Pretoria Branch S_2A_3 News

March 2008

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our March talk:

Date: **Wednesday, 5th March 2008**

Time: **17h15** (to 18h15)

Venue: **Sci-Enza, University of Pretoria**
(Use the Prospect Street Entrance to the main campus. The Sci-Enza is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Dr Jannie Pretorius**
- Scientific consultant in the Chemical and Process Industry in South Africa.
- Collaborator with a Senior Engineering Design Group at Modderfontein.
- Research member of the Chemical PBMR Research team at UP.

Topic: **The power of a scientific computer cluster**

Refreshments will be served after the talk.

Abstract

Over the past years Super Computers resembled a computing monster only afforded by large and established research and/or technical institutions.

These 'monsters' demanded meticulous attention in upkeep and skill to prepare software in a specific style, which left the privilege of use to a selected few.

Recent years have seen a new concept of Large Scale computing achievable in reverting back to previous (older) principles of number processing but utilizing the resources more effectively.

This fresh concept has been labelled CLUSTER COMPUTING.

This talk will attempt to highlight the following:

a) What has changed over the years to reach this point in computation?
b) How do we now define a CLUSTER Computer?
c) How are these machines addressed from a user's perspective and as software developers?
d) How do the components of a CLUSTER communicate?
e) How can these systems help us solve problems and work for me?
f) What complexity of software development has now emerged compared to the previous norms?
g) Typically what kind of computation is performed on these systems (generally)?
h) How does my personal computing environment phase in with this new architecture?
i) Why Cluster Computers will play an increasingly commanding role?

Some of the intrinsic concepts of this new architecture will be demonstrated through an interactive link to the UP/PBMR cluster on campus.

Computer Algebra for Everybody

J. F. Ogilvie, ogilvie@cecm.sfu.ca

On the occasion of my address to the Southern Africa Association for the Advancement of Science in Pretoria on 2007 October 3, I was delighted by the enthusiastic response of the numerous audience, and I apologise for any deficiency in my presentation that might be due to the fact that this was the first occasion on which I delivered such material to a general audience.

For those persons who are interested in the history of π, you can find much information on internet through browsing on 'pi history' or 'pi symbol', including most content of my lecture. Below I append the six items in the 'test for audience' that I mentioned at the conclusion of my presentation.

In any of its ubiquitous forms from hand-held 'scientific calculator' to notebook to desk models, a computer has become as important for the learning and practice of mathematics as a simple calculator is for mere arithmetic. When some of us were pupils in schools a few decades ago, we undoubtedly were drilled in mental arithmetic and manual calculations of sums, multiplications and even square roots, progressing through use of tables of logarithms and slide rules. In educational curricula for many advanced communities, the standard method of extracting a square root now involves depressing the appropriate button on a calculator. One really hopes that every child will still become adept at arithmetic, both mental and manual, but naturally, the importance of use of a calculator for practical purposes cannot be underestimated. Although it is doubtful that a pupil in primary or secondary school should become dependent on a computer to undertake basic operations in algebra, geometry and trigonometry – as opposed to evaluation of any arithmetical quantities that arise in the treatment of such problems, computer software can certainly play a constructive part in the learning of these elementary mathematics through the graphical capabilities and otherwise.

In a post-secondary context it is essential for a student to become familiar with the use of mathematical software as a tool for successful practice of natural and physical sciences, engineering, economics et cetera: any educational curriculum that omits such a component is seriously deficient in preparing a student for a technical career. The most powerful general software for both the learning and practice of mathematics is Maple, developed originally in University of Waterloo, Canada, and now marketed commercially by Maplesoft company: www.maplesoft.com; every institution of higher education in engineering and science should arrange a licence for the general use of Maple on its premises. The cost of Maple for an individual student is modest – even less than the cost of a conventional printed textbook in many cases – but for somebody outside an explicitly educational environment the cost is significant. There is, however, freely available through internet other software that has many capabilities of commercial products, including algebra, calculus, linear algebra, differential equations and statistics, strongly supported by graphics facilities; perhaps the best developed, and still being extended, among this free software is maxima, easily 'downloadable' from www.sourceforge.net.

Whilst I remain in University of Pretoria, until 2007 October 30, I shall be pleased to try to answer any queries about such matters; the number for the telephone in my office here is 420-3539, and thereafter I shall still try to respond to inquiries through electronic mail.

Puzzles with π

1 Comment on this extract from Daily Telegraph, 1991 January 2: "The team includes David and Gregory Chudnovsky, who won a place in the Guinness Book of Records by computing π, the ratio between the diameter and the radius of a circle, to more than a thousand million decimal places."

2 Write the capital letters – A, B, C, D, ..., Z – of the English alphabet clockwise along the periphery of a circle. Strike those letters that have vertical symmetry – A, H, ..., Y. What is the relation of the remaining letters to π?

3 Move one match of 15 in the diagram on the right, to produce a useful, but approximate, relation. [Ignore for this purpose a line between numerator and denominator.]

$$\text{II} = \frac{\text{XXII}}{\text{VIII}}$$

4 How is this number related to π? 11.001001000011111011010

5 When is π equal to 29?

6 Prove that 22/7 – π is equal to the integral of $x^4(1-x)^4/(1+x^2)$ between 0 and 1.

SA medicine in early advertisements

Cornelis Plug, plugc@mweb.co.za

Advertisements placed in the newspapers by medical doctors, dentists and pharmacists provide a glimpse of the art and science of healing in a by-gone age. The following advertisements, dating from 1831 to 1853, appeared in the South African Commercial Advertiser, published in Cape Town.

MEDICAL GRATUITOUS ADVICE

Dr L. Liesching will attend at his House in Loop-street, during the summer months from 7 till 9 o'clock in the morning, for the purpose of giving Gratuitous Advice to the Poor. (5 January 1831. This was a fairly common practice at the time).

NEW MEDICAL TARIFF

At a Meeting of the undersigned Medical Practitioners … it was resolved and unanimously agreed to, that the following Tariff of Fees be adopted from the 1st of January 1831.
Advice at Home [of doctor]: 1s to 5s
A visit in Town: 2s to 5s
A visit beyond four miles from Town (exclusive of Horse-hire), per hour: 12s to £1
For introducing… Catheter, extracting teeth, bleeding and other minor oparations: 3s to 15s
For reducing dislocations and fractures: £1 10s to £4
For Capital operations, viz: Amputation, Aneurism, Hernia, Trepanning…extraction of cataract, &c: £3 to £15 (5 January 1831, advertisement abreviated; "s" stands for shilling, equivalent to 5 new pence)

SURGICAL INSTRUMENTS

Messrs Jones & Cooke have received by the 'Salus' 1 Cooper's Instrument, for extracting Calculae per Urethram; and 1 Weiss' improved Lithontriptor, which are for sale at the invoice price (14 March 1832. Lithontriptor: an instrument for crushing stone in the bladder).

DENTAL SURGERY

MR CARTER has received per 'Mary and Jane' and the 'Earl Bathurst', Terro-metallic, Prepared, Natural, Ivory, and every description of Incorrodible Artificial TEETH, which he will continue to apply from one to a complete set, upon such a secure and permanent construction as never to require removing, even for the purposes of cleansing; and the process of mastication will be as easy and perfect as with natural Teeth… (8 September 1832).

DR HAMILTON's DIAPHORETIC EXPECTORANT APERIENT COUGH PILLS – For Coughs, Colds, Asthmas, insipient Consumptions, difficulty of Breathing, sore Throats, Hoarseness, &c &c.

A small supply of the above Medicine, which is known to several individuals in this Colony as an efficacious remedy in the ailments abovementioned, has been recently received by Mr Tredgold, 93 Long-street (23 January 1836. Diaphoretic: promoting perspiration. Aperient: laxative).

FRESH MEDICINES

Mr Barth, Apothecary, Chemist and Druggist, begs to announce to the Public at Large, that he has received per 'Henry' and per 'Packet' a carefully selected genuine Assortment of Drugs and Chemicals, comprising a variety of Articles now in demand – as Carbonate of Ammonia (Baker's Salt) in a fine transparent condition; Carbonate of Soda, Rochelle Salt, Tartaric Acid; Cream of Tartar, finely prepared for making Ginger Beer; Italian Juice; Refined Liquorice; Isinglass, best quality; Sarsaparilla; best white Jamaica Ginger; Peruvian Bark, and Turkey Rhubarb, fresh Chamomile Flowers, &c (2 December 1837, abbreviated).

TO THE MEDICAL PROFESSION

FOR SALE, just arrived per 'Apprentice', - Cyclopaedia of Practical Medicine, Cooper's Surgery, Ryan's Midwifery, Works on Chemistry and Pharmacy, &c. Apply to Messrs NORDEN & PERRY, Castle-street (17 June 1840).

DOCTOR FERDINAND von SOMMER

Having obtained the necessary authority from His Excellency the Governor, purposes to practise as Physician and Surgeon in this Colony.
Dr V.S. resides for the present, at No 12, top of Castle-street (part of Dr Wehr's late House), where he will, before 9 o'clock in the Morning, afford gratuitous Medical Assistance to such as may be in need of it. (21 March 1840).

INDIAN LEECHES, EX 'SAMARANG'

C.F. BARTH, Apothecary, has just received a large quantity, comprising 6000 of perfect healthy Indian leeches, scarcely ever imported in such a healthy condition, which may be had in any quantity, Wholesale and Retail, to suit Dealers and Customers. Price from 1s – 2s.

Also Cape leeches from 3d to 6d each (13 December 1843; "d" stands for "penny". Leeches were used to bleed patients as a curative measure, but went out of fashion after 1860.

TO APOTHECARIES, CHEMISTS AND DRUGGISTS

A MEDICAL PRACTITIONER, lately arrived in this Colony,will receive Tenders from such Apothecaries, Chemists and Druggists, as are desirous to prepare his Medical Prescriptions. Tenders will be received until the 15th of February next: - the rate of per Centage that will be allowed on each Prescription must be stated in Sterling Money. Tenders to be addressed to R. Leech, Esq., M.D., No 99, Imposition Square. (26 January 1842).

READ HERE! A CURE FOR DEAFNESS

SCHRODER'S EAR BALSAM, a new invented remedy, which has cured several persons who were labouring under that complaint for a number of years. A few drops of this Balsam are to be dropped into the ear morning and night. Prepared and sold exclusively by H. Chr. Schröder, Apothecary, Stellenbosch (13 February 1850).

HOMEOPATHIC MEDICINES AND BOOKS

Now unpacked a variety of spare Tubes of Homeopathic remedies of various potencies, also a few works on the subject of Homeopathy.
J.T. POCOCK & Co. (30 March 1853).

Pretoria Branch S_2A_3 News

April 2008

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our April talk:

Date: **Wednesday, 2nd April 2008**

Time: **17h15** (to 18h15)

Venue: **Sci-Enza, University of Pretoria**
(Use the Prospect Street Entrance to the main campus. The Sci-Enza is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Dr Ruric Vogel**
Counselling Psychologist

Topic: **Emotion Regulation**

Refreshments will be served after the talk.

Abstract

Emotion regulation is a relatively new topic of research. Until the early 1990's there were very few citations per year referring to emotion regulation. Since then there has been roughly a fivefold increase in the citations referring to emotion regulation every five years.

The talk will first look at what emotion is and then at how it is regulated. Emotions play an important role in every day life by effecting behaviour, tuning decision making, influencing memory, and facilitating interpersonal interactions. Emotions can be beneficial or detrimental to the individual. An individual uses emotion regulation to dampen, intensify, or just maintain emotion as to achieve specific goals.

A century ago: The S_2A_3 meeting in 1908

Cornelis Plug, plugc@mweb.co.za

The sixth annual meeting of the South African Association for the Advancement of Science was held in Grahamstown in July 1908. Altogether 71 papers were read, including addresses by the president of the Association and by the presidents of its six sections. The *Report* of the meeting, comprising just over 400 pages, was printed in Grahamstown and published by the Association in Cape Town and Johannesburg. Its editor was Dr Selmar Schönland (1860-1940), Director of Albany Museum and Professor of Botany at Rhodes University College. He was assisted by a publication committee of six members.

The president of the Association for this year was Sir Walter F. Hely-Hutchinson (1849-1913), Governor of the Cape Colony. As president for 1909 the delegates elected Sir Hamilton J. Goold-Adams (1858-1920), Governor of the Orange River Colony. Their choice may have been influenced by the decision to hold the next annual meeting in Bloemfontein. At this time the Association had four vice-presidents, 37 members of council, an honorary general secretary and three assistant general secretaries, an honorary treasurer, and three trustees.

Council's report for 1907/8

As a result of the continuing economic recession the Association's membership declined steeply during the year, to stand at 767. The decline in membership resulted in an equally steep decline in income (membership fees were £1 per annum), with the result that expenses had to be further reduced. The research grants to Professor J.C. Beattie (for his magnetic survey of South Africa), J Burtt-Davy (for the compilation of a catalogue of Transvaal plants), J.D.F. Gilchrist (for his study of South African freshwater fishes), and Professor J.E. Duerden (for his study of local tortoises) were reduced, though all of them eventually completed their projects. Beattie and Burtt-Davy both presented papers on their work at this year's meeting.

Public lectures

The Pretoria Branch of the Association was the only active branch at this time, as it is today. Its committee reported a successful year of lectures and related activities. Under the auspices of the Association Professor Walter Raleigh of Oxford delivered a series of lectures on English literature in various South African towns during July-August 1907. The Johannesburg committee, with financial assistance by the Witwatersrand Council of Education, arranged a series of lectures on historical subjects by Professor Fisher of Oxford, to be delivered during the second half of 1908.

The South Africa Medal (gold)

The South Africa Medal was awarded for the first time this year, to Dr Sir Arnold Theiler (1867-1936), bacteriologist to the government of the Transvaal Colony. As Sir Hely-Hutchinson was prevented by official duties from attending the meeting, the award was made by the acting president, Professor Schönland. In his brief address he said, "Your work on the Trypanosoma bearing your name, on equine and bovine Piroplasmosis, and your recently concluded successful researches on the prevention of Horse-sickness give you rank amongst the foremost comparative pathologists of the day…. Council is confident that with your knowledge and enthusiasm, and with the splendid resources placed at your disposal by your government [the Onderstepoort Veterinary Research Laboratories were completed this year], we may look forward to continued important results of your researches, which will

to an enormous extent benefit our country". Theiler's subsequent contributions to science show that he fully deserved the confidence placed in him.

Hely-Hutchinson's presidential address

The president's address, read on his behalf, included a general review of recent scientific developments in South Africa, and particularly their practical benefits and economic value. In this regard he referred to the application of scientific surveying methods, advances in combating stock diseases, new methods of preventing plant diseases and insect pests, and developments in genetics and their application to plant breeding. The review bears testimony to his excellent general knowledge of science and his familiarity with the research of South African scientists in particular. He praised the dedicated work of both professional and amateur scientists, often carried out without remuneration, and cited many specific examples.

Some interesting papers

Robert A. Lehfeldt (1868-1927), professor of physics at the Transvaal University College in Johannesburg (later the University of the Witwatersrand) and already the author of textbooks of physics and physical chemistry, discussed "The treatment of electrodynamics". He was dissatisfied with the fact that most English physics textbooks treated magnetism before electricity and attempted to "explain" the latter in terms of magnetism. With recent progress in the theory of the electron and its application to electrical phenomena he thought that the time was ripe "to put the treatment of electrodynamics, including magnetism, on a more logical basis" and proceeded to do so, starting with Ampère's work on the force between two current carrying conductors. His more elegant approach may have had some effect, but physics textbooks continued to present magnetism before electricity for many decades.

William Cullen (1847-1968), a chemist and general works manager of the dynamite factory at Modderfontein, presented a paper on the subject of mine ventilation. The high mortality amongst miners had directed attention to the quality of air in the mines. Cullen found that on the Witwatersrand contamination of the air by poisonous gases, particularly carbon monoxide, resulting from the use of explosives, posed a serious hazard. He managed to obtain air samples immediately after blasting, finding unexpectedly high levels of carbon monoxide – high enough to cause almost instantaneous death. Accidental exposure to such air appeared to be an important cause of fatalities. He concluded that "the removal of carbon monoxide by efficient means of ventilation is the most pressing problem which Rand engineers have to face".

Arthur J.C. Molyneux (1865-1920), pioneer Zimbabwean geologist, described the correlation of the sedimentary and volcanic rocks that occupy the lower lying areas of the Sabi and Limpopo valleys in the south of the territory and the Zambesi valley in the north, with the Karoo strata of the Cape Colony.

James E. Duerden (1865-1937), professor of zoology at Rhodes University College, discussed "The domesticated ostrich in South Africa" – a topic of great interest in the days just before the last ostrich feather boom.

Dr Walter Frei (born 1882), assistant government veterinary bacteriologist under Dr Arnold Theiler, presented a review of "Physical chemistry and veterinary science", dealing with the viscosity, surface tension, osmotic pressure, and electrolytic dissociation of biological fluids such as blood and lymph, and their effects in veterinary medicine.

Charles E. Gray (1864-1937), principle veterinary officer for the Transvaal Colony, reviewed the epidemic of East Coast Fever, a cattle disease that had swept across Zimbabwe, the Transvaal and Natal from 1902. Despite intensive research no effective way of preventing or curing the disease had yet been found and hundreds of thousands of cattle were lost. At this time the disease was more serious even than rinderpest, outbreaks of which could be quickly controlled.

Ernest E. Galpin (1858-1941), bank manager at Queenstown and amateur botanist, presented a list of some 400 identified plants collected by him and his wife in 1904 on the Cape part of the high Drakensberg – a region never previously explored by a botanical collector.

Several other papers dealt with various aspects of education, including the teaching of history, Latin, health, and physical science. To me the most interesting paper of all was a review of work on variable stars by Arthur W. Roberts, a topic to which I hope to return in a future newsletter.

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Visit our **website** at http://s2a3.up.ac.za. Any comments or suggestions are welcome.

By subscribing to the S_2A_3 list server you will be notified via e-mail of forthcoming popular scientific lectures and other events of interest presented by the S_2A_3. See http://s2a3.up.ac.za/ for more details.

To join this list, send an e-mail message to majordomo@kendy.up.ac.za, with the following command in the body of your message:

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The list server will respond with a message checking the validity of your e-mail address. Please follow the instructions in that message to complete your subscription. If you have difficulty in subscribing or unsubscribing from this list, or you have questions about the list itself, you may contact the list owner at: owner-s2a3_announce@kendy.up.ac.za.

2008 S2A3 Membership fees are now due (R80-00 ordinary, students R50-00).

Pretoria Branch S_2A_3 News

May 2008

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our April talk:

Date: **Wednesday, 7th May 2008**

Time: **17h15** (to 18h15)

Venue: **Sci-Enza, University of Pretoria**
(Use the Prospect Street Entrance to the main campus. The Sci-Enza is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Prof Dieter Holm**
Sustainable Development Consultant and former head, Department of Architecture, University of Pretoria.

Topic: **Towards (Energy) Sufficiency in a House**

Refreshments will be served after the talk.

Abstract

Prof Dieter Holm and his wife live and work in a house that is self sufficient as far as electricity and water is concerned. Electricity is generated by photovoltaic panels while the water is supplied by stored rain water.

Contrary to expectations, they have all the amenities that one would expect in a modern household – computers, fridge, washing machine, warm water etc.

In his talk, Prof. Holm will explain how this was achieved, and what the average South African homeowner can do to save energy and reduce his dependence on the municipal water and energy supply.

A.W. Roberts and the beginnings of variable star research in SA

Cornelis Plug, plugc@mweb.co.za

At the sixth annual congress of the South African Association for the Advancement of Science, held in Grahamstown in 1908, the president of Section A (mathematics, physics, astronomy, meteorology, geodesy and geography) was Alexander W. Roberts, teacher and amateur astronomer. His presidential address was entitled “Variable star research”, a subject in which he had already acquired an international reputation. Variable stars change in brightness over time, either irregularly or regularly, with periods varying from hours to years. Such stars attracted little professional attention before the middle of the nineteenth century. However, it gradually it became clear that the variations in brightness were caused by several different processes, some internal and some external, and could reveal much about the development and physical characteristics of the stars. As a result not only observational astronomers, but also mathematicians, physicists and chemists became interested in variable stars. When Roberts reviewed the field in 1908, sketching its history, methods, results and problems, it was well within the main stream of astronomical research. Furthermore, Roberts himself had played a significant role it its development, particularly through his extensive observations of variable stars in the southern hemisphere.

Who was A.W. Roberts?

Alexander William Roberts (1857-1938) was born in Farr, Scotland, and trained as a teacher in Edinburgh at a Free Church College and the Heriot-Watt College, graduating at Edinburgh University. He was interested in astronomy from an early age. After teaching in northern Scotland for three years he obtained a post at Edinburgh University. In 1883 he was appointed as a teacher at the training school of the Free Church Mission College at Lovedale, near Alice in the Eastern Cape. He remained there until 1920. In 1884 he married Elizabeth Dunnett and they eventually had one son and two daughters.

Though his days were fully occupied with teaching, Roberts retained a strong interest in astronomy, particularly in variable stars. In 1888, equipped with a pair of field-glasses and a second-hand theodolite, he became the first regular observer of variable stars in the southern hemisphere. In consultation with his friend Dr David Gill of the Royal Observatory, Cape of Good Hope, he erected a small observatory at Lovedale and by 1894 had discovered 20 new variable stars, four of them eclipsing binaries of the Algol type. The results of his first decade of work were presented in ten papers published in the *Transactions of the South African Philosophical Society* during 1890-1897, and in some 30 papers in overseas journals during 1893-1900. He was particularly interested in eclipsing binaries and for his work on this group the University of the Cape of Good Hope conferred on him its first honorary Doctor of Science (DSc) degree on 10 August 1899.

International recognition

British patrons of science who recognised the value of Roberts’s work presented him with improved instruments, which enabled him to precisely compare the brightness of a variable star to that of a distantly situated comparison star. His most detailed observations were made of the eclipsing binaries RS Sagitarii, RR Centauri, and V Puppis. However, the importance of his work lies not only in extended series of precise brightness measurements, but in their interpretation. From the light curves of these stars he deduced parameters such as

the period of revolution of the binary system, the size and eccentricity of the orbit, the relative brightness of the component stars, their distance apart, their relative masses, and even distortions of shape resulting from the intense tidal forces acting on two stars revolving almost in contact. Thus he was able to determine observationally that the component stars of V Puppis were spheroidal (rather than spherical) in shape - a finding that was in line with theoretical derivations by Sir George Darwin and others. Similarly he was able to determine that the two stars of RR Centauri coalesce, forming a rotating dumbbell shape.

At the first congress of the South African Association for the Advancement of Science in 1903 Roberts reported the preliminary results he had obtained on five binary systems. Two years later, at the joint meeting in South Africa of the British and South African Associations for the Advancement of Science, he updated his findings in a classic paper on "Apioidal [i.e., prolate] binary star systems". The paper was one of the few published in full in the British Association's *Report* for 1905 and was also included in the *Addresses and papers...* published after the meeting. By this time he had made about 250 000 independent observations of stellar brightness. Another important contribution to the study of Algol binaries was his finding that the average density of eight southern Algol variables is only one ninth that of the sun - a result that was important in the study of stellar evolution.

In addition to his presidential address he read another short paper at the 1908 meeting in Grahamstown, dealing with long-term increases in the periods of some close binary stars called beta Lyrae stars. His own extensive series of observations of V Puppis, stretching over 18 years, indicated that the period of this binary (of just under 35 hours) was increasing at the rate of about one millisecond per revolution. This slowing down of the system could be explained by a small and gradual increase in the distance between the two stars, caused by the tides they raise on one another.

Roberts's later life

Roberts is regarded as the second most important amateur astronomer (after Sir John Herschel) to have worked in South Africa up to his time. His work inspired several other amateur astronomers, particularly variable star observers. In addition to his astronomical work he was a meteorological observer for the Meteorological Commission of the Cape of Good Hope. He was elected a Fellow of the Royal Astronomical Society in 1894, of the Royal Society of Edinburgh in 1898, and of the newly named Royal Society of South Africa in 1908. As a foundation member of the South African Association for the Advancement of Science (1902) he was the recipient of a grant of £100 in support of his work on variable stars, was awarded the South Africa Medal in 1912, and was President of the Association at its annual congress in 1913. He served as president of the Astronomical Society of South Africa in 1927/8, and in 1929 was a member of the South African National Committee in Astronomy.

Roberts's labours in the cause of native education later led him to represent the indigenous population as a senator of the Union of South Africa from 1920 to 1929, and as a member (later chairman) of the Native Affairs Commission from 1920 to 1935. In 1925 he attended the meeting of the International Astronomical Union as a South African representative. The next year he published an important paper on the probable growth of the South African population. He was an excellent speaker, an authority on all matters relating to race and colour, and highly respected for his impartiality, modesty, sympathy and tolerance for different views. His last public lectures on astronomy were delivered at the Herschel Centenary Celebrations in 1934.

What is the S_2A_3?

The *S_2A_3* aims to stimulate a broad public interest in science and its applications, research, discoveries, history, ethics and philosophy. To do so, the ***S_2A_3*** arranges regular meetings, with speakers who are both entertaining and knowledgeable, as well as field trips, excursions and other interesting events.

Being added to our **e-mail address list** is *free.* Anyone wishing to receive ***S_2A_3*** announcements via e-mail but who has difficulty using the listserver service, is welcome to send their address to:
owner-s2a3_announce@kendy.up.ac.za

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To join this list, send an e-mail message to majordomo@kendy.up.ac.za, with the following command in the body of your message:

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Join the S_2A_3:

– Annual membership fees:
  Full: R80
  Student: R50
– Website:
  www: http://s2a3.up.ac.za/

Pretoria Branch S_2A_3 News

June 2008

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our June talk:

Date: **Wednesday, 4th June 2008**

Time: **17h15** (to 18h15)

Venue: **Sci-Enza, University of Pretoria**
(Use the Prospect Street Entrance to the main campus. The Sci-Enza is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Dr Francois Engelbrecht**
Department of Geography, Geoinformatics and Meteorology, University of Pretoria.

Topic: **Climate change over South Africa: projections and perceptions**

Refreshments will be served after the talk.

Abstract

Most main stream scientists agree that the warming Planet Earth has experienced over the last four decades can be ascribed to anthropogenic forcing – specifically the burning of fossil fuels and deforestation. The gradual melting of the polar ice caps, the retreating glaciers of the Northern Hemisphere, and reduced snowfall over Marion Island and mountain Kilimanjaro are all thought to be fingerprints of Global Warming and Climate Change. But how will the climate of South Africa be affected by this global problem? In particular, how will rainfall patterns over South Africa change over the coming decades?

In this talk, it will be explained how mathematical models of the atmosphere (called Global Circulations Models, GCMs) can be used to predict how climate will change in response to enhanced greenhouse gas concentrations. Emphasis will be placed on the uncertainties that are associated with these projections of future climate. From this background, it will be shown that there is insufficient proof for the perception that "South Africa will become wetter in the east and drier in the west" as a result of Global Warming. In fact, it is plausible that the country will become generally drier. It will be shown that there is strong evidence to suggest that the winter rainfall region of South Africa (the southwestern Cape) will become significantly drier in the future climate. Eastern South Africa may be expected to experience shorter summer rainfall seasons with more intense rainfall events, and also this region may be expected to be come drier on the average. Finally, perspective will be given on the perception that Climate Change can still be prevented. It will be shown that the world is already committed to inevitable anthropogenically induced Climate Change.

An iceberg seen from Marion Island: a sign of Global Warming?
Photograph: Elizma Yelverton (2003).

Why are there 60 minutes in an hour?

Cornelis Plug, plugc@mweb.co.za

The number 60 plays an important role in the division of time and in angular measurements. There are 60 seconds in a minute, and 60 minutes in an hour; similarly the degree of plane angle is divided into 60 minutes of arc, and each of these into 60 seconds of arc. To what do we owe this unusual subdivision, which fits in neither with our decimal arithmetic, nor with any of the subdivisions of other units of measurement from pre-metric times? The answer lies in a form of counting and arithmetic that originated in the Middle East more than 5000 years ago and was adopted, adapted, and transmitted by several successive cultures to reach Europe during medieval times.

The sexagesimal system

This ancient system of counting, calculation and numerical notation used powers of the number 60 much as the decimal system uses powers of 10. Its origins remain obscure, as its use predates the invention of writing around 3000 BCE. The system appears to have been developed by the Sumerians, whose language was the only one to include a system of sexagesimal counting. They probably also invented the method of sexagesimal calculation, which seems to have been based originally on the use of a set of counters, in the form of small clay tokens, representing the numbers 1, 10, 60, 600 (i.e., 10 x 60), 3600 (60 x 60), 36 000 (10 x 60 x 60), and 216 000 (60 x 60 x 60). This series of numbers reflects the use of a mixture of sexagesimal and decimal numbers. Decimal numbers were probably inspired by the practice of counting on one's fingers, but why 60 was chosen as a base number is not clear. Scholarly speculation about the subject is unconvincing owing to a lack of evidence. The system of sexagesimal

numerical notation appears to be an adaptation of the set of counters to a form that could be represented in writing. It came into use when writing was first invented.

A detailed study of the origins and early history of the sexagesimal system was made during the nineteen-seventies by Marvin Powell, who produced a doctoral dissertation and several subsequent publications on the subject.

Beware of Greeks bearing gifts

The sexagesimal system was adopted, with other elements of Sumerian culture, by the Semitic speaking Akkadians. Their cuneiform script on clay tablets became the means by which the system was preserved and more widely distributed. Later Babylonian astronomers developed sexagesimal arithmetical methods to describe the observed motions of the sun, moon, and planets against the star sphere, though mainly for astrological purposes. The system was still in active use when the Greeks under Alexander the Great invaded the Middle East around 330 BCE. During the next two centuries of Greek occupation of Mesopotamia sexagesimal arithmetic became incorporated into the Greek tradition and was widely used for astronomical calculations during classical times. Its greatest exponent was the second-century astronomer and geographer Claudius Ptolemaeus (or Ptolemy), whose astronomical treatise, now known as the Almagest, remained the standard work in astronomy to the fifteenth century. In his astronomical calculations Ptolemy followed the Babylonians in dividing the circle into 360 degrees, and subdivided these according to the sexagesimal system into successively smaller fractions which later came to be called minutes and seconds of arc.

Baghdad rules

During the reign of Caliph al-Mamun, in the first half of the 9th century, many classical Greek works were translated into Arabic in Baghdad. These included Ptolemy's Almagest, translated by the Jew Sahl al-Tabari. Islamic mathematicians became the pioneers of decimal arithmetic, but because Ptolemy's work was adopted as the theoretical basis of Islamic astronomy, scholars became acquainted also with the sexagesimal system. In fact, sexagesimal arithmetic, including addition, subtraction, multiplication, division, and the extraction of square roots, was used so extensively by Islamic astronomers that it became known as "the astronomer's arithmetic".

Many Arabic works, and Arabic translations of classical works, were translated into Latin for the first time from the 12th century onwards, mainly in Spain. These books included Ptolemy's Almagest. As a result knowledge of the sexagesimal system reached European astronomers as an integral part of their subject. The sexagesimal subdivisions of the circle thus came to be firmly established among mathematicians, astronomers and geographers, and survives to this day.

Just a minute

The word "minute" represents the medieval Latin phrase "pars minuta prima", denoting 1/60 of a unit in the system of sexagesimal fractions. Further subdivisions were denoted by "partes minutae secundae/ tertiae/ quartae", etc., with denominators equalling the successive powers of 60. These subdivisions are called seconds, thirds, fourths, etc. in English. This system was first applied to subdivisions of the hour during the 13th century. For example, the medieval scholar Roger Bacon referred to the reckoning of time in terms of hours of 60 minutes, each of 60 seconds, in about 1270. During the 14th century this meaning of the word "minute" slowly replaced its earlier meanings, which included 1/10 hour and 1/60 day. The adoption of the new division of the hour may have been facilitated by the development of clocks during the first half of the 14th century, which increased the accuracy of time measurements.

The French challenge

The most important challenge to the sexagesimal subdivision of the hour and the degree came with the introduction of the metric system in France around 1800. As part of the new system it was proposed that the day should be divided into 10 decimal hours, which were to be subdivided into 100 decimal minutes of 100 decimal seconds each. With regard to angular measurement it was proposed that the degree should be replaced by a new unit, equal to 1/100 of a right angle. This was unit was named the "grade" in French and later the "gon" in Germany. Like the hour it was divided into 100 minutes of 100 seconds each. The new divisions of the day found little popular support and soon faded into obscurity. The grade on the other hand came into limited use in several European countries, though it failed to replace the degree.

A less serious challenge to the sexagesimal division of the hour was made by a Frenchman named Goedseels at the International Congress of Chronometry in 1902. He proposed an hour equal to 1/40 day, to be decimally subdivided, in an effort to adapt the divisions of time to the division of the circle into 400 grades. Had he been successful a time difference of one hour would have corresponded to 10 grades of longitude .

A trivial pursuit

The following incidental and trivial consequence of the current divisions of time and angle may be of interest to motorists. If one travels in a north-south direction at about 110 km/h your latitude changes by one minute of arc per minute of time, or one second of arc per second of time. Happy motoring.

Pretoria Branch S_2A_3 News

August 2008

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our August talk:

Date: **Wednesday, 6th August 2008**

Time: **17h15** (to 18h15)

Venue: **Sci-Enza, University of Pretoria**
(Use the Prospect Street Entrance to the main campus. The Sci-Enza is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Mr Terry Newby**
Institute for Soil, Climate & Water, Agricultural Research Council.

Topic: **Remote Sensing: A remote concept or a practical tool for agriculture.**

Refreshments will be served after the talk.

Abstract

Eyes in the sky are now routinely used to gather information about the nature, state and condition of our planet. Electromagnetic energy and the wave nature of light have proved to be a useful carrier of information in remote sensing. Applications of this capability of obtaining information about the earth's surface from imagery captured in space and from aircraft has facilitated improved information for decision making in agricultural. This talk will illustrate some of these applications including the use of remote sensing in

- Land Cover mapping
- Invader vegetation monitoring
- Precision farming
- Drought monitoring
- Crop estimation

ARCEagle, Field spectrometry and Hyperspectral remote sensing will also be introduced.

False colour aerial photograph of a farm house with surrounding vegetation and infrastructure.

Women in SA science – the pioneers

Cornelis Plug, plugc@mweb.co.za

A striking characteristic of South African science until well into the twentieth century is its domination by English speakers, even though there were more local Dutch speakers during most of this period. Only two of the approximately seventy local scientific societies that flourished (often only briefly) during the nineteenth century were entirely or predominantly Dutch: the *Staats Natuurkundig Genootschap* (State Natural Science Association) in Potchefstroom (1873-1881) and an obscure *Natuurhistorisch Gezelschap* (Natural History Association) in Pretoria (c.1892). Several others were bilingual, but most had only English names and left records only in English.

Similarly, until well into the twentieth century relatively few women contributed to the advancement of science in southern Africa. This is in line with the division of social roles between British men and women at the time. However, in the course of the nineteenth century it became socially acceptable for women, also in South Africa, to embark upon the study of natural history, particularly as collectors and illustrators of plants. Most of the local female pioneers have been written up for the *S_2A_3 biographical database of southern African science*, which is the main source of the information presented below.

In the beginning: An eccentric British visitor

The first woman known to have been scientifically active in southern Africa was Lady Anne Monson (1714-1776), daughter of Henry Vane, Earl of Darlington, and his wife, Lady Grace Fitzroy, and a great-granddaughter of King Charles II of England. She appears to have been rather eccentric, but was well-educated and had a strong interest in natural history. In 1767 the Swedish botanist C. Linnaeus, who appears to have been infatuated with her, named the (mainly South African) plant genus *Monsonia* in her honour, while the species *Erica monsoniana* also carried her name.

Anne's second husband was Colonel George Monson of the Honourable (English) East India Company. In 1773 he was appointed on the supreme council of Bengal and the next year she accompanied him to Calcutta (now Kolkata). They interrupted their voyage to spend some time at the Cape of Good Hope, which was then still in Dutch hands. There she met the visiting Swedish botanist Carl P. Thunberg, who was also greatly charmed by her. With Thunberg and the British plant collector Francis Masson she collected natural history specimens in the vicinity of Cape Town. According to Thunberg she made several fine collections, particularly zoological, and had brought a draughtsman with her to draw rare or unusual specimens.

After leaving the Cape the Monsons arrived in Calcutta in October 1774. Anne became a prominent figure in society, but died there less than two years later.

Locals enter the scene

Our next female naturalist was Miss Hester Joubert, who was born at the Cape in 1805. She was the first locally born woman known to have collected plants in southern Africa. Her collecting activities took place during the eighteen-twenties and were confined mainly to the farm Soetendalsvlei, some 20 km south of Bredasdorp. She presented her specimens to the botanist C.F. Ecklon and several plant species were named after her. Her brother, Advocate Josua Andries Joubert, owned the estate "Nooitgedacht" near Cape Town and allocated a portion of it to Ecklon to cultivate bulbous plants. Hester later

became the second wife of Gysbert J.K. Reitz of Cape Town.

The important contributions to natural history made by Mrs Mary E. Barber from the late eighteen-forties onward have already been described in a previous newsletter. Three other ladies who were active during the first half of the nineteenth century deserve mention. Miss M.C. Owen, sister of the British missionary Reverend Francis Owen, collected plants while accompanying her brother on his missionary travels in Zululand, the Eastern Cape and Transvaal during 1837-1840. Her specimens went to the Trinity College Herbarium in Dublin. Arabella E. Roupell, who visited the Cape Colony for health reasons in 1843, painted local plants. She was a meticulous and painstaking artist and her paintings were published in 1849. And Isabella M. Kolbe, married to the missionary Reverend Friedrich W. Kolbe, collected plants in Namibia in 1850. Her specimens also went to Dublin.

Natural history becomes popular

During the next few decades more women became scientifically active, as shown by the number of entries in the *S_2A_3 biographical database*:

1831-1850: 4
1851-1870: 7
1871-1890: 17
1891-1910: 38

However, during the same period the number of men who became scientifically active rose equally fast, with the result that the *percentage* of women in science remained constant at about 4%. In other words, the numbers above do not provide evidence that local attitudes towards women in science changed significantly between 1830 and 1910. On the other hand the range of scientific activities in which women were involved gradually expanded. Before about 1870 almost all of them were plant collectors or illustrators, and botany remained the most attractive subject until at least 1910. But after 1870 several entered other branches of natural history, particularly as collectors of shells and insects. During the same period Miss Abbie Ferguson in Wellington and Miss J. Marshall in Wynberg made regular meteorological observations for the Meteorological Commission of the Cape Colony; Mrs Mabel Nevill (a former South African women's singles tennis champion) was an astronomical assistant at the Natal Observatory; Miss Agnes Clerke from Britain made some observations at the Royal Observatory, Cape of Good Hope; Lady Anne M. Barkly published *A revised list of the ferns of South Africa*; and the naturalist Miss Mary Glanville succeeded her father as Curator of the Albany Museum in Grahamstown. During the next two decades (1991-1910) ten women published scientific papers, mainly on South African botany.

Women in early scientific societies.

Attitudes towards women in science still varied widely during the late nineteenth century. One of the most progressive views in this regard was that of T.F. Burgers, president of the South African Republic (Transvaal), who was also president of the short-lived Transvaal Literary and Philosophical Society. In his anniversary address to this society, delivered in Pretoria in February 1875, he argued that women were the intellectual equals of men and expressed the hope that they would soon be allowed to take up their rightful place in society. However, other societies accepted women more grudgingly. At an ordinary meeting of the South African Philosophical Society in 1878 "the chairman announced that the question as to the admissibility of ladies to the meetings of the Society having been brought before the Council, it had been decided that ladies were admissible as visitors at meetings under Section II, No. 3 of the By-laws of the Society" (Transactions, 1: vii). The relevant rule stated that members were entitled to bring three visitors to meetings, without referring to gender.

From about 1880 women were regular visitors at the meetings of natural history societies. For example, at a lecture on the fertilization of plants, delivered by botanist Dr Selmar Schonland before the Albany Natural History Society in 1891, the audience consisted of 29 ladies and 17 gentlemen. However, few women became *members* of scientific societies, a fact illustrated by the early membership lists of S2A3. In 1903 women represented only 3.9% of the 742 members. There were also 41 "associates", who attended the association's annual congress. Almost all of these were wives or daughters of male members. The percentage of female members of the association rose gradually, reaching 5.6% by 1918.

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Pretoria Branch S_2A_3 News

October 2008

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our October talk:

Date: **Wednesday, 8th October 2008**

Time: **17h15** (to 18h15)

Venue: **Sci-Enza, University of Pretoria**
(Use the Prospect Street Entrance to the main campus. The Sci-Enza is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Prof Derck Smits**
Department of Mathematical Sciences, UNISA

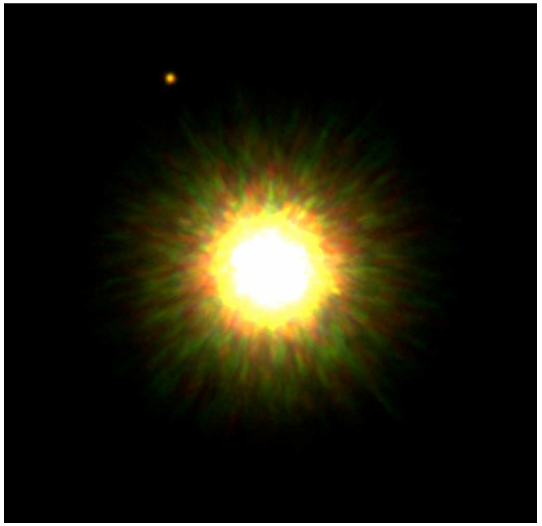
Topic: **Current Frontiers in Astronomy**

Refreshments will be served after the talk.

Abstract

Although astronomy is the oldest science, new discoveries are being made everyday that illustrate that the Universe still has many elusive secrets. Several large-scale projects are under way which have led to the development of new telescopes or are in the planning stage to build front-line research facilities to address some of these issues. These new telescopes will probe regions of the Universe that have never before been seen in such detail, and should yield surprizes that our imaginations cannot even conceive of.

In this presentation I will give a personal view of some of the topics that are at the forefront of current astronomical research, as well as some problems that have been with us for several years. Latest results from telescopes such as Spitzer and the VLT will be discussed, as well as what can be expected from some of the new telescopes being planned such as the James Webb Space Telescope which will replace the Hubble Space Telescope, and ESO's Extremely Large Telescope which will have a primary mirror of 30m diameter. Other items on the agenda include the nature of the enigmatic gamma ray bursts, is there life elsewhere in the Universe, what is dark matter and dark energy, how do we know they exist, and what is the fate of our Universe. Time permitting I will discuss the latest experiments being done to test whether Einstein is right about gravity.



Located just 500 light-years away toward the constellation Scorpius, this star is only slightly less massive and a little cooler than the Sun. But it is much younger, a few million years old compared to the middle-aged Sun's 5 billion years. This sharp infrared image shows the young star has a likely companion positioned above and left - a hot planet with about 8 times the mass of Jupiter, orbiting a whopping 330 times the Earth-Sun distance from its parent star. The young planetary companion is still hot and relatively bright in infrared light due to the heat generated during its formation by gravitational contraction. In fact, such newborn planets are easier to detect before they age and cool, becoming much fainter. Though over 300 extrasolar planets have been found using other techniques, this picture likely represents the first direct image of a planet belonging to a star similar to the Sun.

The hand, the foot and other limb units

Cornelis Plug, plugc@mweb.co.za

The measurement of length or distance has been ubiquitous in technology, commerce and everyday life since early historic times. Such measurements involve the choice of a specific length as a standard, in terms of which other lengths or distances may be expressed. The standard thus becomes a unit of length. Before measuring rods became widely available it was often found convenient to use the lengths of some parts of the adult human body, for example the foot, as units of length. Such units are known as body measures, or limb units. Some limb units, albeit in a more standardised form, have survived to the present, even in the scientific and technical literature.

A system of limb units

At various times during the historical period (the past 5000 years) the most common limb units, in order of size, were:

- the *digit* (breadth of a finger)
- the *hand* (breadth of the palm)
- the *span* (maximum distance between the tip of the extended thumb and little finger)
- the *foot* (length from heel to toe)
- the *cubit* (distance between the elbow and the tip of the middle finger)
- the *step* (a single pace)
- the *yard* (distance from the breast bone to the finger tip of the outstretched arm)
- the *double pace*, and
- the *fathom* (distance between the finger tips of the extended arms)

Limb units are very convenient, as the measuring device is always at hand, and their informal use continues today. However, their use in commerce, land measurement, technology, and science required two adaptations. First, the units were standardised (often in many different places and at different times) by marking them on measuring rods, thereby eliminating personal differences in body measures. This development took place near the beginning of the historical period, and perhaps even earlier. For example, part of an early Sumerian standardised cubit (equal to 496 mm), divided into 30 digits, has been found inscribed on the statue of King Gudea of Lagash, dating back to c. 2170 BCE.

Second, the sizes of the units employed in a given culture were adjusted to make them commensurable, that is, all integer multiples of the smallest unit. In this way systems of limb units were created. This development also took place in early historical times. Parts of a widespread system of limb units were described by the Greek poet Homer (c. 9th century BCE), the Roman architect Vitruvius (1st century BCE) and many others. This system was based on the following relative sizes:
Digit = 1; hand = 4; span = 12; foot = 16; cubit = 24; step = 40; double pace = 80; fathom = 96.
This system was, however, subject to many variations. For example, the Egyptian royal cubit, in terms of which measurement problems were set out and solved in the Rhind mathematical papyrus (c. 1650 BCE), was divided into seven hands and 28 digits.

The foot

Whereas the cubit was the principal unit of length in ancient Egypt and Babylonia, the foot was more prominent in classical Greece and the Roman Empire. In Greece its length varied from one city to the next, and also over time, but a standard marked on the Parthenon in Athens was equal to about 309 mm. The Roman foot (of which there were 5000 in a Roman mile) equalled about 295 mm and came into use throughout the empire. However, for the purpose of settling a border dispute with the Tungri, a Germanic tribe living in present Belgium, the Romans were forced to adopt a local foot measure which became known as the Drussian foot and which was two digits longer than their own (c. 333 mm). A foot of this length was commonly used in English and French architecture during the Middle Ages. Numerous other local foot measures were used throughout Europe and the Middle East.

The foot in South Africa

When the first European settlers came to the Cape of Good Hope in the mid-seventeenth century they introduced the Rhineland foot of about 314.9 mm. It was later renamed the Cape foot, twelve of which formed the Cape rood. Both the Cape foot and Cape rood were used as land measures and were linked to the dimensions of the earth, at least in theory, by claiming that there were 2000 Cape roods in a Dutch geographical mile of 1/15 degree latitude. The Cape foot remained in use in land measurement until the twentieth century. Its final length was assumed to be 314. 8581 mm.

Meanwhile the British imperial system of weights and measures, including the English foot, had been introduced to South Africa during the first half of the nineteenth century. This foot of about 304.8 mm came to be used for all purposes except the measurement of land. One of the consequences of its introduction was that many South African maps were drawn to unusual scales, because land measured in terms of the Cape foot and rood was represented on maps measured in English inches. For example, a series of geological maps of portions of South Africa issued between 1910 and 1936 were drawn to a scale of 1000 Cape roods to the English inch, or 1:148 752.

The situation was further complicated following the geodetic survey of South Africa, carried out between 1883 and 1906, which provided the basis for all subsequent surveying and mapping. The results of this survey were supposed to be expressed in terms of the English foot (now defined as 304.8mm exactly). However, owing to slight differences between the metre as legally defined in Britain at the time and the international metre, the results came to be expressed in a slightly smaller unit. This fictitious unit, called the South African geodetic foot, is equal to 304.797 265 4 mm. The corresponding Cape geodetic foot was put equal to 314.855 575 mm for the conversion of land measures to the metric system during the nineteen-sixties.

The decline of the foot

Most foot measures gradually faded into obscurity following the adoption of the metric system all over the world. The English foot, as represented by the national standards of various English speaking countries, was found to vary slightly in length, for example 304.7997 mm in England, 304.8006 mm in the United States, 304.805 mm in India, and 304.796 mm in Australia. To achieve uniformity in science and technology the national standards institutes of the United Kingdom, United States, South Africa, Australia, Canada and New Zealand agreed in 1959 to redefine the yard (of three feet) in terms of the metre, so that the foot would be exactly 304.8 mm. Not long thereafter the foot was replaced by the metre in these countries too. Currently the United States is the only significant country in the world where the foot and a host of other outdated weights, measures and technical units are still used in technology – to the confusion and inconvenience of the rest of the world.

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