

Henry, Me and Philosophy

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ABSTRACT

*Forty years ago this year, in 1984, I sat with renowned surveyor, lecturer and historian Mr A.P.H. (Henry) Werner to review and edit what would be his final published work. You see... Henry was dying. I had first met Henry when he was a lecturer and I was a student at the University of New South Wales in the mid-1970s. He was a character and always made any lecture interesting. Several years after graduating, while working at the NSW Department of Public Works, I was contacted by Henry seeking my help with a paper he was preparing for publication in *The Australian Surveyor*, the national surveying journal of its time. Henry said he did not have much time left. We worked on the paper together over several months. He would draft his text and I would edit and fact-check against his references and other sources. The paper was published in September 1984 under the title 'The philosophy of progress: Any lessons from the history of surveying?' Henry's message in that paper is as relevant today as it was when he first wrote it. This paper outlines the life and times of Henry Werner for context, also touching on his esteemed career. However, the main objective of this paper is to highlight the words and wisdom of Henry Werner from way back in 1984. It aims to demonstrate the continued relevance of his words to today's fast-changing world, using examples such as how we are grappling with the application, potential and concerns of an unbridled Artificial Intelligence (AI). Henry's paper does not refer to AI, but it appears that he knew it was coming as he urges us to be aware "of the far-reaching consequences of progress in relation to the future of mankind."*

KEYWORDS: *Henry Werner, surveyor, philosophy, knowledge, wisdom, AI.*

1 INTRODUCTION

Arthur Paul Heinz "Henry" Werner (1918-1984) is best known as a former surveying lecturer at the University of New South Wales (UNSW). Henry was born in Germany at the end of World War I. He was 15 when Adolf Hitler came to power and 21 at the outbreak of World War II. He remained conscripted in the German army until the end of the war. Henry graduated with a Diplom-Ingenieur (Verm.) from the University of Bonn in 1950 and arrived in Australia in 1951. Joining the School of Surveying at UNSW in 1960, Henry was a lecturer of legendary status to most undergraduate students during the 1960s and 1970s.

So why is Henry Werner still so relevant in 2024? As well as a lecturer, Henry was an 'historian', a 'philosopher' and a prolific contributor to surveying journals including *The Australian Surveyor*. Seen in Figure 1, aged 61, Henry received a terminal diagnosis some four years later, in 1983. Henry yearned to write one last paper. Knowing his cognitive skills were in decline, Henry sought my assistance to review and help edit his paper. I was a 28-year-old former student of Henry's, who just happened to be coordinator of a NSW Department of Public Works conference in 1982 where Henry delivered an address on the

philosophy of technological progress using the historic example of surveying for the Great Pyramid of Giza. In early 1984, over a period of four to five months, Henry, with my help, converted that address into a paper for publication in *The Australian Surveyor*. The paper was published in September 1984 under the title ‘The philosophy of progress: Any lessons from the history of surveying?’ (Werner, 1984).

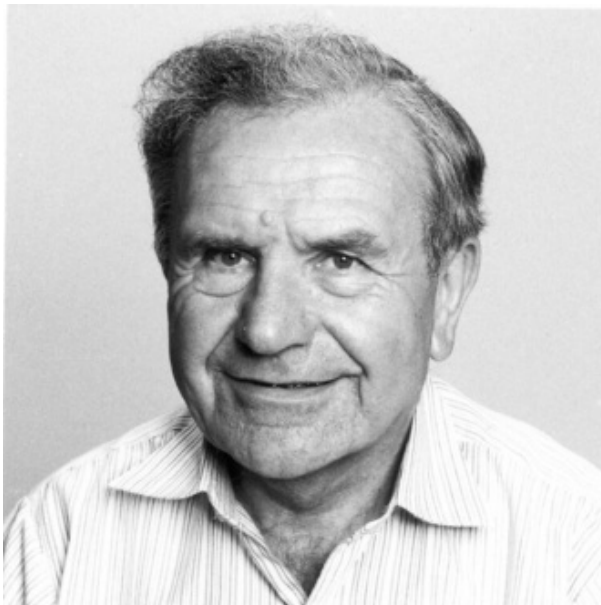


Figure 1: Henry Werner, 1979 (courtesy of UNSW).

Henry’s philosophical message in the 1984 paper is as relevant today as it was when he first wrote it. In 1984, the world was in a state of cold war dealing with the ever-present threat of nuclear weapons. In 2024, the world is in a state of digital suspicion dealing with endless opportunities and potential threats posed by generative Artificial Intelligence (AI).

This paper is not intended to be a biography or a full account of Henry’s life. It is, however, necessary for context to include some biographical information and relevant aspects of Henry’s life and the times in which he lived. This will give insight into the possible motivations as to why a learned yet humble surveyor would have deemed it absolutely necessary to write a paper for publication in *The Australian Surveyor* in the final few months of his life.

2 LIFE AND TIMES OF HENRY WERNER

Arthur Paul Heinz “Henry” Werner was born in 1918 in the eastern German town of Lübbenau, approximately 100 km south of Berlin and halfway to Dresden. At the time, his father was a surveyor with a German army unit on the western front.

Henry received his high school education in the western German city of Essen where his father was by then a municipal surveyor. Essen was a major industrial centre. Henry believed that his social attitudes were largely moulded in his school days when he mixed with the sons of leading industrialists, lawyers, merchants, musicians and coal miners. Figure 2 shows Henry aged 12. Evident is an inquisitive mind and a yearning to understand how things work.



Figure 2: An inquisitive Henry Werner, aged 12, in Essen, 1930 (courtesy of Sibylle Werner).

Henry matriculated in 1937 and served the compulsory two years of army service. His intention was to commence studies in meteorology, but with the outbreak of war in 1939 he remained drafted in the German army and was assigned to an anti-aircraft unit until May 1945. Figure 3 shows a relaxed Henry in uniform with his parents in 1941.



Figure 3: Henry Werner with his parents in Essen, 1941 (courtesy of Sibylle Werner).

During the war years, in 1944, Henry married his ‘forever’ wife, Ruth, spending their honeymoon in East Prussia. With the rumble of artillery never far away, Henry said it “*was a change from the never ceasing entertainment provided by the Allied Air Forces over much of Germany.*” With Germany’s surrender in May 1945 and after release from a prisoner of war camp, Henry underwent pre-university training with a registered surveyor before enrolling at the University of Bonn in April 1946. Figure 4 shows Henry around this time embarking on a lifetime of study to learn, question, share knowledge and stimulate others.



Figure 4: A young Henry Werner studying hard (courtesy of Sibylle Werner).

In the book ‘The Snowy: The people behind the power’ (McHugh, 1995) we learn that in May 1950, Roy Robinson, a young engineer with the Snowy Mountains Hydro-Electric Authority, was dispatched to Europe with instructions to select over 600 tradesmen and as much of the top engineering and surveying talent as he could muster. They had to be healthy and politically acceptable. The Australian Military Mission arranged with the German authorities to put ads in the press and on the radio. They interviewed nearly 3,000 people, each having been assessed beforehand. Roy Robinson had to ensure that he did not recruit anyone who had Nazi sympathies or had been part of the Nazi side of politics. When the Germans surrendered, they failed to destroy their very large filing systems – they had virtually a dossier on every citizen in Germany and one of the first things done was to refer any names to an organisation run by the joint military occupiers, the Americans and British, to get a clearance before an interview.

Henry graduated with a Diplom-Ingenieur (Verm.) from the University of Bonn in 1950. About the same time he spotted an advertisement on the university noticeboard seeking suitably qualified engineers and surveyors to work on the fledgling Snowy Mountains Hydro-Electric Scheme (Snowy Scheme) in Australia. In an oral history project (Unger, 1974), Henry was interviewed by Margaret Unger and said that he “*was sick of the idea of having to go through a secondary state examination [to become a licensed surveyor in Germany] after having just passed his university exams.*” Another 2½ years of indenture, study and exams would have made him 34 years of age. As such the advertisement was very appealing, the wages good, and as explained by Henry, “*I thought it would be a marvellous excuse to avoid that and have a look at the other side of the world.*”

In the interview by Unger (1974), Henry recalled being visited by an “*Englishman*” in his home, essentially to be further screened. Germans in general were very successful applicants and Henry believed the assessment process may have been able to statistically forecast behaviour patterns, strong and weak points, the ability to succeed on the project and to generally fit in.

McHugh (1995) comments that in 1949 “*Australians were still xenophobic, their lifestyles a caricature of English customs, warped by time and distance, but never relinquished. Roast dinners on sweltering Christmas days, heavy serge school uniforms, carefully nurtured BBC accents on the radio, cricket and lawns and imported flowers.*” In contrast, McHugh (1995)

also comments that a European ‘invasion’ followed after World War II: “*Soon a bewildering cacophony of accents and languages could be heard in every centre, as the unlikely looking newcomers assembled in the cities, towns and villages. Shopkeepers grappled with ridiculous-sounding ideas like sour cabbage, boiled sausages and black bread.*”

Henry arrived in Australia by plane. In the interview by Unger (1974), he said that arriving from Europe at Mascot Airport in May 1951 was like “*departing Sydney today [in 1974] and arriving in Cobar [presumably as an example]*”. He felt utterly lost and, having left Darwin’s heat, was plunged into a cold Sydney day in May. Arriving with other Germans, the group was photographed by a Sydney Morning Herald photographer, appearing in print the next morning under the headline ‘German Scientists Arrive’. Henry commented that it was a rather “*bombastic title*”. The photograph caption also misidentified Henry as a Mr Wassermann. Some thought that it was done deliberately to prevent victimisation and aggressiveness by those who opposed Germans arriving and working in NSW. Henry thought this was a feeble excuse and that it was most likely a journalistic error. Mr (Wally) Wassermann was in fact a surveyor and did travel with Henry on their way to Cooma and then on to the Adaminaby staging camp.

2.1 Henry, the Surveyor

Men and women from Europe outnumbered Australians on the Snowy Scheme. McHugh (1995) noted that the atmosphere in the camps was not always harmonious. The Germans often held senior positions in survey and, unless they were particularly diplomatic, their methods could easily rankle with some of the other Europeans. A Czech chainman took umbrage at Wally Wassermann’s curt manner of addressing him and said “*Hold on, this isn’t Germany now, this is free Australia!*” Wally got the message, and the two eventually became good friends.

There were also some clashes with Australian surveyors over the use of the term ‘surveyor’. Henry was not registered or licensed and regarded any restriction on the use of the term as a “*professional humiliation*”. The objection was largely at the local level as the Snowy Mountains Hydro-Electric Authority highly valued European experience and to it, Henry acknowledged, he was a ‘surveyor’.

At many camps, surveyors were German and chainmen were Polish. Wartime animosity sometimes came through. Henry explains in the interview with Unger (1974) that on his first day of surveying, while providing instructions to his Polish chainman for some work in difficult terrain, Henry tried to explain the theory of compensating errors and hence better ways of carrying out the measurements. A few days later, Henry said, he had a revolt on his hands and was “*likened to some Gestapo bloke trying to re-establish a concentration camp*”. Henry said he quickly realised the value of boiling the billy and, using his sense of humour, established a reasonable working relationship over time. In Figure 5, Henry is seen surveying at Island Bend near Guthega in the Snowy Mountains.



Figure 5: Henry Werner at Island Bend in the Snowy Mountains, 1951 (McHugh, 1995).

Henry was mainly engaged in engineering surveys, varying from road location to dam construction surveys and supervision of contracts. He was involved in the early levelling, traversing and control work at Eucumbene Dam. Henry tells Unger (1974) that once, while carrying out early investigations into a road to the Eucumbene Portal using magnetic compass and simple distance techniques, he became lost in a blizzard not far from the camp. He was unaware that the basalt in the region was deflecting the compass needle and after 2½ hours of surveys with snow all around, blazing trees and painting them red as they went, his team finished up unexpectedly back at the camp, conveniently beside the fire, as he had unknowingly surveyed in a circle.

Some of the unique challenges confronted and managed by Henry and the teams of surveyors working on the Snowy Scheme stemmed from the reality that most were not trained mining surveyors and had to learn mining terminology from scratch and how to deal with miners more familiar with mining iron ore or coal than they were with driving tunnels. Henry mentioned to Unger (1974) that some of the problems encountered were unique to the surveyors but not unique to construction. He said that with a good university background, the surveyors could adapt and they did. With one or two exceptions, most people involved with surveying for the tunnels were graduates of European universities, particularly German ones.

Henry was extremely proud of his survey work carried out for the Snowy Scheme and identified two personal construction highlights to Unger (1974). The first being the completion of the concrete-arch Tumut Pond Dam, which provided challenges requiring survey techniques to be adapted from European university texts, refined for the local conditions. The monitoring methods needed to be easily replicated as the pace of construction was “*hectic*”. To achieve the precision required and be confident as the concrete arch was being constructed, four or five epochs were needed to be surveyed and calculated each day. The second highlight was seeing the nearby Tantangara Tunnel meet in the middle!

Unger (1974) asked Henry about the meritorious aspects of the Snowy Scheme. He responds that in pure surveying terms it was, for the first time in Australia, the use of one point of origin for all surveys – what would shortly after become known as integrated surveys. In more esoteric terms, Henry believes it was the successful integration of peoples from all over the world and being a part of the major training place for future generations of construction and surveying leaders in Australia. On personal terms, Henry well understood that “*the experience and reputation that went with [working on the Snowy Scheme] got me a good interview with the University [of New South Wales].*”

2.2 Henry, the Academic

In 1960, Henry Werner joined the fledgling Department of Surveying in the School of Civil Engineering at UNSW as a lecturer. Henry made an early impression on students as he was a year 1 surveying lecturer (Figure 6). Not only was his accent strange to most students but also his sense of humour. Loeffel (2007) includes several anecdotes. Students learnt to correctly pronounce ‘kilometre’ in a distinctly German accent. Henry’s ‘History of Surveying’ lectures were always informative and amusing with references to his time on the Snowy Scheme and on Egyptian survey history. Henry related to young students on a practical level. He updated each year’s notes with handwritten additions. He once handed out mine surveying notes in German. Henry’s marking notes were legendary... from ‘mm’ (millimetre madness) to Bible quotes for bad handwriting (e.g. “*see Daniel 5:8*”). At survey camps, to make exercises more interesting, Henry would provide a prize buried under a coordinated point (often in the form of beer).



Figure 6: Henry delivering a lecture at UNSW, 1976 (courtesy of UNSW).

Henry’s celebrated research work was his more than 6-year project, commencing in 1964, on the precision levelling and assessment of the degree of settlement for the Sydney Opera House foundations, particularly those resulting from tidal movements. The results demonstrated that the Opera House rose and fell “*a couple of centimetres*” with the tides due to the movement of water into and out of the sandstone.

Henry Werner retired from UNSW in 1978 after 18 years of service. Photos from his farewell dinner show elements of Henry’s quirky personality (Figure 7). During Henry’s time at UNSW, some 700 students were exposed to his ideas in the pursuit of knowledge. His methods were innovative, original and at times unorthodox. Teaching, for Henry, was an adventure in participation in which the student had to extend him or herself at least as much as the lecturer.



Figure 7: (a) Prof. Peter Angas-Leppan and Henry with typical 'mischievous' look, and (b) Henry reading his farewell speech... from an 'Egyptian' scroll, both 1978 (courtesy of UNSW).

2.3 Henry, the Writer

Henry joined the Institution of Surveyors in 1959 and he was elected a Fellow in 1970. He was an active participant in Institution affairs and contributed many papers to *The Australian Surveyor* and enlivened the correspondence pages of the *NSW Surveyors' Monthly Bulletin*, and later *Azimuth*, with letters presenting provocative challenges in an often-humorous style (N.N., 1984).

As commented in N.N. (1980), Henry's "*attitude to research was that of a labour of love, directed not towards self-advancement but instead towards the advancement of scientific knowledge for its own sake.*" Henry's major contribution was devoted to an historic compilation of surveying events through time, embracing all its branches. Published in 1966 as 'A calendar of the development of surveying' (on one occasion using the spelling 'calender' and on another replacing the word 'development' with 'history'), it comprised papers in eight consecutive issues of *The Australian Surveyor* commencing with Werner (1966) and concluding with Werner (1968). The late Professor Harry Biesheuvel of the University of Natal, where Henry spent a sabbatical year in 1968, wrote that "*Henry's 'Calendar' was a monumental piece of research which will be of inestimable value to all those who in their teaching get beyond technicalities of the subject and relate it to its impact on man and human society.*"

3 HENRY AND ME

I had the privilege of first meeting Henry Werner as a surveying lecturer and 'prac' supervisor during my time at UNSW (1974-1977). Henry was in the final years of his career. My main recollection of the time was being in a lecture hall with Henry passionately delivering lectures on the history of surveying. Whilst history is part of what we do as surveyors, Henry was going back way beyond my then knowledge and was talking about times that I had only loosely known from social studies in primary school and Charlton Heston movies. To that history he was adding themes of mathematics, measurement, astronomy, cartography and geodesy mixed with a dose of philosophy. Henry was legendary and memorable to anyone within his orbit and to many outside of it.

After university, I was working at the NSW Department of Public Works and came across Henry again during the Department's Sydney Opera House monitoring surveys in 1981. Due to Henry's previous knowledge and extensive survey work at the Opera House in the 1960s, he was enlisted by the Department to assist, observe and book observations during the 1981 monitoring surveys (Figure 8). A year or so later, I was appointed an organiser for the Department's 'Survey and Property Branch Conference 1982'. Henry was invited to deliver an address to the conference that he titled 'The philosophy of progress: Any lesson [sic] from the history of surveying?'. That address formed the basis of Henry's 1984 paper which was to come later. In Werner (1984), Henry comments that his address to the conference mainly "*described the dimensions of the Great Pyramid of Giza, near Memphis on the Nile River in Egypt*" and that "*the address was short on philosophising and long in an informal talking manner... utterly unsuitable for printing.*"



Figure 8: Henry Werner reading directions on P7, S.E. Pylon SHB, 1981 (courtesy of NSW Public Works).

A year or so after the Public Works conference, Henry contacted me to seek help to review and edit a paper he was preparing for publication in *The Australian Surveyor*, the national surveying journal of its time. Henry had shortly before been diagnosed with an incurable cancer. The diagnosis appeared to trigger Henry into action. He had had a paper in his mind for some time now and the address to the Public Works conference a year earlier did not go far enough. Now was the time. It would be his legacy paper.

I recall Henry saying that as his cancer developed his thought capacity would be diminished. The 28-year-old me, who struggled with level 2 English at the HSC, would need to be his editor, grammar and spell checker, fact checker and 'project manager'. At the time, Henry and his wife, Ruth, lived in a beautiful federation home in the Sydney suburb of Beecroft. I lived only a 15-minute drive away. The decision to help him was an easy one.

Each week on a Tuesday night, as I recall, I would attend Henry's house. We would sit in the traditional lounge room either side of a small table. Henry would go through his handwritten drafts of the various sections of his paper. We would chat, he would show and explain the reference texts, ask me what I thought about various parts of his draft and make amendments... if he agreed. I would take that section away, review and check against his references again and arrange for it to be typed. The next week, I would return the typed section for Henry's final review and any discussion. The whole process would then recommence on Henry's next handwritten section.

As time went by, Henry's ability to concentrate for long periods of time noticeably diminished. Our meetings became shorter and although he generally managed to have his draft sections ready on time, he began to rely on me more and more. If I thought there was a better way to write something, he would listen and mostly simply agree. It took Henry and I four to five months to complete the paper and prepare all the accompanying diagrams. The final paper by A.P.H. Werner, titled 'The philosophy of progress: Any lessons from the history of surveying?' was submitted to *The Australian Surveyor* on 10 May 1984 and published in the September 1984 edition (Werner, 1984).

4 THE 1984 PAPER

Henry commences his paper with a short abstract (Werner, 1984). He explains how his paper is presented in two parts. "*The first, with the help of history, shows the need for an appreciation, and adoption, of spiritual aims in progress to match the leaps and bounds of material progress...*" The second part relates to spiritual and material progress as evidenced by the Great Pyramid of Giza in Egypt, particularly the significance of the measurements extracted there from. This paper concentrates predominantly on the first part of Werner (1984).

In his introduction, Henry apologises to readers familiar with his quality of publishing, suggesting they may detect shortcomings but hoped they would be small. It was an acknowledgement of his failing health. Henry notes that "*Science, or just surveying, has progressed at such a fantastic rate since World War II that few surveyors have had the time, and have not interpreted this development, except by uttering generalities. Indeed the 'great' of international geodesy are known by formulae, not any philosophy connected thereto.*"

Interestingly, the Editorial to the September 1984 edition of *The Australian Surveyor*, in which Henry's paper was published, focused on the new "*Global Positioning System (GPS) being heralded as a technique that will revolutionise surveying in much the same way as EDM did in the 1960s.*" Surveyors were encouraged to "*act now and prepare for GPS.*" Although education was also encouraged, there was no mention of any philosophical considerations about the use by surveyors of what was originally an application limited to use by the United States military. In wrapping up his introduction, Henry observes that "*The surveyors' present lack of interest in any philosophy supporting their deeds is a sad abdication of ethical responsibility which is, in terms of international law (Nürnberg, 1945), a despicable lack of attitude.*"

4.1 Philosophy

The word philosophy comes from the Greek 'philo' (love) and 'sophia' (wisdom) and so is literally defined as 'the love of wisdom'. Henry notes that the Oxford dictionary (4th edition) describes philosophy as "*a love of wisdom or knowledge, especially that which deals with ultimate reality or with most general causes and principles of things.*" The Cambridge online dictionary describes philosophy as "*the use of reason in understanding such things as the nature of the real world and existence, the use and limits of knowledge, and the principles of moral judgement.*"

Philosophy can be a difficult concept to understand when continually surrounded by daily engineering and real-world surveying problems and deadlines. There are hundreds of

definitions of philosophy on the internet. However, the online World History Encyclopedia [sic] attempts to break it down to first principles. It describes philosophy as “*the study of the most basic and profound matters of human existence.*” It wonders exactly when and where philosophy first began to develop. “*Uncertain*” it says, but finds the simplest answer is that “*it would have begun – at any place in the distant past – the first time someone asked why they were born, what their purpose was, and how they were supposed to understand their lives.*”

4.2 The Philosophy of Progress

In Werner (1984), Henry poses “*Is it necessary to analyse progress by means of a philosophy?*” He notes that a French philosopher said that “*true scientific progress leads from error*” and that “*there are also natural and moral philosophies. General causes [of progress] in the history of surveying are wars, Halley’s Comet, man’s vanity... and, if circumstances are favourable, lead to discovery and progress.*”

Henry postulates that “*a proper philosophy of progress demands that the researcher and scientist asks oneself: does my research serve the progress of mankind?*” Henry quotes an example of the doubling of computer capacity from 4 K to 8 K as numerical progress. (That may not seem much, but it was the early 1980s and it is the concept!) “*Progress could be expressed in savings of time and remuneration. A philosophy of dollars!*” So, “*The more rapid the numerical (or material) progress, the faster grow moral responsibilities.*”

Henry mentions a surveying example whereby the advances in geodesy led to baseline measurement by the 18th century. “*Progress was made because of the need for maps, for political or military reasons, ultimately to make better wars. Not much of a progress for people.*” The latter half of the 20th century saw the emergence of better positioning by satellite or the Global Positioning System (GPS). Henry had concerns: “*We have better updating of coordinates and are guaranteed a better wipe-out next war.*” Henry does not leave it there though and poses that “*moral obligation seem foreign words to a geodesist.*” However, “*The difficulty is that we do not know about the long term effects of any progress.*” But, “*There is no excuse for supplying solutions under contract for missile projectories [sic].*”

4.3 Progress

Henry states that “*Material progress is when a method or instrument improves our knowledge.*” He muses “*Was the appearance of boundary stones in Egypt and Mesopotamia material progress? Yes, it secured rights and orderly agricultural production and engaged their Gods in the process. The midday sun shadow falling over the north face of the pyramid at Giza gave surveyors a line for orientation on the muddy flats when setting out the plots after the flood had subsided.*”

Henry continues that “*Material progress was balanced by spiritual attitudes. Did a faster ‘religious’ survey give, beside material progress, a greater spiritual one? Of course, a quicker survey gave a better production which was ultimately considered to show the Gods being favourably inclined.*” He comments “*If progress was under threat anywhere, one observes a prompt acceleration of progress. Amazing what fear does to rulers.*” So, in those circumstances, “*All scientific progress was without responsibility: an easy time for everyone on the winning side.*” Henry goes further: “*After the war, the German technical progress was no longer a threat, but the Russian Bear gave rise to incredible progress. The rate of it was so breathtaking that anyone worrying about ethics or God seemed to be an odd fellow.*”

Henry had concerns that *“magnificent progress has now lost speed and concern for absence of spiritual responsibility is popping up everywhere.”* So, *“What happens if scientists do not attempt to balance the two parts of progress? They become obsessed with their work and forget their people. Einstein saw this too late and felt deeply upset.”* Henry sums up his thoughts with this: *“Any human endeavour which tries to balance the physical gains achieved by scientists and technologists [including surveyors] with an increased awareness of the consequences of such progress on the community is real progress.”*

Students and tertiary education were not left out of Henry’s thoughts on progress. *“The influx into tertiary education began in the late 50s on a grand scale... Only since 1980 is there evidence of a better educated young person giving hope that our community is progressing.”* *“If our students had to study the history of surveying properly, the universities could invite Rabbis and Imams to lecture on their views on the need for acknowledging God in the sciences; it would enrich the presently pitifully poor attitudes to professional ethics. For instance, geometry and numbers had a divine significance.”*

In concluding his thoughts on philosophy and progress, Henry summarises: *“A philosophy of the history of surveying should measure material and spiritual progress. This act requires a love of wisdom and knowledge. Usually, wisdom reigns at a higher level. Knowledge comes from data and wisdom from their proper use.”*

5 MOTIVATIONS TO WRITE THE 1984 PAPER

It is hard to recall, 40 years on, if Henry ever said to me why he wanted to give that particular address to the Public Works conference in 1982, an address based on philosophy and lessons from surveying history. It is easy to see why he consequently wanted to write the 1984 paper. It was simply a natural progression for an academic and fervent contributor to academic journals. He had delivered his address to the Public Works conference before his terminal diagnosis, so submitting a subsequent paper to *The Australian Surveyor* was almost certainly on his mind. But was there more to his motivation? Henry retired from full-time work in 1978, 4 years before his address to the Public Works conference in 1982. So in conjunction with his terminal diagnosis, was Henry’s motivation simply to write one last paper of a cautionary nature for future generations of surveyors? Maybe his motivation was more deeply seated than that and there may be clues from his experiences and general philosophical approach to life and work. The following sections provide some additional possible influences.

5.1 Germany Before World War II

The following three paragraphs (sourced from Wikipedia) are included for background only. They provide a snapshot of the political and social times in Germany through Henry Werner’s formative years. One can only imagine that they had an impact on him and left him with lasting memories.

The Great Depression of the 1930s severely impacted Germany’s progress. There was high unemployment and subsequent social and political unrest. On 30 January 1933, Adolf Hitler was appointed as Chancellor to head a coalition government including his far-right Nazi Party. Hitler promptly used his powers to thwart constitutional governance and suspend civil liberties, which brought about the swift collapse of democracy and the creation of a one-party

dictatorship under his leadership.

In the midst of the Great Depression, the Nazis restored economic stability and ended mass unemployment using heavy military spending. Financed by deficit spending, the regime undertook extensive public works projects including the Autobahnen (motorways) and a massive secret rearmament program, forming the Wehrmacht (armed forces). Racism, Nazi eugenics, anti-Slavism and especially anti-Semitism were central ideological features of the regime. Christian churches and citizens that opposed Hitler's rule were oppressed and leaders imprisoned. Education focused on racial biology, population policy, and fitness for military service.

From the latter half of the 1930s, Nazi Germany made increasingly aggressive territorial demands, threatening war if these were not met. Germany invaded Poland on 1 September 1939, launching World War II in Europe.

5.2 World War II and Nuclear Weapons

Henry turned 15 the year that Adolf Hitler came to power. He turned 21 at the outbreak of World War II and spent the entire war assigned to a German anti-aircraft unit. He turned 27 the year World War II ended. This tumultuous time in German, European and world affairs must have left an indelible mark on the young Henry Werner. He was educated, a scientist/surveyor and a thinker. Throughout his 1984 paper, there are multiple references to World War II, wars in general, ethics, international law, Nürnberg, bombs and nuclear armament.

He asserts that "*The issue is now [in 1984] to question the international reputation of mainly computer manufacturers who earn millions from the nuclear armament industries. We should refuse dealing with them on that ground.*" Many who saw last year's 'blockbuster' film, 'Oppenheimer', will know that Albert Einstein was an associate of Robert Oppenheimer, the lead scientist on the Manhattan Project to design and build the first atom bomb. In the film, Oppenheimer says to Einstein: "*When I came to you with those calculations, we thought we might start a chain reaction that might destroy the entire world.*" Einstein responds, "*What of it?*" to which Oppenheimer replies "*I believe we did.*"

Previously we have learnt from Henry that scientists focused on their work can forget the human side of progress. Henry's example was Einstein who, he noted, "*came to that realisation too late and felt deeply upset.*" In Bird and Sherwin (2005), the Danish physicist Niels Bohr, a great friend and mentor of Robert Oppenheimer, wrote that "*Knowledge is itself the basis of civilisation, but any widening of the borders of our knowledge imposes an increased responsibility on individuals and nations through the possibilities it gives for shaping the conditions of human life.*" That sounds very much like our own Henry Werner.

Los Alamos in New Mexico was established in 1943 as Project Y, a top-secret site for designing nuclear weapons under the Manhattan Project during World War II. Many of the world's most famous scientists, including Nobel Prize winners, were brought together at Los Alamos. Initially they were focused on unravelling the secrets of nuclear fission and producing an atom bomb. Bird and Sherwin (2005) provide great insight into the feelings of the scientists over time. "*By late 1944, a number of scientists at Los Alamos began to voice their growing ethical qualms about the continued development of the 'gadget'.*" Meetings were called to discuss "*the impact of the 'gadget' on civilisation.*" They held meetings and

pondered questions such as “*What will this terrible weapon do to the world? Are we doing something good, something bad? Should we not worry about how it would be applied?*”

“*On July 12 1945, an Army poll of 150 scientists in the project, seventy-two percent favored a demonstration of the bomb’s power as against its military use without prior warning.*” The first nuclear test occurred near Alamogordo, New Mexico, codenamed ‘Trinity’, on 16 July 1945. It was an ‘unearthly’ success. Two other atomic weapons were soon produced and used in the attacks on Hiroshima and Nagasaki... without warning. As Henry would say, the scientists forgot the human side of progress until it was too late.

5.3 A Calendar of the Development of Surveying

Henry’s ‘A calendar of the development of surveying’ was first published in *The Australian Surveyor* in September 1966 (Werner, 1966) and continued in the next seven issues of the journal over a 2-year period. In his opening remarks he notes that “*The transmission of knowledge is effected by direct contact between people and the study of old instruments and documents.*”

Further, Henry includes his reasons for writing this epic surveying calendar:

- Few surveyors have ever attempted to write a comprehensive history of surveying in all its forms.
- To encourage interest and to open avenues of communication between surveyors of all countries for better understanding and efficiency.
- To give students required clues for serious study.
- So specialist surveyors may experience moments of serendipitous relaxation while searching for information of special value to them. Henry quips further: “*Even a fanatic specialist may have preserved enough sense of humour to enjoy reading that a musician designed telescopes or a brewer spent his nights looking through them, geodesists read Omar Khayyam’s non-astronomical verses, poets discussed global mapping and emperors declared the new moon to have risen.*”

In his calendar, Henry is linking technical knowledge and endeavour to humanity in a fundamental way. He also has his eye on the future, one being enhanced by a clear mind, broad and open communication, continued learning and moments of respite. Perhaps we see here Henry’s philosophical approach to progress and a future influenced by clear thinking and learning from the past.

6 FORTY YEARS ON – ANY RELEVANCE IN 2024?

6.1 Artificial Intelligence

According to Smith et al. (2006), “*The term ‘artificial intelligence’ was first coined by John McCarthy in 1956 when he held the first academic conference on the subject. But the journey to understand if machines can truly think began much before that. In 1945, Vannevar Bush’s seminal work ‘As we may think’ proposed a system which amplifies people’s own knowledge and understanding. Five years later, Alan Turing wrote a paper on the notion of machines being able to simulate human beings and the ability to do intelligent things, such as play chess.*”

AI robots have been around for much longer in film. Press (2016) notes that the 1927 science-fiction film ‘Metropolis’ features a robot double of a peasant girl, Maria, which unleashes chaos in Berlin of 2026 – it was the first robot depicted on film. Another good example is C-3PO in ‘Star Wars’. C-3PO appears to be an outlier in that it is generally a good robot in terms of relations with humans.

Often though, in film, ‘intelligent’ robots go off the rails and cause havoc and generally threaten the Earth or the human race with destruction. A recent example was the 2023 film ‘The Creator’. Set in the year 2065, the film depicts a world in which humans and AI robots coexist. However, after an AI-related nuclear event in Los Angeles, the West stops development of AI and finds itself in conflict with New Asia (an amalgamation of East Asian countries). War erupts between the human race and the forces of AI. Humans must hunt down and kill the Creator, the elusive architect of advanced AI who has developed a mysterious weapon with the power to end the war... and mankind itself.

Back to the present and with the recent appearance of programs such as ChatGPT, generative AI and machine learning are very much in the public spotlight. Generative AI builds on the foundation of machine learning and turns machine learning inputs into content. Generative AI can both learn to generate data and then turn around to critique and refine its outputs (Robb, 2023).

So, with a little browsing through news media over the past few months, it is not hard to find articles both positive and negative towards generative AI. Dr Andrew Leigh, Assistant Minister for Competition, gave a speech in September 2023 about AI’s rapidly growing role in the economy. He says the rise of AI engines has been remarkable and offers the potential for “*immense economic and social benefits*” and “*has the potential to turbocharge productivity*”.

I suspect that Henry may have said he had heard those arguments before and would like to see a little more work on understanding the human consequences of such progress. He may have felt vindicated or perhaps depressed if he could have read the following media reports from 2023:

- Sydney Morning Herald (SMH), 31 May 2023 (Gregg et al., 2023): “*Mitigating the risk of extinction from AI should be a global priority alongside other societal-scale risks such as pandemics and nuclear war,*” according to the statement released by the non-profit Centre for AI Safety. The open letter was signed by more than 350 researchers and executives, including chatbot ChatGPT creator, OpenAI’s CEO, Sam Altman, as well as 38 members of Google’s DeepMind artificial intelligence unit.
- SMH, 22 September 2023 (Gittins, 2023): “*Scientists have been talking about AI since the 1950s... It took the telephone 75 years to reach 100 million users, the mobile phone took 16 years, the web took 7 years*” whereas ChatGPT “*took just 2 months*”. “*We should beware of established businesses asserting their right to train AI models on their own data (which is how the models learn), while denying access to that data to competitors or new businesses seeking to enter the industry... The latest ChatGPT version uses data up to only 2021 [at the time of writing]*” so may not be using current data. “*The big question is how amenable to competition the development of AI is?*”
- Reuters, 26 October 2023 (Sandle, 2023): “*British Prime Minister Rishi Sunak said only governments could tackle the risks posed by AI, a technology he said could make it easier to build chemical or biological weapons, spread fear and, in a worse-case scenario, escape human control. Speaking ahead of a global gathering he has convened next week*

to examine the risks of the technology, Sunak said he hoped the participants could agree on the nature of the risks and establish a global panel to assess them.”

- GRC World Forums, 31 October 2023 (GRC World Forums, 2023): *“The British Prime Minister, Rishi Sunak, has disclosed plans for the UK to house the world’s first Artificial Intelligence (AI) Safety Institute. In a speech in London yesterday, Sunak detailed the institute’s pivotal role in advancing global understanding of AI security. He underscored its core mission of thoroughly assessing and understanding risk factors associated with emerging AI models, ranging from social biases to more extreme threats. The PM also highlighted the institute’s commitment to transparency; plans are in place to share certain data publicly while retaining national security information for circulation with like-minded governments. One key aim is to guarantee the safety of AI models before their public release, Sunak asserted.”*
- SMH, 3 November 2023 (Swan, 2023): *“Cybersecurity researchers are sounding an alarm about the hacking community’s answer to ChatGPT, a new generative AI tool dubbed WormGPT, which is being used to create sophisticated attacks on Australian businesses. WormGPT is being described as similar to ChatGPT, but with no ethical boundaries or limitations, and researchers say hundreds of customers have already paid for access to the tool on the dark web.”*

Henry Werner may have seen the film ‘Metropolis’. He may have even read Frank Herbert’s 1964 novel ‘Dune’, set well after the ‘age of computers’ had come and gone to a calamitous end. Regardless, I suspect Henry was well aware of the term ‘artificial intelligence’. Whether he could have envisaged generative AI coming along is debatable, but even so the lessons in his 1984 paper still apply and are still relevant today. He certainly had concerns over the global tech giants earning billions from nuclear armaments and other defence industry contracts. So why would he not have concerns over a small number of global tech giants holding the keys to generative AI?

In Werner (1984), Henry shows us a way forward and makes the following statement which I repeat here due to its continuing relevance today to generative AI and other breakthrough technologies: *“Any human endeavour which tries to balance the physical gains achieved by scientists and technologists with an increased awareness of the consequences of such progress on the community is real progress.”* It is evident from the above media clippings that we still have a long way to go but if we bear Henry’s words in mind, there is a way.

6.2 AI and Surveying

Hess (2023) tells us *“The integration of AI and machine learning (ML) is helping land surveyors to automate data processing and analysis, and to identify patterns and trends that may not be easily discernible through traditional methods.”* What does seem to be clear is that large datasets, such as those created by Light Detection and Ranging (LiDAR) or laser scanning, are particularly suited to analysis by AI. Mehta (2021) defines AI in simple terms as *“the capacity of a computer to act intelligently as opposed to natural intelligence in humans. This ‘intelligence’ is implemented in the form of algorithms to perform specific tasks, learn, and adapt to provide solutions.”*

Clifford (2023) suggests that *“some areas of surveying do not lend themselves to AI. For example, boundary surveying, or determining lines of ownership, is often referred to as ‘the art and science of surveying’, as it isn’t as simple as measuring between physical monuments and certifying the results. In this regard, it seems unlikely that an honest professional would*

cede their judgements to a machine. However, there are plenty of areas that could offer opportunities for AI to enhance the industry.”

A review of several websites discloses that some areas of potential application for AI in surveying may be (amongst others): title reports, accelerating data extraction for ground penetrating radar, construction control and layout, deformation monitoring, LiDAR and drone or Unmanned Aerial Vehicle (UAV) data analysis, scanning railway lines to quickly get a better overall view of their condition, reduced overheads and reduction of post-processing time. In addition, machine learning algorithms can be used to automatically detect and map changes in land use over time, allowing for land surveyors to easily recognise areas that may be of interest or concern.

Encouragingly, Hinds (2023) *“does not expect AI to replace the role of a surveyor. Instead, AI-powered software and tools will continue to help surveyors collect, process, and analyse large amounts of data, making it easier to map out land features, identify potential hazards, and assess the impact of development projects.”* This seems to be the general view at the moment.

A few years ago, on Reddit (2019), there was some interesting chat about AI and land surveying. The view of ‘majorkev’ was that *“AI... will make more work faster to do. Does that mean you’ll be able to roll into the office at 8 and go home by noon? Absolutely not... AI will bring about a calamity of sorts where you will have fewer people doing actual work, but there will be more work for them to do. People won’t be stress free, or working shorter hours since paradigms will shift, and we’ll all go along for the ride.”*

Although progress using generative AI seems to be widely embraced and encouraged across the surveying landscape, Henry would be disappointed that there seems to be little thought to ethical concerns and impacts on the community. However, there was one group, Land Surveyors United (2023), who made these comments via its ‘AI for Land Surveyors Hub’: *“AI also holds the potential to enhance the capabilities of land surveyors, improve efficiency, and provide new opportunities for innovation. The integration of AI into the field of land surveying requires careful consideration, ethical discussions, and ongoing collaboration between technology developers and surveying professionals.”* And *“As with any emerging technology, ethical considerations are important when implementing AI in land surveying. Privacy concerns, data security, and the responsible use of AI algorithms are some of the aspects that surveyors need to address to ensure ethical practices.”*

Land Surveyors United also wanted to know *“what the surveyors of the world think.”* In August 2023, they arranged a 4-day ‘SurvAI Forum’. It concluded that professional land surveyors appear to have various concerns and fears regarding the adoption of AI. It provided a list of reasons why professional land surveyors seem to be fearful of AI, including job displacement, accuracy and reliability, liability and responsibility, data privacy and security, loss of professional judgement, dependency on technology, initial investment and training, unpredictable technological advances, loss of human interaction, and ethical and cultural considerations.

It is difficult to find Australian based discourse on the future benefits and consequences of AI, machine learning or deep learning in connection with surveying. However, at the time of writing in late 2023, the Geospatial Council of Australia is advertising a webinar to be held in February 2024, titled ‘An introduction to AI in smart infrastructure and the geospatial world’.

It aims to discuss tools like GeoChatGPT, GeoAI and emerging advanced cartography techniques.

If Henry were here now, I suspect he would be pleased with the approach taken by Land Surveyors United for promoting knowledge around AI and raising questions of ethics and consequences for consideration by land surveyors and others. He would also be encouraging the Geospatial Council of Australia and others to keep their scope wide and include topics of ethics, moral responsibilities and consequences as generative AI evolves our techniques, technology, work and lives.

So, how relevant is Henry's message in his 1984 paper now in 2024 and beyond? Henry said "*Are surveys progressing rightly then? I hope so. It is clear that both parts of progress should not be separated from each other.*" Technological progress progressing hand-in-hand with the understanding of ethical and moral consequences is a message just as relevant to AI today as it was to GPS in 1984 or Egyptian measurements in 3,000 B.C.

7 CONCLUDING REMARKS

A.P.H. "Henry" Werner passed away in September 1984, the same month that his 1984 paper was published in *The Australian Surveyor*. Henry's formative years spanned from World War I through and beyond World War II. Given his life experiences, his devotion to the history of surveying and his spiritual appreciation of progress, it is not surprising that in the final months of his life he was motivated to the extent that he would produce a paper to caution future generations of surveyors and spatial scientists to tread carefully when adopting new technology. By all means 'push the boundaries' but do it in a way that includes ethical awareness and amelioration of detrimental consequences.

On the 40th anniversary of his passing and the publication of his 1984 paper, it has been my honour to bring the life and words of Henry Werner to APAS2024. Henry would expect that you will hear and act on his words and even further develop his message going forward. He has good reason for that expectation because, in his words, there is "*the need for an appreciation, and adoption, of spiritual aims in progress to match the leaps and bounds of material progress... to promote a greater awareness of the far-reaching consequences of progress in relation to the future of mankind.*"

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Late in the development of this paper, I was able to make contact with Sibylle Werner, Henry and Ruth's daughter, who calls Berlin her home but is currently living in Queensland. Sibylle has enthusiastically supported my endeavour to bring her Papa's wise words and

philosophical thoughts from 1984 to us all here in 2024. Sibylle has provided many photographs and documents from her family collection to enhance this paper and the presentation. My sincere thanks go out to her.

Lastly, I would like to thank a legend, the Late Mr Henry Werner, for pushing the boundaries way beyond my own personal comfort zone all those years ago and consequently for giving me the opportunity to write this paper in his honour for the APAS2024 conference.

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