
“Die siel van die mier”: Reflections on the battle for ‘scholarly’ intelligence

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Abstract

This essay traces two research programmes in broad strokes. Both programmes start from the same observation — the behaviour of an ant (or termite) colony and the ability of the ant colony to act in a collective manner to achieve goals that the individual ant cannot. For one programme such behaviour is indicative of intelligence; for the other it is indicative of (collective) instinct. The primary intention of the essay is not to assess the claims of intelligence found, but to consider the rationale of the researchers involved in the two programmes for doing such research. It is observed that virtue in one programme is understanding (with the concomitant ability to explain — and, hence, teach), while the primary virtue in the other programme is the utility — and ultimately efficiency — that this may add to human problem solving skills. The two programmes used as illustration are Eugène Marais’s study of termites in the first half of the 20th century and the emergence of artificial intelligence projects that are inspired by ant behaviour in the second half of the 20th century. The essay suggests that the current emphasis of inquiry at tertiary education institutions embraces utility to the extent that it displaces pure insight — and hence the ability to explain and, ultimately, the ability to teach.

Keywords: Tertiary education, Intelligence, Artificial intelligence, Epistemology

1 Introduction

A *search for intelligence* may be approached from two perspectives. On the one hand one may ask questions about the nature of intelligence. Knowing its nature will enable one to recognise it — and hence *find* it. An alternative approach is one that locates intelligence — establishing *where* intelligence is to be found. Note that both these uses of the term *search* are common in popular culture. Many reality television shows search for some undiscovered talent — without necessarily leaving the television studio. On the other hand, games such as hide-and-seek (or its more recent commercialised versions) clearly denote the second meaning.

An earlier version of this essay formed an oral contribution to the third of a series of three seminars or discussion sessions organised by Prof Fanie de Beer from the Department of Information Science at the University of Pretoria. The series dealt with three aspects of academic enquiry, *viz* spirituality (or the role of ‘spirit’), disenchantment and “Tertiary education and the battle for intelligence”. All three events were attended by a small but passionate group of participants. In addition to the formal discussion an almost emotional undercurrent was present that reflected the participants’ concerns about changes in academic

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life based on non-academic factors (of which monetary value as a current determinant of value of academic activities was a recurring theme).

This essay, being part of the third event, reflected on a search for intelligence using both meanings of the word *search* highlighted above. These two forms of searching are addressed in sequence using a strategy that potentially limits aspects of and locations of intelligence that may be discovered. These limits will be assessed once the strategy has been described. It also applies the strategy to the macro-level, questioning whether intelligence is to be found at the university.

The problem faced by any project that entails a search for some phenomenon is the self-referential nature of the project. In order to search for some phenomenon X it has to define or delineate X to serve as a demarcation criterion to help decide when some instance of X has been found. However, the very definition used as demarcation criterion determines what will be considered a true positive. Reflection based on the true positives may then depend more on the demarcation criterion used *ab initio* than the diversity of the phenomenon as it occurs in all its richness in the “real world”.

Of course intelligence has been the topic of philosophical enquiry over centuries; it is neither possible, nor useful to try to comprehensively trace that history in a short essay such as this.

The artificial intelligence community have been working on creating a form of intelligence for about half a century. During this period they have explored a range of mechanisms intended to artificially recreate intelligence. In much of the most prominent work they have tried to emulate some natural phenomenon postulating (or, at least, considering) that the key to some degree of intelligence stems from that phenomenon. There are two general schools of thought. The one school presupposes that intelligence is an innate ability that stems from ‘logical’ processes, such as thought. This school reflects the famous conclusion by Descartes: *Cogito ergo sum* [9]. The other school proceeds on the premise that function follows form and that somehow, by replicating the form, the function can also be replicated. This latter school observes intelligence in nature and then artificially replicates the structure with the aim of replicating the function. It should be noted that this distinction between the two schools is somewhat blurred in reality, but the details are not important here.

On the other hand many studies have been conducted in attempts to understand behaviour that apparently exhibits intelligence.

This essay claims that the two strategies that search for intelligence represent two very different world views. Two programmes executed about a century apart are traced to explore the different approaches. It is suggested that these approaches — independent from their subject matter — represent two different perspectives on intelligence. We further suggest that these approaches are (and have been) valued differently at various points of history. These forms of intelligence are most acutely juxtaposed against one another in the ‘intelligence enterprise’ — that is, in the tertiary education sector. This explains why a battle between proponents of these approaches are inevitable — and that the battleground for these conflicts are naturally the tertiary education sector.

2 Tertiary education, battles and intelligence

As indicated above, the thoughts contained in this essay resulted from reflection at the intersection of three themes: higher education, a battle and intelligence. An implied fourth theme that was clear from the discussions was one of currency and urgency. Most participants

seemed aware of a battle of some sort raging in their midst that needed to be fought (and won) to secure a meaningful future (and present) for tertiary education.

My rather old but trusted thesaurus [8] distinguishes between two broad categories of intelligence, namely (1) a human capacity and (2) information (such as that collected by military intelligence). Our interest here is clearly in the former, but even for it the thesaurus indicates a wide range of 'synonyms' including *acumen, aptitude, brain power, brightness, cleverness, comprehension, reason* and *understanding*.

The notion of *tertiary education* is, similarly, contested. Until recently a number of options were open for those who wanted to continue their education beyond secondary level; options ranged from hands-on training (in the form of apprenticeships), through applied studies to pure scholarship. Along this continuum the emphasis changed from practical knowledge to 'theoretical' knowledge and the verb switched from 'train' to 'educate' at some point. A select few pursued knowledge for the sake of knowledge. In ancient times universities formed where such scholars congregated to study. Later universities were more formally established as institutions and even later universities became part of national education systems. Trade and craft schools have an even longer history where skills were transferred from one generation to a new generation of skilled artisans. Those wishing to enter the professions studied at institutions logically positioned somewhere between the trade schools and the universities. Over time professional schools were incorporated into universities. Trade schools evolved to become universities of technology. In March 2015 *The Economist* [1] concluded "The world is going to university". The university is no longer an assembly of intellectuals attempting to achieve deeper insight into the world. In the eyes of the world the university has become a facility that produces skilled labour.

In a perverse twist the earlier scholarly quest for understanding through inquiry at universities was commodified into a "research" activity where *production* of papers trumps *gaining* of knowledge. Outdated performance management strategies are used to manage productivity in terms of such outputs. Outputs feed into university ranking systems, where such ranking systems are used to lure new students to be trained for their future careers [1].

As noted above, intelligence is multi-faceted. One of the attributes of a successful skilled artisan, accountant or computer programmer will always be intelligence, but only a fraction of them — and only a fraction of society in general — will want to search for knowledge for the sake of knowledge. Only a few will become intellectuals, whose special flavour of intelligence was once the *raison d'être* of universities.

A premise of this essay is that the various 'flavours' of intelligence are incommensurate — no flavour is better or more important than another. However, it will be argued, from this incommensurability it also follows that an attempt to use one flavour of intelligence as grounds to sell another flavour and/or to imbue another flavour is doomed to failure. To be more specific, attempts to use scholarly intelligence to lure those who want workforce intelligence, to use those who have or want workplace intelligence to exhibit scholarly intelligence or to expect those with scholarly intelligence to imbue workforce intelligence to the masses are doomed to leave most participants disenchanting.

This premise, however, requires reflection before it can be posited. Over millennia words such as intelligence and knowledge have been interwoven. The history of, for example, the words *Episteme* and *Techne* (derived from the corresponding Greek words) is complex; for some they denote the same knowledge (or intelligence); for others they are distinct categories

[19]. In Book VI of the *Nicomachean Ethics* Aristotle distinguishes between various ‘intellectual virtues’ — or parts of the ‘rational soul’. In this context Aristotle distinguishes between five virtues of thought: *techne*, *episteme*, *phronesis*, *sophia*, and *nous*. The enduring debate is between ‘practical thinking’ (approximately *techne*) and ‘scientific thinking’ (approximately *episteme*). A fundamental distinction between *episteme* and *techne* is that the former is an end in itself, whereas the latter is a means to an end; the former is about knowing that what cannot be changed, while the latter is about changing something — very often, about producing something. However, even Aristotle does not use this distinction consistently. In fact, elsewhere he uses education — one of the anchor points of this essay — to demarcate forms of knowledge [19]:

“As Aristotle says, the master craftsman (*technites*) is wiser than the person of experience because he knows the cause, the reasons that things are to be done. The mere artisan (*cheirotechnes*) acts without this knowledge Aristotle goes on to say that in general the sign of knowing or not knowing is being able to teach. Because *techne* can be taught, we think it, rather than experience, is *episteme*... Presumably the reason that the one with *techne* can teach is that he [*sic*] knows the cause and reason for what is done in his [*sic*] *techne*. So we can conclude that the person with *techne* is like the person with *episteme*; both can make a universal judgment and both know the cause.”

Aristotle’s practical examples provide some additions helpful insight: The (pure) mathematician seeks universal (mathematical) truth as an end in itself. The physician needs to *know* human health; the physician *applies* that knowledge to change the health of a specific patient based on knowledge of health; the ‘mere’ artisans who know how to produce or achieve something without an underlying scientific truth does not know the (universal) cause of what they effect, use a different (in principle) unteachable, flavour of knowledge.

Whether we are able to distinguish between all the ‘flavours’ of knowledge (and whether they overlap) is not the primary issue. From discussions (such as the one cited above) it becomes clear that there is a need for (and hence a need for a place for) seeking knowledge (or intelligence) as an end in itself rather than for its utility. Below we will use the phrase *scholarly intelligence* for the search for (and ability to search for) knowledge as an end in itself.

This is then how we see the battle lines drawn: Tertiary education is by and large clinging to or appropriating the term *university*. At the same time scholarly intelligence is disenfranchised and, at most, tolerated. The semblance of scholarly intelligence is maintained by promoting ‘productive’ research. The university’s clientele, by and large, is buying workplace intelligence from it and the utility of intelligence becomes pre-eminent. However, in order to maintain the semblance of scholarly intelligence, the clientele is expected to participate in rituals that emulate scholarly activity — to do research that often answer empty questions and, more importantly, to produce research papers (that will never be read) based on these empty answers.

On paper the result seems like a symbiotic relationship where participants, at the very least, learn about one another’s worlds. In practice, however, the student often does not get the advanced degree because he or she — although an admirable (potential) member of the workforce — does not fit into the scholarly paradigm. The scholar is too busy training others and producing papers to reflect on real problems and left frustrated. The employer of the ex-student deems the training of the student as disconnected with industry needs — especially given the cost of training. The aspiring academic fails to enter academia and turns to industry

as a latecomer. Perhaps the captains of the university industry emerge victorious, but this one possible success is speculative at best.

Many books have been written that, when read in conjunction, support some version of the narrative above. It is possible to find support from a number of sources for each of the assertions above. However, rather than constructing the puzzle from the pieces that we know are available, this essay will follow a different route. Before embarking on that route let us consider a sample of what has been said about the importance of research in tertiary education.

3 Research in tertiary education

Twenty years ago Anderson [3, p.121] already noted the “pretence today [sic] that [higher education’s] main business is the production of new learning, new knowledge. That pretence is a pernicious myth. Very little new knowledge of any worth or substance walks out of the university gates these days.”

Boyer [6] identifies four (overlapping) functions of the professoriate, with ‘scholarship of discovery’ as the first of these functions. In what may seem like a contradiction of Anderson’s dismissal of substantial research results, Boyer points towards the huge strides research has made. However, he reports empirical data that indicates how the emphasis for promotion and (in the US) tenure has shifted towards research, with little assessment of teaching and only lip-service paid to service. His data shows how quantitative research is valued above qualitative research, how journal articles are valued above books and other outputs, and how research is valued above all other academic activities. His empirical results also show a general dissatisfaction of faculty (in the American sense) with these norms.

A more recent book [7] echoes similar sentiments about a South African university.

Various explanations for the emphasis on research are posited. Boyer [6] points to the inherent excitement of discovery and the central role this plays in tertiary education. In fact, it has already been mentioned that early universities originated from scholars forming scholarly communities to facilitate their quest for knowledge. Other possible reasons cited is the ease with which research outputs can be measured (compared to other scholarly activities) [6]. Research outputs also play a significant role in the ranking of universities [1]; a high ranking helps to attract more students, more subsidy and more research grants.

The manner in which research outputs are measured sheds more light on the aspects of research that are valued. Various indicators of research productivity are used. Often the raw count of number of publications (meeting some criteria) is used, which obviously measures quantity rather than quality. In other cases citation counts are used as an indicator of quality: if many scholars refer to one’s work, one’s work seemingly has value. However, this argument is not always valid. Textbooks and review papers (that do not report on new research results) often have higher citation counts than original contributions to a subject’s body of knowledge. It is often also true that erroneous papers attract more citations as other papers point to the errors in such papers. As an extreme example consider Sokal’s paper “*Transgressing the boundaries: Toward a transformative hermeneutics of quantum gravity*” [23] — a nonsensical paper that, at the time of writing this already attracted 1192 citations according to Google Scholar. Of course the many citations to this paper are due to the role it played in the so-called *science wars* [22].

It was therefore not surprising that an index that purported to balance productivity and quality was rapidly accepted by academic institutions. Hirsch's h-index [13] is used almost universally to quantify the quality of researchers. As an example, the South African National Research Foundation manages a rating process that places South African researchers in categories that reflect their reputation as researchers. The NRF's remarks about the role of this metric sheds some light on the importance of such metrics [21]:

In terms of h-index importance in the rating process, it is agreed that it be used as a supplementary source of information for the validation of opinions expressed in peer reviewer reports. It is important to the integrity and fairness of the system that peer-review take precedence over h-index information or other metrics.

As a minimum this indicates that the h-index of a researcher is “used as a supplementary source” — the opinion of peers in the process are more important. However, the h-index is used “for the validation of opinions expressed in peer reviewer reports.” Stated differently, the h-index is secondary to reports; however, it determines (perhaps in part) the veracity of the reports. If only ‘valid’ reports are considered, the h-index effectively determines the rating of the researcher.

The reliance on h-indexes and similar metrics may be justifiable if such indexes measure what they purport to measure. However, it has been shown that the h-index is a combinatorial Fermi problem [26]; in simple terms this means that a researcher's h-index is primarily determined by the researcher's citation count — a measure that was largely rejected in favour of the h-index. Using a very different mathematical approach to analyse the h-index, Waltman and Van Eck [24] identify several other undesirable properties of the h-index. “Given the extensive literature on the h-index, it is remarkable that the inconsistent nature of the index has remained largely unnoticed” [24, p.410]. Barnes [4, p.456] documents the use of this index “contrary to the evidence that the h-index is intrinsically meaningless”.

One would imagine that, given the emphasis on research in tertiary education, findings such as those cited about the h-index would, at the least, cause the university to reflect on their practices based on such a metric. However, experience has shown that this is often not the case. For example, much of the management culture of universities is based on ‘fads’ [5] where research has clearly demonstrated that the technique does not increase productivity (and often decreases productivity and has other negative consequences). In my own field of speciality I have tried in vain to convince the university that regular forced password changes decrease security of campus systems [11, 15, 12] — yet they are unwilling to change their behaviour based on research results. These observations lead one to conclude that the university is not interested in knowledge or intelligence created through research. The importance of research for the university is merely the quantity of the research.

Given this context the journey below is intended to explore the search for intelligence using two related examples — where the presence and absence of some of the factors above impact on the nature of the search.

4 Ant colonies and intelligence

The route that this essay will follow starts with a well-known but still interesting phenomenon: the fact that an ant colony in many ways behave like a single organism rather than the numerous ants that constitute it. It then traces two programmes that stemmed from this observation almost a century apart. It should be noted that both programmes yield to

different interpretations than those presented here. However, we contend that our conclusions can be reconciled with other justifiable interpretations.

Note that we use the phrase 'ant colony' as it is used in related work. It is well known that the behaviour attributed to ants actually refers to behaviour of termites living in colonies.

The two programmes to be discussed start at fundamentally different points of departure. The more recent programme is one that attempts to *produce* intelligence and finds inspiration in accounts of the ant colony. The older programme is one that starts with a fascination of ant colonies and seeks an understanding of their inner workings.

The two accounts follow in reverse chronological order.

4.1 Searching intelligence through emulation

Let us — at least initially — avoid an attempt to define intelligence and assume it is something that can be recognised when observed. It manifests in behaviours (such as physical actions or mental decisions) that lead another intelligent being to conclude that intelligent thought had to underlie that action. Note again that this description is not intended as a definition, but as a construct to facilitate further discussion (but a construct that will not survive this section). In support of this construct many of us have seen actions that were indicative of great intelligence — sometimes by world leaders that shaped the future of history, sometimes by an elderly person who helped a younger person to handle some emotional problem and sometimes even by an animal faced by a challenge to obtain food. Hence the description is familiar, even though it would not withstand rigorous analysis.

Human traits have over the years been associated with many organs. For our discussion it is not important at what point the brain and intelligence were associated. Neither is the truth of this association important — the mere fact that the brain is (almost) universally seen as the seat of intelligence is sufficient for our purposes.

It was therefore logical (and still may be) to analyse the brain to discover its operation. Such analysis may be based on a physical and/or philosophical 'dissection' of the brain. On one level this is simple. The brain consists of neurons and other structures in the presence of chemical substances, where neurons 'fire' under some conditions and where the interconnection of neurons sometimes changes. However, how that produces intelligence remains a mystery reminiscent of the well-known mind-body problem.

The observation of brain structure lead to (at least) two avenues of exploration. On the one hand computer scientists constructed artificial neural networks (ANNs) that consist of artificial neurons that emulate real neurons (to some extent, at least). While the problem-solving abilities of these ANNs are impressive when applied to some problems, they do not even begin to approach human intelligence in any significant manner.

The second line of inquiry was (and is) based on the number of neurons in a human brain. This led to speculation that the operation of intelligence perhaps does not depend on the operation of individual neurons as much as it depends on the number of connections, neurons, or (in general) switches. One of the primary proponents of this view is Hofstadter, who, in his seminal work, *Gödel, Escher and Bach* [14] provides an intriguing (and entertaining) account of how structures in the natural world have certain characteristics when viewed from one perspective, but very different characteristics when viewed from another "layer". From this he concludes that intelligence may (will?) emerge from a sufficiently large

number of structures that are combined on a lower layer. Whether this is true is a metaphysical question that we will not endeavour to answer here.

A variation on this latter theme is one that does not focus on the number of neurons (or similar structures) in a natural or artificial brain, but one where signs of intelligence are seen in a large collection of units and where the intelligence of the collection seems to exceed the intelligence of the individual beings in the collection (or the “sum” of their combined intelligence far exceeds the sum of their individual abilities). One frequently cited example is the collective intelligence of an ant colony (or a termite colony) that is not explained by the intelligence of individual ants.

The seminal work that suggested the use of artificial ant intelligence ‘credited’ the ants: [10, p.3]: “The algorithms that we are going to define in the next sections are models derived from the study of real ant colonies.” The shift to problem solving (for both *humans* and ants) is highlighted even earlier [10, p.2]: “In the approach discussed in this paper we distribute the search activities over so-called ‘ants,’ that is, agents with very simple basic capabilities which, to some extent, mimic the behavior of real ants. ... One of the problems studied by ethologists was to understand how almost blind animals like ants could manage to establish shortest route paths from their colony to feeding sources and back.” However, as will be clear soon, the characteristics that are ‘borrowed’ from ants are very different from those which the student of the ant observes in an ant colony [10, p.24]: “The main characteristics, which are at least partially shared by members of this class of algorithms, are the use of a natural metaphor, inherent parallelism, stochastic nature, adaptivity, and the use of positive feedback.”

4.2 Understanding the ant colony

The programme that is to be juxtaposed to the search for intelligence outlined above, dates from the early 20th century, when the South African journalist, poet, author, lawyer and scientist, Eugène Marais, became fascinated by the behaviour of an ant colony and started a personal programme to observe and experiment with ant colonies in order to gain insight into their behaviour. The account of his studies was published in book form in 1937 in Afrikaans under the title “Die siel van die mier” [18]. However, the results of his studies were published as a series of articles in the early 1920s. The 1937 book was translated into English under the title “The Soul of the White Ant”. In what follows most quotations from the book will be from the 2009 edition of the English translation [17].

The preface included by the translator (Winifred de Kok) in the original English translation already provides interesting contrasts between scholarly activity as practiced by Marais around a century ago and current scholarly activity [17, p.8]:

A scholar and a man of culture, he [Marais] chose nevertheless to live for a period extending over many years in a ‘rondhavel’ or hut in the lonely Waterberg mountains, learning to know and make friends with a troop of wild baboons, whose behaviour he wished to study. He tamed them to such a degree that he could move among them and handle them without any fear or danger to himself. At the same time, he also examined the other end of the chain, and studied termite life. This was a study which often meant tremendous hard work and needed endless patience.

During those years, Eugène Marais was not concerned with any sort of publicity. However, a friend persuaded him to write an article for the Afrikaans periodical Die

Huisgenoot. *This proved so popular that the author was besieged with requests for more research information. The articles continued for almost two years.*

The first striking contrast with current scholarly practice in this passage is the emphasis on studying, learning and understanding, rather than publication. This focus is confirmed by Marais on the very first page of the first chapter of the book [17, p.17]: “Over a period of ten years, I studied the habits of termites in an investigation into animal psychology. Such observation reveals new wonders every day. To mention one instance, the functioning of the community or group psyche is just as wonderful and mysterious as that of people.” The notion of enchantment — the theme of the second workshop mentioned in the introduction of the current essay — is obvious; publication is secondary. When the question of publication arises, Marais explains it as follows [17, p.18] “I want to tell you about the most common of our termites or ‘white ants’. I am also going to explain how anyone may observe what I have. Indeed, readers may even discover new wonders for themselves.” Even publication is about enchantment — about an introduction into a world of wonders.

The importance accorded to time and patience is obvious from the quoted passages. A few pages after the quoted portions, Marais notes this expressly [17, p.33]: “Things always seem pretty hopeless in the beginning when we are dealing with phenomena which lie far beyond our senses, but ‘perseverance pays’ must be the motto of the traveller along these dark and unknown pathways.” The modern researcher is often expected to plan research, specifying details of milestones and deliverables — especially when applying for funding. Perseverance no longer pays; careful planning does. But planning is only an option when one is able to construct some map of the road ahead — not when one is about to “travel along these dark and unknown pathways”.

This sentiment is often expressed. Nobel laureate and discover of the boson named after him, Higgs, says that after formulating his theory on the boson “he struggled to keep up with developments in particle theory, published so few papers that he became an ‘embarrassment’ to his department, and would never get a job in academia now. Then again, in today’s hectic academic world he thinks *he would never have had enough [...] time or space* to formulate his ground-breaking theory” [2] [emphasis added]. In the battle for intelligence academia has become rather explicit about the type of intelligence that they welcome — and it is not the type of intelligence that is enchanted by “dark and unknown pathways.”

In another ironic twist, there is some evidence that this type of intelligence may find a home in (a tiny part of) industry. The “application pointers” for a Shuttleworth Fellowship¹ includes a subheading proclaiming that *“The only true way is not a project plan but a champion.”* Somewhat later these pointers elaborate: “Prospective applicants often ask us to narrow down the parameters for applications and be more specific about what we’re looking for. We are not planning on doing that, as we want to be surprised and intrigued by applicants, no matter how unconventional the idea may be.” Enchantment is the key that unlocks this door — albeit not in the domain of tertiary education.

As already noted, the observation that ants exhibit some form of intelligence lead to contrasting sequels. In the case of artificial intelligence the behaviour is characterised as problem-solving behaviour [10]. This inspires a process of emulation and immediate assessment of the efficiency with which such a solution can solve problems on behalf of humans. The notion that such behaviour may be transferable (and utilised) in another domain is based on metaphysical assumptions. Hofstadter, for example, remarks that “the ants are not the most important feature. Admittedly, were it not for them, the colony

wouldn't exist: but something equivalent — a brain — can exist, ant-free. So, at least from a high-level point of view, the ants are dispensable" [14, pp.331–332]. One recent study [16, p.8392] (based on mathematical modelling) concludes that "Ants use their intelligence and experience to navigate." However, the ant is yet again replaceable: "We emphasize the generic character of our analysis because a homing strategy in foraging is used by other animals with fixed basis, such as bumblebees, albatrosses, etc. Our model is readily applicable to these situations" [16, p.8396]. The overall focus of this last cited paper is, as expected, on efficiency.

It is, in contrast, constructive to read Marais's exposition of ant behaviour in Chapter 4 of the *Soul of the White Ant*. It starts with reflection about what we are able to know about such an organism, and what lies beyond our abilities. From the fact that the colony "acts" he deduces the presence of a psyche and eventually attributes the behaviour of the colony to its psyche based on instinct — or the "race memory" of the species. He illustrates using a number of examples how instinct serves the ant in one context, but fails it in another. "On the whole, the result of inherited memory is to bind a race to a special environment" [17]. Just how sophisticated and specifically adapted the navigational system of (a specific species of) ants is begins to emerge from a recent study [25] that identifies a new 'module', where these modules (in systems theoretic language) process a huge amount of inputs, but always reproduce the same instinctual behaviour.

Just as modern-day researchers immediately 'recognised' intelligence in the activities of the ants or termites, at least one observer reached a similar conclusion before the publication of Marais's book. About this observation Marais remarks "intelligence and thoughtfulness, as we humans understand these qualities, never entered my mind in connection with the termites" [17, p.117], after which he discusses the absurdity of such a notion at length. For him it is clear that the ant colony exhibits no intelligence.

However, he is convinced that the termites execute some collective plan, without any of the individual swarming termites knowing either the plan or the role it plays in the bigger plan. In his search for the origin of this plan, Marais does not attempt to find intelligence — he attempts to locate the brain of the compound organism. He finds it in the queen and advances a number of compelling arguments. One of the most compelling is his observation that when the queen is killed all coordinated activity of the termite colony immediately ceases. However, he does not deem this brain as a manifestation of intelligence. For him it is merely the instinct of the colony that emanates from the queen.

5 The world a century ago

In this essay we followed two programmes that stemmed from the same observations. The differences between the aims and ability to explain between these two programs are huge. However, the danger exists that the reader interprets the essay as a longing for a bygone era where time to think was necessarily more conducive to foster intelligence. Returning to the past is not the magic wand that solves all problems. Marais's own history tells of an era of disenchantment. As a young journalist in the old South African Republic he is disenchanted with the lack of foresight he perceives from the republic's leadership — in particular from the president, Paul Kruger [20]. During his law studies at the Inner Temple in London he is confronted by a Europe where art flounders — due to the loss of royal patrons as democracy sweeps across Europe. Marais's medical knowledge cannot help him escape the perils of a

morphine addiction. Eventually his world of scholarship, of arts and culture — his life of intelligence — is not sufficient for him to consider his life a life worth living.

6 Conclusion

Samuel Johnson once said “The greatest part of a writer’s time is spent in reading, in order to write: a man will turn over half a library to make one book.” Scholarly intelligence is similar in nature: it depends on absorbing others’ intelligence, on study and reflection. Only in the context of intelligence — including intelligent critique — can intelligence flourish.

However, we live in a time where scholarly intelligence is increasingly marginalised by practical intelligence and, more seriously, emulated intelligence. ‘Truths’ are produced at ever increasing rates, but neither verified, nor engaged with.

Marais was able to contribute to scholarly intelligence in conditions of isolation. In fact, many of his observations would not have been possible without such isolation. The early scholars who established the first universities also often established such universities to isolate — and, often enough, to protect — them from the establishment.

Perhaps, as one commentator suggested, the ruins of the university in which we live may provide the isolation to revive scholarly work. The by-line of the piece in *The Economist* that proclaimed that the world goes to university asked whether it was worth the cost. Arguably it is not. And soon the disenchantment of the workplace with what the university now offers may initiate a decline and fall of the modern university. And perhaps this will be the point where the ascetic scholar will be able to help foster a new generation of scholars who seek knowledge for the sake of knowledge.

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