting here is that due to less fit individuals surviving and reproducing due to protection from natural selection with the use of causal memory, more individuals would survive and hence overall increased variance is noted from type within the population.

It should be noted that Marais refers to both the morphological variation and psychological variation (Marais, 2002). He believes that species with a higher degree of individual variation have a better chance of survival in providing "raw material" for natural selection and possible new adaptations. High levels of variation also produce, as in humans; a higher range of possible behavioural patterns (responses to change) and increases overall plasticity (see below) of the species which relies on causal memory. At the same time, however, this variation from type could be seen as possible source of degeneration. Marais notes that individual variation from type could lead to disease and when applied to behaviour, mental disease. He believes that humans possess the greatest amount of individual variation from type when compared to any other species and is consequently in increased danger of mental disease. In terms of behaviour the 'type' behaviour would have been the best fit behaviour of that species. Hence, with increased variation from type ("adaptive") instincts, and the causal memory as the authority a misbalance can occur, leading to mental disease and disease in general.

This entire system is under the control of natural selection (Marais, 1939). When discussing this topic many indirect references to Eugenics and Social Darwinism are made as Marais believes that admixture leads to greater variation with increased possibility of falling off from the adaptive type and hence decline into disease. The solution according to Marais is as follows:

> If mankind wishes to escape the doom which now threatens its existence on earth: if, in the last ditch man still wishes to fight unrelenting nature, it would appear possible only by the adoption of one strategical measure and that is the variation from type and the great increase in population must be stopped in some scientific way (Marais, 1939, p.10).

While recording his scientific observations, Marais usually describes the type specimen of the baboon (the type specimen refers to the average morphological trend defined for a specific species and according to Marais the ideal set of adaptations for the particular environment) and the amount of morphological variability we find within this species. For example he states:

> But it is only by the operation of hostile nature that selection within a species can take place, and it is only by selection that the type of race can be preserved. In many instances it has been proved experimentally that those individuals of a race which vary furthest from type are the first to perish when a sudden change in environment takes place. In America it has been shown by measurements that of the thousands of birds that die during sudden storms almost every one vary distinctly from type in one or other direction. On the other hand, also, all animals which enjoy a high degree of protection show a correspondingly high degree of individual variation from type. On some islands of the Pacific there are indigenous insects which have no natural enemies and the climate is so equable and favourable that deaths among the insects are never due to sudden environmental changes. The result is that in all the mountain valleys, separated often only by a cliff from each other, different kinds of the same species can be found. This can be ascribed only to the fact that the individuals that vary are never destroyed by unfavourable environmental conditions (Marais, 1939, p.6-7).

This appears contradictory but what Marais is implying is that protection from natural selection leads to increased numbers within the population. However, the consequence of this, he observed, leads to a high degree of individual variation from type. This high degree of individual variation according to Marais leads to anomalies (such as disease and pathology), which act as a strong terminating force hence culling the population with the threat of extinction. So the point he is making is that animals that have a high variation from type are usually those protected from natural selection and this protection is a direct resultant of the causal memory. This would obviously increase the number of individuals within the population and hence the population as whole. However, due to the accompanying high level of individual variation from type, more diseases would become prevalent within the population which would in effect start decreasing the numbers.

Marais discusses the mechanism of morphological specialisation and how it could be disadvantageous and leading to extinction. He compares the morphological implications of specialization with mental specializations. Marais emphasises how mental specializations (innate learned tendencies) are more disadvantageous than morphological specializations in most cases leading to death and extinction. This is important in that it demonstrates how sensitive mental adaptations are to the selection process. For example he states:

> It is sometimes a very slight and apparently insignificant morphological modification which describes the fate of an animal under a changed environment...Organic modification, however, is never as powerful in limiting an animal to a certain environment as psychic specialization (instinct). An instinct in this respect is tyrannous. Where it is a dominant factor in behaviour, an animal will overcome the fear of death itself – that strong determinant of action – rather than violate the inborn direction. In nearly all the examples of non-primate behaviour I have described, this compelling power of hereditary memory will be apparent (Marais, 1969, p.83).

Additionally he states:

> Even in cases where instinct is strictly correlated to organic structure it seems evident that the bodily specialization never so surely confines an animal to a limited environment as the attendant instinct (Marais, 1969, p. 84).

The consequence of this specialisation is unequivocally Darwinian in nature. Hence the result is that specialisation might lead to extinction, while the generalist will have better chances of survival.

According to Marais the plasticity of the phenotype provides higher fitness in the context of environmental change. This plasticity is embodied in causal memory which reaches its highest point in *Homo sapiens*. It enables survival in different and changing environments. Marais assumes a similar tendency within *Papio*; they apparently share a higher degree of the causal memory as in humans, but not to the same extreme. When he applies this causal memory to other monkeys, such as the vervet monkey, he identifies a different degree of the causal memory represented in the minds of these animals. Marais states

> The vervet is certainly not as 'clever' as the chacma. It is slower to accumulate individual memories and its comprehension of causality in the individual memory is not as perfect as in the chacma. ...If in the vervet the 'dual control' is so equally divided that it is almost impossible to say to which side the balance swings, then it is in the chacma that the process of submergence of the instinctive mentality first becomes clearly apparent. Here for the first time individual memory assumes dominant control of the mind. And there is a further singular difference between the chacma and the vervet in respect of the instinctive mentality. In the vervet there is great uniformity of instinctive behaviour; in the chacma, individuals are found that are almost as completely equipped with hereditary memories as the vervet; but a large percentage lack even the most essential ones. Generally speaking, it is the 'clever' chacma that is without phyletic memories. The 'stupid' ones are sometimes highly instinctive." (Marais, 1969, p.88).

More recent data shows that researchers are still trying to identify continuity between human and ape and also between ape and monkey (Whiten, 1996).

While phyletic memory (instinct) is specialised causal memory allows for diversity of survival strategies. In this way species which rely primarily on causal memory do not have to go through the long process of adaptive evolutionary change to survive, they are, to use Marais's words, "protected" from changes induced by natural selection. Marais states:

> There was, of course, no sudden leap in the inception of the new mind. It was a thing of infinite gradations and stretches away through vast periods of time. The mills of God grind slowly and very uniformly. This de-specialisation tendency is, in fact, as widespread as organic life itself. It is only when we reach the order of primates, however, that the new mind emerges for the first time to take a great or even a controlling share in generally determining the animal's reaction to environment (Marais, 1969, p. 87).

Darwin believed that natural selection caused species to change more or less continuously and that the slow accumulation of gradual change eventually produced new species. While Darwinism is now generally accepted, many evolutionary biologists question gradualistic explanation of the evolutionary process (e.g. Eldredge and Gould, 1972). These new ideas, however, were far in the future and based on many new theoretical innovations as well as empirical facts, particularly in the field of paleontology. Hence, it becomes clear that Marais was strongly reliant on the principles of Darwinian evolutionary theory to substantiate his theory on the evolution of consciousness based on his behavioural observations.

Marais applies adaptation and natural selection throughout his argument and is quite specific concerning their consequences. Natural selection especially, is understood by Marais as the key mechanism of evolutionary change and he also identifies it as the "dark struggle for

life" as so many of his counterparts assumed. Marais therefore opted for Darwinism, a theory which is accepted as a paradigm in modern biology.

> Alternately, his contemporary, Sigmund Freud opts for Lamarckism as his preferred theoretical framework. As well known, modern genetics denies the validity of the inheritance of acquired characteristics, one of the key principles of Lamarckism. More recently, Memetics is a basic idea that has many avenues of interpretation. Basically, a meme is the analogous behavioural functional unit (replicator) that natural selection acts upon in much the same manner that the gene is the biological functional unit (replicator) that natural selection acts on (Dennet, 1990). Memes constitute ideas, ideals, beliefs and so forth that are passed on through interaction between vehicles such as human beings and organisms, in the same as the nucleus is the vehicle for genes to be passed on. Ancestral belief, ideals and such, could be easily passed on as a meme with the use of Neo- Lamarkism.

Marais was therefore not only a pioneer in terms of his primatological method but should also be acknowledged for his choice of framework (Darwinism) applied to explain his theory on the evolution of consciousness.

Marais's development of a theory on the evolution of consciousness

Continuity, Gradation and Hierarchy

As mentioned previously, Marais was well aware of Darwin's theory of evolution by natural selection. This formed the theoretical framework for his ideas regarding a phylogeny of behaviour, based on his many observations of animals. With closer inspection, one can also identify how similar Marais's ideas are to Darwin's concerning

the evolution of the mind. The following section was therefore aimed at achieving a deeper understanding of the comparison between Marais and Darwin with the use of their individual publications, *The Descent of Man* (Darwin) and *The Soul of the Ape* (Marais).

In the opening chapters of the *Descent of Man* a few fundamental ideas are brought forth that may have been a direct influence on how Marais conceptualized his theory. Firstly, the concept of continuity had a considerable significance. During this period the evolutionary scientists, philosophers, and Darwin himself relied on continuity. Continuity could be understood as identifying humans as part of the animal kingdom, but more significantly this continuity was extended to gradual gradations in both structure and behavior from the 'lesser' animals (insects) to the 'higher' animals (primates) and the paramount humans. Darwin tried avoiding linear progression and teleological interpretations (Ghiselin, 1973) but was not immune from them. These ideas were deeply engrained epistemologically, extending from Aristotle's *Scala Naturae* to St Augustine's *Chain of Being* and they still had come to fore strongly during the Victorian era. As Ruse (2012, p.191) noted, Darwin was "... a child of the Industrial Revolution, a Briton living at the time when his county ruled that waves and much land, too. It [the idea of progress] permeated his thinking and most of his countrymen." Darwin does however remove the uniqueness of humans in his *Descent of Man*, consequently rejecting humanity's special place in nature. He does this in his opening chapter by showing how structurally similar we are to other animals, mammals and primates in particular. Darwin states "It is notorious that man is constructed on the same general type or model with other mammals. All the bones in his skeleton can be compared with corresponding ones in a monkey, bat or seal." (Darwin, 2010, p.4).

Darwin describes how the brain of humans is similar to the brain of the orangutan as described by Huxley. Darwin then shows how we share the same pathologies, hence physiology, with other animals, as the same medicinal extracts are effective in alleviating the symptoms.

He also shows how the same parasites internally and externally affect both humans and mammals. His section on embryonic development beautifully illustrates continuity from lesser to higher forms, with a dependency on Haeckelian recapitulation. He quotes Huxley's response to the question

> does man originate in a different way from a dog, bird, frog or fish? ...the reply is not doubtful for a moment; without question, the mode of origin and the early stages of the development of man are identical with those of the animals immediately below him in the scale: without a doubt in these respects, he is far nearer to apes, than the apes are to the dog. (Darwin, 2010, p.7).

Darwin hence had a strong sense of continuity within his interpretation of the evolution of life. He demonstrates how mammals, birds and insects share certain fundamental life histories, including gestation periods, reproduction and sex difference.

Darwin's section on rudimentary organs highlights the effects of use and disuse on certain structures and how they are eventually reduced or become non-functional. He states

> In order to understand the existence of rudimentary organs, we have only to suppose that a former progenitor possessed the parts in question in a perfect state and that under changed habits of life they become greatly reduced, either from simple disuse, or through the natural selection of those individuals which were least encumbered with a superfluous part. (Darwin, 2010, p.15).

From this quote the connection of descent with modification becomes quite clear.

Darwin dedicated his second chapter to the extension of this continuity in anatomy and physiology into the mind or behavior. He illustrated this, with numerous examples, showing that lower animals have the ability to perform intelligent acts and that higher animals also have complex instincts. In this section of his work the

connection from lower to higher animals becomes more apparent. He states

> We must also admit that there is a much wider interval in mental power between one of the lowest fishes, a lamprey or lancet, and one of the higher apes, than between an ape and man; yet this immense interval is filled up by numberless gradations(Darwin, 2010, p.17-18).

From this quote the gradations of animals connect infinitely in a stream from lowest to the higher animals and the gap between them lower animals and apes is much larger than that identified between apes and humans. Hence this continuity extends from animal into human via infinite gradations but more specifically, this continuity is then superimposed onto humans, who still display a hierarchy via gradations. This hierarchy is expressed in humans as a scaling from the savage to the Newton; thus, the theme of continuity extending to humans follows a hierarchical scaling from primitive (savage races) to derived (Victorian Caucasians). It should be mentioned that Darwin was not in favour of using his theoretical theory to emphasize racial science and that earlier ideas, especially the dominant school of thought, physiognomy, discovered an almost direct claim that human superiority could itself have been developed out of social behavior in animals (Jann, 1992).

The concept of continuity of animal into human, connected by infinite gradations of mental power in a hierarchical system, can also be found in Marais's writings. Marais illustrates this continuity of animal into human with examples from his animal behavioral observations. In Marais's terminology this continuity is described as infinite gradations of the expression of instincts (phyletic memories) and intelligence, learning and reasoning (causal memories). Similar to Darwin, Marais saw this continuity as succeeding along a set hierarchical path towards the penultimate: humans. When the concepts of continuity and hierarchy are considered in relation to filling the gap between human and animal mentality Marais, like Darwin, constructed a connection from the highest animal (monkeys

and apes) through the "lowest human" (savages) to the "highest human" (Caucasians). An interesting comparison of this connection between higher animal, lower human and higher human can be found in Darwin's opening chapter whereby he observes animal temperament for tea, alcohol and tobacco by providing examples of monkey taste perception in relation to neural activity. Darwin finds that, based on the similar effects displayed by both monkeys and humans in relation to their physiological responses, these animals are homogenous with humans. Marais carried out the same study on his baboons and other species but he illustrates continuity in a somewhat different manner.

In his book, *The Soul of the Ape,* Marais mentions what he terms "pain of consciousness". This pain of consciousness is a direct consequence of the recent acquisition of the causal memory and the loss or suppression of the phyletic memory. Hence only animals recently endowed with a substantial degree of the causal memory would in effect experience this pain of consciousness which is expressed behaviorally as what Marais termed Hesperian Depression. Marais then speculates that this Hesperian Depression (specific to those with recent acquisition of causal memory) can be alleviated with the use of alcohol. For this reason he does studies on various animals and humans observing their level of addiction in response to alcohol intake. If the animal shows signs of addiction to alcohol and develops a taste or temperament for it, the animal is relieving the awkwardness of the pain of consciousness and also Hesperian Depression, which is only active in the causal memory agents. Pain of consciousness could be interpreted within the framework of humans or animals realizing self, yet this self-knowledge comes with a cost. The removal from the beast within and the detachment from nature due to this causal memory is depicted by the pain of consciousness.

From these studies Marais argues how the savage (Hottentots) as well as baboons have an addiction to alcohol and hence he makes the assumption that they have recently acquired the causal memory and

the consequent pain that they relieve with alcohol. He goes on to show how 'lower' animals such as the ververt monkey (*Cercopithecus aethiops pygerythrus*), warthog (*Phacochoerus aethipicus aethiopicus*), and klipspringer (*Oreotagus saltator*) do not show any signs of acquiring a taste for alcohol due to their lack of the pain of consciousness coupled with the causal memory (Marais, 2002, p.99). Within humans, Marais tries to show that Hottentots have a depressed demeanor and as such the pain of consciousness has been a recent advent in these individuals' mental psyche. This, Marais claims, makes them similar to the baboons and different from more "advanced" races of humans whereby the causal memory has been fully established. He therefore illustrates continuity between animal (baboon) and human and then makes a hierarchical connection from the highest animal to the lowest human via the endowment of the causal memory coupled with the pain of consciousness.

From this discussion one can argue a close resemblance to Darwin's ideas on continuity, hierarchy and gradation and Marais's work. However, Marais's personal struggles pervade his interpretation of behavior. In his chapter on Addiction and Depression, (Marias, 2000, p.89), one can identify his personal journey to understand addiction, depression and the use of intoxicants in an evolutionary framework and all three of these spheres had a direct and extremely influential contribution to his life and his thinking. Hence, Darwin uses the commonality of taste for stimulants between human and animal to project continuity, whereas Marais uses the commonality of the psychological effects from the use of stimulants to project continuity.

Lower versus Higher Mental faculties

The nature nurture debate was a controversial topic and at the same time an integral component in the understanding of the development

and evolution of the mind. This was the case for Darwin as well as Marais. From the onset it should be noted that both individuals were attempting to derive a theory based on the evolution of the mind. Marais's was undoubtedly strongly influenced by Darwin's theory in this respect.

However, they had the same fundamental approach but, as will be shown below, differed in their solutions to some of the problems and issues relating to the evolution of the mind. Darwin for one tried to show that all of the behaviours that are considered as human are in fact diversely spread across species from the lower animals to the higher animals, each endowed with a different degree of mental powers and predominantly linked in the form of instincts. Darwin states

> Spiritual powers cannot be compared or classed by the naturalists; but he may endeavour to shew [*Sic*], as I have done, that the mental faculties of man and the lower animals do not differ in kind, although immensely in degree."(Darwin, 2010, p.113).

Marais alternatively tried to show that all animals, including human were subject to the endowment of instinct as well as individual causal memory, but in as much as he shows continuity between species, he insists on a clear separation in the mental faculties once we reach the level of mammals.

As mentioned previously Marais used many different examples of animal behaviour, some of which was from his own studies and quite a few from other individuals' observations including some of Darwin's. Darwin did much the same in terms of using personal observations as well as from other sources such as Reggner, who studied monkeys. What is interesting though is that the animal study subjects were similar, for example, it is well known that Darwin observed instinctual behaviour in ants and bees so did Marais, other examples include the use of monkeys, birds and apes which Marais makes reference to quite often. This could be related to Darwin's

chapter on the *On the Affinities and Genealogy of Man*, whereby he tries to establish a phylogeny from the lowest animals such as fishes to the reptiles to the birds and mammals. Within this phylogeny Darwin clearly hypothesised that human's progenitor (ancestry) would be from the primates but more specifically from the African apes and anthropomorphous apes. Darwin states

> Our great anatomist and philosopher, Prof. Huxley, has fully discussed this subject, and has come to the conclusion that man in all parts of his organisation differs less from the higher apes, than these do from the members of the same group.(Darwin, 2010, p.116).

Additionally he states

> No doubt man, in comparison with most of his allies, has undergone an extraordinary amount of modification, chiefly in consequence of his greatly developed brain and erect position; nevertheless we should bear in mind that he 'is but one of several exceptional forms of Primates'. (Darwin, 2010, p.120).

Furthermore he states

> And as man under a genealogical point of view belongs to the Catarhine or Old World stock, we must conclude, however much the conclusion may revolt our pride, that our early progenitors would have been properly designated.(Darwin, 2010, p.121).

More specifically pertaining to Africa Darwin suggests the following

> In each great region of the world the living mammals are closely related to the extinct species of the same region. It is therefore probable that Africa was formerly inhabited by extinct apes closely allied to the gorilla and chimpanzee; and as these two species are now man's nearest allies, it is somewhat more probable that our early progenitors lived on the African continent than elsewhere.(Darwin, 2010, p.121).

I am sure that many researchers pursued this speculation of Darwin that firstly our closest living relatives within the animal kingdom are the great apes and anthropomorphous apes but in general Primates, secondly that this progenitor would most probably come from Africa

from which we find the Old World stock. It seems as if Marais was also enticed by Darwin's speculation hence his choice of study subject, the primates, and secondly his location of study, within Africa. This in relation to availability of specimens to study (baboons) as well as easy access for observation (Waterberg Mountains) makes sense in terms of his choice of animal as well as location to be studied.

Instincts

As mentioned both Marais and Darwin thought that all animals, humans included, have instincts of the same type but consider that the degree of their expression to vary across different species. They, however, approach the topic of the mind (causal memory in Marais's terminology) differently. Darwin has a more holistic approach into his enquiry of the mind whereas Marais has a very rigid hierarchy that tends to see qualitative difference when compared to instincts, particularly in relation to the mind of primates. Darwin on the other hand tries to show continuity throughout the animal kingdom and only sees a possible separation (hiatus) at the level of the social animals, with his clear focus on morals as the dividing factor between human and animal. However, even within this separation, he retains continuity with the use of his social instincts such as sympathy linking lower to higher.

Marais considers instincts to be the source of relatively fixed behaviours and refers to them as phyletic memories. He explains

> Notwithstanding this, it would still be convenient to speak of instinct as phyletic memory. There are many analogies between memory and instinct, and although these may not extend to fundamentals, they are still of such a nature that the term phyletic memory will always convey a clear understanding of the most characteristic attributes of instinct (Marais, 2002, p.60).

In terms of his definition of instincts, Marais states

> Instinct in its purest form may therefore be described, from an evolutionary point of view, as a hereditarily established tendency to certain definite behavior selected as a reaction to, and as most beneficial, under certain normal environmental conditions (Marais, 2002, p.60).

His fundamental instincts include sexual sense (reproduction and care of young), fear of death (counteracting common environmental dangers) and procuring food as previously mentioned. Significantly, Marais believes that the fixed nature of instinctive behavior is due to the fact that it is so specialized. This overspecialization may eventually lead to extinction in much the same way a structural or somatic specialization may lead to extinction due to the fixity and lack of variability in a changing environment which might pose new challenges to the species survival. Marais gives numerous examples of how this fixity could be disadvantageous from his animal observations.

Some of these were previously noted by Darwin. For example, Marais uses ant behavior to show how instinct was fixed and hereditary and so did Darwin. However, they use different behaviors to illustrate the same concept. Darwin has a section on slave-making ants which shows variability of instincts under the control of natural selection; Marais illustrates direct fixity with his study, observing ants crossing a bridge. He uses Darwin's Galapagos lizard example from the journal of researchers from which he explains how this animal will face death itself than go back into the water where it initially fled from predators in the water and hence the development of the instinct. Moreover, Marais stresses how much more deleterious a behavioral fixation (phyletic memory) could be in relation to a somatic fixation in the struggle for existence:

> It is sometimes a very slight and apparently insignificant morphological modification which decides the fate of an animal under a changed environment...Organic modification, however, is never as powerful in limiting an animal to a certain environment as psychic specialization. An instinct is in this respect tyrannous. Where it is a dominant factor in behaviour, an animal will overcome the fear of death itself –that strong

> determinant of action – rather than violate the inborn direction. In nearly all examples of non-primate behaviour I have described, this compelling power of hereditary memory will be apparent.... Even in cases where instinct is strictly correlated to organic structure it seems evident that the bodily specialization never so surely confines an animal to a limited environment as the attendant instinct.(Marais, 2002, p.84).

Marais does believe that fixed behaviors can change but only in respect to a new instinct developing separately from the old. He states "Where an instinct is replaced or modified in nature, it is done not by acquisition of an individual causal memory but by the evolution of a fresh hereditary memory through natural selection." (Marais, 2002, p.83). Marais further believes that reason or individual causal memories do not develop into instincts as they appear through two separate evolutionary pathways.

In this regard he differs from Darwin who believes that a rational habitual action can become an instinct. Darwin states

> The anthropomorphous apes, guided probably by instinct, build for themselves temporary platforms; but as many instincts as largely controlled by reason, the simpler ones, such as this of building a platform, might readily pass into a voluntary or conscious act. The orang is known to cover itself at night with the leaves of the Pandanus; and Brehm states that one of his baboons used to protect itself from the heat of the sun by throwing a straw-mat over its head. In these latter habits, we probably see the first steps towards some of the simpler arts; namely rude architecture and dress, as they arose amongst the early progenitors of man.(Darwin, 2010, p.29).

Marais highlights two important aspects in terms of the understanding of instincts which are definite or fixed behaviors and also significantly, heritability. Darwin dedicates an entire chapter to the idea of instincts in his book *The Origin of Species* (1859).However, Darwin was more cautious in his conceptualization of instincts: "I will not attempt any definition of instinct." (Darwin, 2004, p.230).He then goes on to describe in a general manner what instincts are

> An action, which we ourselves should require experience to enable us to perform, when performed by an animal, more especially by a very young one, without any experience, and when performed by many individuals in the same way, without their knowing for what purpose it is being performed, is usually said to be instinctive (Darwin, 2004, p.230).

It is important to note that Darwin does not restrict himself to the definition that Marais has provided namely concerning the fixed nature of instinctual behaviors. Darwin states

> It will be universally admitted that instincts are as important as corporeal structure for the welfare of each species, under its present conditions of life, it is at least possible that slight modifications of instinct might be profitable to a species; and if it can be shown that instincts do vary ever so little, then I can see no difficulty in natural selection preserving and continually accumulating variations of instinct to any extent that may be profitable. It is thus, as I believe, that all the most complex and wonderful instincts have originated.(Darwin, 2004, p.231-232).

From this statement it becomes clear that Darwin considered instinct behavior as variable even if this variability is minute. It is interesting to note that even though they use the same organisms to illustrate instinctive behaviors, their interpretation is different. Darwin further stipulates

> As some degree of variation in instincts under a state of nature, and the inheritance of such variations, are indispensable for the action of natural selection, as many instances as possible ought to have been given; but want of space prevents me. I can only assert that instincts do vary – for instance, the migratory instinct, both in extent and direction, and in total loss." (Darwin, 2004, p.234).

Hence variation within instinctive behavior is strongly maintained in Darwin's interpretation of instinctual behavior because variability is an essential ingredient for the function of natural selection.

What's more significant is that Darwin is suggesting that variability within and between instinctive behaviors could be passed on or inherited. This was a fundamental construct of Marais's

understanding of instincts. Darwin states "The possibility, or even the probability, of inherited variations of instinct in a state of nature will be strengthened by briefly considering a few cases under domestication." (Darwin, 2004, p.235). Darwin's domestic instincts are ideally suited examples showing that instincts might be variable and that these variations are heritable.

Additionally Darwin states

> Domestic instincts, as they may be called, are certainly far less fixed or invariable than natural instincts; but they have been acted on by far less rigorous selection, and have been transmitted for an incomparably shorter period, under less fixed conditions of life. (Darwin, 2004, p.236).

Darwin concludes by stating

> that domestic instincts have been acquired and natural instincts have been lost partly by habit, and partly by man selecting and accumulating, during successive generations, peculiar mental habits and actions, which at first appeared from what we must in our ignorance call an accident. (Darwin, 2004, p.239).

From this it seems peculiar that Marais never considered this variant character of instincts, as it has been documented that he had conducted animal captive studies on wild and a few domesticated pets that he observed external to his longitudinal non-captive studies (Rousseau, 2000).

Concerning heritability, Darwin identifies and gives an explanation as to what happens to sterile social insects and their specific instincts, how will they be passed on? Darwin states "I allude to the neuters or sterile females in insect-communities: for these neuters often differ widely in instinct and in structure from both the males and fertile females, and yet, from being sterile, they cannot propagate their kind." (Darwin, 2004, p.259). Darwin's explanation for this includes him identifying with the group and the individual, he considers the community as an organism and as such the organism can still propagate and pass on individual instincts via the community as a whole. Darwin states

> ...the difficulty lies in understanding how such correlated modifications of structure could have been slowly accumulated by natural selection. This difficulty, though appearing insuperable is lessened, or as I believe, disappears, when it is remembered that selection may applied to the family as well as to the individual, and may thus gain the desired end. (Darwin, 2004, p.261).

He summates by stating

> Thus I believe it has been with social insects: a slight modification of structure, or instinct, correlated with the sterile condition of certain members of the community: consequently the fertile males and females of the same community flourished, and transmitted to their fertile offspring a tendency to produce sterile members having the same modification. And I believe that this process has been repeated, until that prodigious amount of difference between the fertile and sterile females of the same species has been produced, which we see in many social insects.(Darwin, 2004, p.262).

It seems odd that Marais never considered this aspect of the instincts especially in terms of his ten year study on termites (Marais, 1969), whereby he considers the termitary an organism in much the same way that Darwin considered social insect communities.

Additionally Darwin gives a lengthy review in the *Descent of Man* pertaining to social instincts giving rise to morals, Marais never considered this even though his observations include behaviors such as altruism and kinship. Darwin concludes the following in terms of his understanding of instincts and its relation to natural selection

> No doubt many instincts of very difficult explanation could be opposed to the theory of natural selection – cases in which we cannot see how an instinct could possibly have been originated; cases in which no intermediate gradations are known to exist; cases of instinct of apparently such trifling importance, that they could hardly have been acted on by natural selection; cases of instincts almost identically the same in animals so remote in the scale of nature, that we cannot account for their similarity by inheritance from a common parent, and must therefore believe that they have been acquired by independent acts of natural selection. (Darwin, 2004, p.259).

Marais does not consider the domestic instincts, social instincts, the variable instincts and also heritability of sterile instincts in social insects, even though he was well aware of both Darwin's ideas as well as evidence from his personal experiments and observations. Furthermore, Marais has a very definite, almost absolute definition of instincts whereas Darwin seems more conservative in his approach to instincts including a broad, diverse view of these mental faculties as many behavioral manifestations under the effects of natural selection. Marais possibly ignored or disagreed with Darwin's interpretation of instincts or alternatively he chose to focus on one aspect of instincts to ensure simplicity of understanding within his theory.

Changing instincts (use and disuse)

In consideration of the development of new instincts both Darwin and Marais share a similar understanding in terms of how instincts change. Instincts in this regard are developed from the habitual use of a specific behavior that eventually becomes an instinct that is hereditarily passed on. Conversely, the disuse of the specific behavior leads to non-functionality and loss of the behavior. Marais states

> In explanation of my definition of instinct, it must be pointed out that every set of muscular actions originally evolved in an organism by its environment must be either advantageous or disadvantageous. The organism that engages in such reactive muscular movements as would give it a better chance of surviving would retain that chance only by constantly making similar movements, under similar conditions, and so certain definite actions become selectively established. That seems to have been the evolutionary pathway of instinct (Marais, 2002, p.61).

As mentioned in the evolutionary theory section, Darwin depended on Lamarck's theory occasionally in terms of the use and disuse of both somatic as well as behavioral modification. Darwin states

> Whether the several foregoing modifications would become hereditary, if the same habits of life were followed during many generations, is not

known, but is probable" (Darwin, 2010, p.70) " We have seen that man incessantly presents individual differences in all parts of his body and in his mental faculties."...."We may feel assured that the inherited effects of the long-continued use or disuse of parts will have done much in the same direction with natural selection. Modifications formerly of importance, though no longer of any special use, will be inherited." (Darwin, 2010, p.437).

Hence, Darwin and Marais was aware of and used Lamarckian principle to explain modification of behaviors however, Marais seems to have had a much stronger dependency on Lamarckism than Darwin. As Rousseau points out from the correspondence between Marais and his son, Marais still believed in Lamarckism after his son had sent him the publication debunking Lamarck from Weismann's work. (Rousseau, 2000, p.53) states

> Thus he would write, after reading another draft chapter, that what his father had written was not in accordance with Weismann's theory, the nature of it, but never from any of his own work. I never much believed in his own views because, for one thing, his denial of the transmission of acquired characteristics is not true. Fox-Terriers are born with beautiful, amputated tails. I myself have seen three such litters.

For this reason it seems as if Marais had a much deeper dependency than Darwin who merely used it as an alternative to explain hereditary within his theory.

Reason and causality

When dealing with the higher mental faculties the first difference in terms of understanding becomes apparent between Marais and Darwin. Marais considered the higher mental faculties as one mechanism which he referred to as the individual causal memory. Marais states

> If we look at the development of mental processes in the primate from one point of view – namely, in relation to the animals struggle for existence – it is apparent that the process is fundamentally one of memory – memory in the human sense. It is not merely the memory of things in relation to locality, which even insects possess to a high degree. It is the ability to

> memorise the relation of cause and effect. It is the ability to accumulate what may be termed individual causal memories" (Marais, 2002, p.59).

This very broad definition of causality could encompass a list of different mental faculties such as intelligence, learning, reasoning, rationalizing and so on. This broad definition was not unique to Marais and as Ghiselin, (1973, p.966) mentions this was an understanding which was popular in Marais's time:

> In the older literature "instinct" was often contrasted with another concept, sometimes called reason, sometimes called intelligence. The latter terms could designate anything from the most elemental forms of learning to the highest manifestations of reflective thought processes. Instincts were complex behavior patterns, unlearned and yet adaptive.

Darwin understands the mind and its evolution as complex. He considers other facets outside of reasoning and intelligence and extends his understanding of higher mental faculties to emotions, imagination, imitation, religiosity and morality. In the *Descent of Man*, Darwin identifies the different behavioral phenomena which the scientific as well as general public considers unique human characteristic mental actions. These include the emotions such as pain, anger or happiness, imitation, attention, memories, imagination, dreaming, reasoning to mention a few. He tries to show how all of these apparently uniquely human mental faculties are spread across the animal kingdom maintaining continuity but that its expression is distributed at differing degrees. For example when discussing emotions, Darwin states

> We will now turn to the more intellectual emotions and faculties, which are very important, as forming the basis for the development of the higher mental powers. All animals manifestly enjoy excitement and suffer from ennui, as may be seen with dogs, and, according to Rengger, with Monkeys. All animals feel Wonder, and may exhibit Curiosity. They sometimes suffer from this latter quality, as when the hunter plays antics and thus attracts them; I have witnessed this with deer, and so it is with

> the wary chamois, and with some kinds of wild-ducks.(Darwin, 2010, p.22).

Darwin shows with the use of animal and insect behavioral observations that higher and lower animals express each of the above mentioned faculties just at different degrees of endowment. His section on reasoning is of particular interest as it directly relates to Marais's individual causal memories. Darwin states

> Of all the faculties of the human mind, it will, I presume, be admitted that *Reason* stands at the summit. Few persons any longer dispute that animals possess some power of reasoning. Animals may constantly be seen to pause, deliberate, and resolve. It is a significant fact, that the more habits of any particular animal are studied by a naturalist, the more he attributes to reason and the less to unlearnt instincts"...."No doubt it is often difficult to distinguish between the power of reason and that of instinct.(Darwin, 2010, p.25).

Darwin provides the following animal studies to support his view of reasoning:

> So many facts have been recorded in various works shewing [*Sic*] that animals possess some degree of reason, that I will here give only two or three instances, authenticated by Rengger, and relating to American monkeys, which stand low in their order. He states that when he first gave eggs to his monkeys, they smashed them and thus lost much of their contents: afterwards they gently hit one end against some hard body, and picked off the bits of shell with their fingers. After cutting themselves only once with any sharp tool, they would not touch it again, or would handle it with the greatest care." (Darwin, 2010, p.26).

These examples are similar to Marais's clearly illustrating modifying behaviour according to the process of causality in animals.

Continuity between human and animal is strongly projected in both Marais's animal examples as well as Darwin's. Additionally, Darwin states

> It has, I think, now been shewn that man and the higher animals, especially the Primates, have some few instincts in common. All have the

> same senses, intuitions and sensations-similar passions, affections, and emotions, even the more complex ones; they feel wonder and curiosity; they possess the same faculties of imitation, attention, memory, imagination, and reason, though in very different degrees. Nevertheless many authors have insisted that man is separated through his mental faculties by an impassable barrier from all the lower animals.(Darwin, 2010, p.26).

From this statement Darwin clearly suggests that higher mammals, particularly primates possess a low number of shared instincts but all of them have the ability to express higher mental faculties.

Marais suggests the same idea but his higher mental faculties only include the individual causal memories. He states

> It becomes clear that, generally speaking, in the non-primate most memory necessary for it to exist in a certain definite environment is phyletic and can remain latent for an indefinite time until it is called into activity through some suggestion from without. In the primate, little such memory is inborn.(Marais, 2002, p.76).

Additionally, Marais states

> Both types of mentality can therefore be recognized and distinguished in all the higher mammalia in different degrees, but between the highest non-primate animal and the lowest primate there is a considerable hiatus in their relative activity. The low primate compared with the high non-primate seems somewhat beyond the transition stage.(Marais, 2002, p.68).

Causality of action is clearly demonstrated from Darwin's examples

> It has often been said that no animal uses any tool; but the chimpanzee in a state of nature cracks a native fruit, somewhat like a whalnut, with a stone. Rengger easily taught an American monkey thus to break open hard palm-nuts, and afterwards of its own accord it used stones to open other kinds of nuts, as well as boxes. It thus also removed the soft rind of fruit that had a disagreeable flavour. Another monkey was taught to open the lid of a large box with a stick, and afterwards it used the stick as a leaver to move heavy bodies; and I have myself seen a young orang put a stick into a crevice, slip his hand to the other end, and use it in the proper

> manner as a lever. In the cases just mentioned stones and sticks were employed as implements; but they are likewise used as weapons.(Darwin, 2010, p.28).

Marais uses similar examples of causality as mentioned previously when pertaining to his stone tool manipulation of the Baobab tree and also irrigated water channels for cooling observed from the Chacma baboon.

Morals to Darwin was one of the most unique fundamental characteristics of human behavior and he shows how it was developed from lower organisms via the slow continuous gradations of complex social instincts. Darwin states "I fully subscribe to the judgement of those writers who maintain that of all the differences between man and the lower animals, the moral sense or conscience is by far the most important" (Darwin, 2010, p.40). Subsequently, he adds

> The following proposition seems to me in a high degree probable-namely, that any animal whatever, endowed with well-marked social instincts, would inevitably acquire a moral sense or conscience, as soon as its intellectual powers had become as well developed, or nearly as well developed, as in man. For *firstly*, the social instincts lead an animal to take pleasure in the society of its fellows, to feel a certain amount of sympathy with them, and to perform various services for them. The services may be of a definite and evidently instinctive nature; or there may be only a wish or readiness, as with most of the higher social animals, to aid their fellows in certain general ways.(Darwin, 2010, p.41).

Therefore Darwin believed that morals were truly considered the ultimate divider between human and animal and he shows how morals are actually derived from the accumulation of social instincts. This would suggest that Darwin believes that instincts could have led to higher mental faculties whereas Marais believes that this is not possible, rather the mental faculties are divided into two separate isolated developmental pathways.

Evolutionary development and application

When considering the actual application of lower and higher mental behavior within the work of Darwin and Marais we find similarity in terms of the structural framework which includes the continuity of human and animal, hierarchy and the connecting links gradually incorporated with infinite gradations of endowment. However, as mentioned Darwin tries to show continuity by highlighting that what was considered as human mental faculties are actually identified in the instincts of lower animals. Marais shows continuity to highlight our connectionism to each other but clearly separates animals when pertaining to primates and higher mammals in terms of the endowment of the causal memory. Both individuals believe that the endowment of these mental faculties was expressed in different degrees within the animal kingdom. Marais's summative points of his theory are described as follows:

a) That the behaviour of all organisms is controlled by 2 different types of mentality
b) That the foundation of the newer mentality is the ability to accumulate memories with causal comprehension
c) That one is not the evolutionary culmination of the other
d) That phyletic mentality is inhibited by individual causal mentality and becomes inactive where the latter controls behaviour
e) That the one is inherited as a complete mechanism for reacting to the customary environmental events
f) That in the other the hereditary extends only to the ability to accumulate individual memories, which renders possible beneficial reaction to all environmental events, whether customary or unusual
g) That both these types of mentality exist in different degrees of activity in all the higher mammalian.

(Marais, 2002, p.77)

The interpretation and definition of the lower and higher mental faculties are discussed differently, between Marais and Darwin. Marais hypothesizes that instinct and intelligence have two different evolutionary pathways and that they did not develop into each other or from each other. He states

> Nor can I quite agree with Professor Bergson's further assertion that these two types of mind are the outcome of two divergent pathways in evolution...In the meantime I wish to emphasize that this speculation of Professor Bergson's seems irrefutable: One cannot speak of 'intelligence' as an evolutionary culmination of 'instinct' in the same sense as one would speak of the wing of the bird as the evolutionary outcome of the fore-arm of the reptile. It must always be remembered that we are dealing with functions and not with organs, and there can be no question that 'intelligence' is the function of the new organ – an organ quite different from that which governs instinct. In the brains of primates and non-primates the organs of instinct and intelligence function in different degrees. It would therefore be incorrect to speak of 'intelligence' as transformation of 'instinct' as one might perhaps speak of flying in the bird as a transformation of walking in the reptile, which is an evolved general function of the same transformed organ – in the case of instinctive and intelligent mentality they are different functions of different organs. (Marais, 2002, p.68).

Darwin has a different view on the development of these two mental faculties, as he states

> The fewness and the comparative simplicity of the instincts in the higher animals are remarkable in contrast with those of the lower animals. Cuvier maintained that instinct and intelligence stand in an inverse ratio to each other; and some have thought that the intellectual faculties of the higher animals have been gradually developed from their instincts. But Pouchet has shewn [*Sic*] that no such inverse ratio really exists. Those insects which possess the most wonderful instincts are certainly the most intelligent. In the vertebrate series, the least intelligent members, namely fishes and amphibians, do not possess complex instincts; and amongst mammals the animal most remarkable for its instincts, namely the beaver, is highly intelligent. (Darwin, 2010, p.19).

Additionally he states:

Although the first dawnings of intelligence, according to Mr. Herbert Spencer, have been developed through the multiplication and co-ordination of reflex actions, and although many of the simpler instincts graduate into actions of this kind and can hardly be distinguished from them, as in the case of young animals sucking, yet the more complex instincts seem to have originated independently from intelligence. I am, however, far from wishing to deny that instinctive actions may lose their fixed and untaught character, and be replaced by others performed by the aid of the free will. On the other hand, some intelligent actions - as when birds on oceanic islands first learn to avoid man – after being performed during many generations, become converted into instincts and are inherited. They may then be said to be degraded in character, for they are no longer performed through reason or from experience. But the greater number of the more complex instincts appear to have been gained in a wholly different manner, through the natural selection of variations of simpler instinctive actions. Such variations appear to arise from the same unknown causes acting on the cerebral organization, which induce slight variations or individual differences in other parts of the body; and these variations, owing to our ignorance are often said to arise spontaneously. We can, I think, come to no other conclusion with respect to the origin of the more complex instincts, when we reflect on the marvelous instincts of sterile worker-ants and bees, which leave no offspring to inherit the effects of experience and modified habits." ..."Although a high degree of intelligence is certainly compatable with the existence of complex instincts, as we see in the insects just named and in the beaver, it is not improbable that they may to a certain extent interfere with each other's development. Little is known about the functions of the brain, but we can perceive that as the intellectual powers become highly developed, the various parts of the brain must be must be connected by the most intricate channels of intercommunication; and as a consequence each separate part would perhaps tend to become less well fitted to answer in a definite and uniform, that is instinctive, manner to particular sensations or associations." (Darwin, 2010, p.20).

Darwin was conservative in his views on development of these mental faculties, ideally describing that an instinct could develop out of reason from the habitual use and disuse of the behavior and claiming that the inverse is not possible. Darwin also states that the he has no clue as to the origin of these mental faculties: "In what manner the mental powers were first developed in the lowest organisms, is as hopeless as an enquiry as how life first originated. These are problems for the distant future, if

they are ever to be solved by man." (Darwin, 2010, p.17).Marais speculates

> This is not advanced as a demonstrable theory. It is no more than an attempt to show that it is hardly possible to imagine conditions existing anywhere in nature at any time which would not in some degree tend towards the evolution of such an attribute. If these present conditions are self-evidently likely to select it, how much more likely for instance, would not its birth and growth have been during the earlier history of the planet, during the Pleistocene period, when cataclysmic movements of its crust and great and repeated climatic changes still belonged to the usual and customary category of natural events."(Marais, 2002, p.85).

Both agree on the fewness of instincts in human compared to other animals. Marais seems to concur with Cuvier's claiming an inverse ratio in terms of instinct and intelligence but he does not believe that the instincts replace the intelligence or that the one develops into the other. He maintains that they are separate entities both still present in the individual, while their expression leads to the submergence of one and the dominance of the other. Marais states:

> The phyletic history of the primate soul can clearly be traced in the mental evolution of the human child. The highest primate man is born an instinctive animal. All its behaviour for a long period after birth is dominated by the instinctive mentality. The knowledge of its natural food supply and where to seek it is inborn. It has a knowledge and fear of falling, a phyletic memory of an arboreal past. It clings to the mother. It knows how to show distress by its cries. But it has no memory, no conception of cause and effect, no consciousness. Then, as it grows, the new mentality slowly, by infinite gradations, emerges. The earliest sign of its dawning is the dim appearance of memory, and a mother's first glad exclamation in recognition of its coming has always been, 'My baby remembers'. Its mind can register, vaguely and uncertainly at first, an individual causal memory. And it is here that the wonderful transition occurs, a transition which the phyletic evolution of the soul of the chacma exemplifies. As the new soul, the soul of individual memory slowly emerges, the instinctive soul becomes just as slowly emerged ...The one is not an outgrowth of the other. The individual soul seems gradually to overshadow the instinctive one. For a time it is almost as though there were a struggle between the two. The control is divided. But in the end the new soul ousts the instinctive one from directing the mechanism which controls the

behaviour of the individual, and assumes forever after the predominant place. Surely in this manner and in no other, the higher primate soul evolved from that shadowy beginning of individual causal memory which we first clearly see in the higher mammals." (Marais, 2002, p.78).

Ontogenetic development of mental faculties

Concerning the ontogenetic development of the mental faculties during the individual's lifetime, Marais states:

> All these stages that we see in nature in different degrees in different animals are convincingly portrayed in the ontogenetic, or individual, development of the primate soul. It is known that the development, both embryonic and post-natal, of the organism is to a certain extent a recapitulation of the evolution of the species. To this general rule mental evolution affords no exception. (Marais, 2002, p.78).

In many regards he believes that the phyletic and individual causal memory have an ontogenetic development during the individual's lifetime. To use humans as an example, Marais believes we were born with instincts or phyletic memories which are key for survival and as our development progresses the instincts become submerged and the individual causal memories emerge until we reach adulthood, when the full emergence of the causal memories becomes established and the instincts are completely submerged. Marais states:

> Nor on the other hand, is instinct – or phyletic memory – absent in the primate. Its activity is submerged by the soul of individual memory (cf. Freuds theories), and as we ascend higher in the scale to the anthropoids, the more noticeable does this submergence become. (Marais, 2002, p.67).

The above mentioned ideas seem to synthesize Freud's Oedipus complex, psychoanalysis and regressive stages which include the id (unconscious) and the ego (consciousness) with the Haeckel's concept of recapitulation (Gould, 1977).Marais carried out experiments on human subjects whereby he hypnotized them and noticed that their

senses were dramatically heightened in a hypnotic state. He believes hypnosis paralyses the conscious psyche and allows the subconscious to surface hence the fundamental instincts, such as our sense perception, surface. This has an uncanny similarity to Freud's regressed states of psychoanaylysis as well as Freud's deep dependency on Haeckel's recapitulation in his post-humously published phylogenetic fantasy (Gould, 1977 and Gould, 2003).

Darwin does not include these philosophical constructs on the function of consciousness in relation to ontogenetic development and activity. It was probably after Darwin's time. Darwin does, however, use recapitulation to strengthen his phylogenetic continuity at the ontogenetic level. The history of our past ancestry is systematically represented in the development of the embryo and fetus.

Mental Organs

Both individuals believed that the brain was the organ of interest in relation to the evolutionary changes characterized by behavior. Darwin extends this into a phylogeny of humans clearly identifying primates as the progenitor to man and Marais seems to follow the same trend. Marais states

> ...it is possible that pure instinct may be described as 'psychic' only in the sense that it employs, and in a similar manner, the same motor mechanism which the indeterminate mentality makes use of, and that both function through the central nervous system, though quite certainly in different centres. (Marais, 2002, p.60).

This is the same organ, the brain, which has different functional areas (centres) that represent the different mental faculties. Additionally he adds

> No generalizing perfection of hand or foot, nor the attainment of the upright position, nor the transformation of any function in any single organ could render a species immune from the danger inherent in suddenly changing natural conditions. It is not conceivable that it could have been attained in any other way than through *a modification of the brain and its*

> *functions*. In other words, the attributes selected had necessarily to be psychic. (Marais, 2002, p.85).

Hence, both Darwin and Marais believe that the mental faculties are a function of the brain and nervous system.

Selective Cause

When considering the selective cause, natural selection is the mode of operation, but they view it in different ways. Marais provides an extremist view of Darwinian application in the sense that he strictly believes that the outcome of natural selection certainly leads to specialization. He states:

> All transformations in organic matter, all modifications or organ function brought about by natural selection, are specializations. That is to say, every modification is selected to react favourably under certain definite sets of natural conditions, and the organism in which such modification has been selected is limited, as far as that modification is concerned, to the special set of natural conditions which selected it. (Marais, 2002, p.79).

Additionally he adds:

> Some specializations may appear to be more extensive adaptations to natural conditions than others, but in any case it is only in a relative sense that a modification can be described as general. However widespread these conditions may be, the modification which embraces them is nonetheless a specialization, and the limitation of the organism to the specific environment in which these selecting conditions exist is an inevitable condition. (Marais, 2002, p.79).

He then describes how these specializations are disadvantageous; "No specializations in nature are without an attendant number of disadvantages." (Marais, 2002, p.79-80). Furthermore, he adds

> Whether the specialization continues and the attendant disadvantages are eliminated by selection of course depends upon their relative values in the struggle for existence ...Organic evolution is at best but the line of least resistance. Selection is not so much the preservation of the fit as it

> is the destruction of the unfit....It is, in fact, difficult to escape the conclusion that one great tendency of natural selection is to localize as well as to specialize (Marais, 2002, p.80).

Marais includes a variety of animal examples on the verge of extinction due to climatic changes to illustrate his point, these include; the bontebok (*Damaliscus pygargus*), blesbok (*Damaliscus albifrons*), springbok (*Antidorcas marsupialis marsupialis*) and black gnu (*Connochaetes gnou*). The move from 'great inland plains to bushveld decided their fate'. Human influences such as farming, hunting and domestication limit the animal's ability to accommodate migration out of newly occupied areas by humans. Thus, he perceives the fixed nature of instinctive behaviors to be specializations which could lead to extinction due to the lack of plasticity. He shows with the use of many animal examples (some of which Darwin used previously), to show the disadvantage of having fixed instinctual behaviors (specialized behavior) and how it could possibly lead to extinction. In this regard natural selection favors a less specialized behavior, that of the individual causal memory, which allows for behavioral plasticity in relation to the set conditions. Darwin identifies the effects of natural selection to be acting on the variation of simple instincts into complex instincts. This extreme adaptationist view of Marais's was probably why he limits the degree of variability identified from his instinct animal behavioral studies. It could be suggested that this was related to his own personal projection of ideas taken from Darwin's theory.

The disadvantage of the individual causal memory is that the individual 'memories' are not heritable according to Marais, if it was heritable it would be more destructive because the next generation would have inherited, individual causal 'memories' specific to the individual's life and not the species as a whole. Marais states

> Phyletic memories, as the name implies, are hereditary; causal memories are not. The ability to accumulate individual causal memories is of course

> transmitted, but the work done, the accumulated memories themselves, are never inherited by progeny from parents."(Marais, 2002, p.72).

The ability to accumulate individual causal memories (the mechanism) is transmitted and is shaped by natural selection, not the individual memories. Marais believes that the heritability factor is still maintained with the individual causal 'memories' with the use of tradition and language (culture); Darwin also identifies the significance of culture and language and believes that these factors are what drove or propagated the higher mental faculties especially in humans to their current state.

Moreover, Marais states

> Under such circumstances an animal with the most highly developed causal memory would hardly have had the same chance as the animal that enters upon life furnished with all the most essential environmental memories. But inherent in the new mentality is the element of tradition. It is in reality only a consequence of the normal activity of the causal memory, but it has the result of enabling an animal to reap the benefit of the accumulated memories of its ancestors without the need of direct experience. In the highest primate, articulate speech has enormously increased the scope and extended the benefit of tradition. The general effect of tradition therefore is equivalent to the general effect of hereditary memory. It is hereditary memory without the sting of limitation. There was, of course, no sudden leap in the inception of the new mind. It was thing of infinite gradations and stretches away through vast periods of time. The mills of God grind slowly and very uniformly. This de-specializing tendency is, in fact, as widespread as organic life itself. It is only when we reach the order of primates, however, that the new mind emerges for the first time to take a great or even a controlling share in generally determining that animal's reaction to its environment. And it is here that we encounter for the first time behaviour clearly under dual control. It is the same duality of control that we see in the human child when individual memory first becomes active. In the lower African arboreal monkeys this psychic doubling can be clearly studied in many different stages." (Marais, 2002, p.87), and Darwin states:

But the relation between the continued use of language and the development of the brain has no doubt been far more important. The mental powers in some

> early progenitor of man must have been more highly developed than in any existing ape, before even the most imperfect form of speech could have come into use; but we may confidently believe that the continued use and advancement of this power would have reacted on the mind by enabling and encouraging it to carry on long trains of thought. (Darwin, 2010, p.32).

Conclusion

From the above mentioned comparison, certain shared trends were identified between Marais and Darwin. The similarity supports the idea that Marais was highly influenced by Darwin's theory and more specifically his application of evolution by natural selection to the mind. This similarity extends to the choice of animal study subject and in many regards Marais seems to be replicating studies. He also concurs with Darwin in focusing on Africa as the "Cradle of Humankind" They both believe that the brain is the organ that houses the mental faculties and that with a better understanding of the brain, the actual neuronal functional attribute of each mental faculty could be ascertained more clearly, as most researchers of their time did.

They both consider that the mind and behavior are controlled by higher and lower mental faculties. Both accept the concepts of continuity, hierarchy and gradation to link the "lower" animals to the "higher animals" in terms of endowment of these mental faculties. Both agree that each species is endowed with a different degree of the mental faculties. Marais differs from Darwin in terms of his understanding and definition of lower mental faculties (instincts) and higher mental faculties (causality). Darwin has a much broader category for both mental faculties which is less constrained by the duality of mental faculties identified in Marais's theory. This could be related to Marais's very limited definition of natural selection, which seems to be extremely adaptationist. With this in mind they view the evolutionary development and processing of the mental

faculties differently. They both share a similar understanding of language and culture in terms of its influence on the mental faculties.

Marais seems to have relied heavily on Darwin's theory as the general explanatory framework. . However, at certain levels, he projects his personal views into his theory such as the aforementioned 'pain of consciousness' and also his extremist adaptationist view in the struggle for existence. It's almost as if Marais is trying to make sense of his own worldview (personal agenda) with the use of Darwin's theory, whereby addiction, depression and this extremist struggle for existence has a significant input into the overall theory.

It is also clear that Marais modified his selectionist views following some ideas of Freud and Bergson, specifically in terms of understanding the philosophy of the mind (i.e. the psychology). Ernest Haeckel and Jean-Baptiste Lamarck's ideas are also obvious within his theory but he uses their ideas in much the same way that Darwin did but Marais had a stronger dependency in terms of Lamarck

CHAPTER 4

Two main disciplines were discussed when analysing Marais's research - primatology and Evolutionary Psychology, but that was not all that he had accomplished. Marais had carried out many experiments on a variety of animals and insects and also developed numerous theories that were not analysed in this thesis. *The Soul of the White Ant* is an ideal example of Marais's dedication to the observation of insects; - he had studied termites for ten years and eventually proposed a theory based on identifying the termitary as a singular functioning biological organism.

Another example of his diverse interests and contributions could be found in his Chapter on Addiction and Depression in *The Soul of the Ape*. Marais identifies what he calls Hesperian Depression which is related to the cyclical changes between an animal's circadian rhythm and seasonal changes that he discusses decades before any recorded data was published on the subject now known as Seasonal Affective Disorder.

As discussed in Chapter 1 Marais's research was either too romanticized or simply disregarded as without much value to science and the aim of this report was to establish whether or not Marais's research attempts constituted any value within science as we understand it today as well as in the context of his time. Hence the following discussion summarises his relevant contribution to the fields of primatology and Evolutionary Psychology.

Primatology

Marais was unique in terms of his methodology when considering his primate studies. He had the foresight to understand that observing animals in their natural environment, under natural conditions is the best method of understanding their life history and natural behaviour. The actual time spent observing animals in the wild was equally important in terms of understanding their behaviour. It is clear from

the primatological history provided that Marais was undertaking his non-captive study at least a decade before the first documented study had been implemented. In many regards it was this methodology that provided Marais with insightful knowledge into the life of baboons. His descriptions of the Chacma baboon's life history were mostly correct when compared to contemporary findings - he does, however, use strongly anthropocentric descriptions. Despite this it should be noted that Marais never expected his manuscripts to be published in a scientific journal, as he wrote for the public and usually had his work published in Afrikaans periodicals. In his observation of the life history of these baboons he does highlight certain trends that were being debated within the primatological community at the time. These include hierarchy and order within non-human primate groupings, discussion on sexual behaviour and also the gender roles within the groupings. Concerning play, communication and also the role of females, he identifies these factors as important but only provides superficial detail in terms of their function within primate groups. One problematic issue within Marais's discussion of baboon behaviour is the impression he projects of their uniqueness, a troop of 300 baboons with equal numbers of male to female ratios is highly unlikely according to modern science but could have been the reality. From a general point of view Marais made a considerable contribution to primatology with his novel methodology. His erroneous and anthropocentric data compares minimally to his overall achievements. Primatology as a discipline would have bridged large gaps in thinking if Marais's methodology had been introduced earlier allowing researchers such as Zuckerman to make correct inferences on the natural behaviour of the primates they had studied. Non-captive studies allow animals to act out their normal behaviour, in a natural setting; hence, diet, social behaviour and locomotory patterns can be identified directly and without bias. In this regard Marais should be recognised and acknowledged for his method of understanding non-human primates.

Evolutionary Psychology

The main premise in the Evolutionary Psychology section of Marais's analysis was to understand how consciousness had evolved. It should be mentioned that Marais never focused on primates in their entirety to explain consciousness; rather he used a wide range of species to depict and strengthen his arguments. This was not a novel method of interpreting behaviour as most ethologists at the beginning of the twentieth century relied on a range of different species to test hypotheses. It was unique that he applied his knowledge base to the question of consciousness, as this was understood to be the psychologist's choice of study and they usually confined their research to humans, as was the case with Freud.

Consciousness can be understood from various aspects - philosophical, psychological, that of neuroscience all of which often culminates into a confusing bundle of information. This could be identified in the history when relating to instinct, for which a clear definition is currently unavailable unless the context or field of study is specified. From this stand point Evolutionary Psychology is the context in which Marais's theory of the evolution of consciousness was discussed. Darwinism is the fundamental premise used within Evolutionary Psychology today and Marais clearly depends on this theory to substantiate his ideas on the evolution of consciousness. Darwinism was not necessarily the popular choice to explain evolutionary concepts during Marais's period, (refer to the eclipse of Darwinism) but Marais remained devout in his explanation of adaptation by natural selection.

Marais's main contribution to the evolution of consciousness was the identification of the causal memory and its relation to the phyletic memory. From his observations Marais realised that certain animals had developed the causal memory (the ability to identify cause and effect and act accordingly) compared to animals he identified as possessing the phyletic memory only (instinct). The causal memory

was a definite advantage as the animal could prepare for future survival, and had the ability to make behavioural choices based on cause and effect which is not confined to the limitations of instinctual behaviour. He further extrapolates that natural selection and adaptation is acting on both phyletic and causal memory. However, the causal memory, although formed by natural selection, once highly developed allows for minimal further modification by natural selection due to its behavioural plasticity (animals that retain the causal memory can survive in a variety of different environments) in distinction to the instinct driven species.

Marais also believed that animals that were "protected" from natural selection had high individual variation from type (best adaptive structure and behaviour). If applied to humans, with such a large capacity for causal memory and hence protection from natural selection, we, as a negative consequence, find high numbers of pathologies which are expressed as extreme individual variants from the ideal type. Hence, divergence from the ideal type leads to abnormality, which Marais believes manifests as pathology and with regard to the mind, diseases such as schizophrenia and manic depression. This interpretation of the evolution of consciousness with particular reference to the pathology shares similar fundamental principles that the developing discipline Darwinian Medicine implies today. Significantly, Marais anticipated Evolutionary Psychology in the use of Darwinian evolutionary principles to the mind or study of behaviour, also his interpretation of evolution according to Darwin was extremely adaptationist which is a current theme amongst contemporary Evolutionary Psychologists as described by Gould. However, his overall understanding of instincts differs substantially from how we understand Evolutionary Psychology today. Marais considered humans to possess less instincts compared to other animals, Evolutionary Psychology suggests we have more instincts than our earlier researchers would have anticipated. Also, Marais considers the application of his causal individual memories to be

content-domain-general in much the same way that most psychologists during his time had perceived it. This means that our individual causal memory could supply solutions to environmental problems in a general manner, pertaining to any situation. Evolutionary Psychology as we know it today constitutes many instincts firstly and secondly these instincts are content-domain-specific in terms of function. This suggests that we have specific neural circuits or modules (instincts) that are very specific to selective environmental problems that we experienced during our species' past ancestral life history. As a final note Marais's best feature was his methodology, his observation of nature for most of his life was the ideal laboratory for him to anticipate discoveries decades before their time and he made full use of it.

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