Reflections on Victor de Mello, Friend, Engineer and Philosopher

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Abstract. The author first met Victor de Mello in 1975 at the 6th African Regional Soil Mechanics Conference in Durban, South Africa. For over 30 years he has retained a close personal friendship with this remarkable man and his family. The First Victor de Mello Lecture illuminates something of him as a person, an engineer and a philosopher. It describes his upbringing and schooling in India, his university education at MIT and some highlights of his professional career as an international civil engineer specialising in dams and geotechnics. The key messages from some of his major lectures are presented and discussed. Engineers of all disciplines have much to learn from this brilliant, inspiring and cultured man. Above all we can learn from his insistence that we are human beings first, engineers second and specialists third - the order being very important.

Keywords: Victor de Mello, geotechnics, engineer, philosopher.

1. Introduction

Words cannot adequately express how privileged I feel to have been invited to deliver this first lecture in honour of Victor de Mello. But a huge responsibility rests on my shoulders for I have no doubt at all that the Victor de Mello Lecture will become one of the major events of the geotechnical calendar.

The more I thought about possible topics the more strongly I felt that this first lecture should attempt to capture something of Victor the person and Victor the engineer. The responsibility suddenly becomes even greater, for how can one adequately portray someone with the vitality, the breadth of interests, the culture, the creativity, the intellect and, yes, the shear genius of Victor de Mello? My aim is to reflect on my friendship with Victor and share something of that. This is not the time or the occasion for a scholarly treatise on Victor's engineering contributions. The word 'reflection' means 'the throwing back of images' and that is what I hope to do - to share some images of this remarkable man.

2. First Encounter with the de Mellos

I first met Victor and Maria Luiza de Mello on Friday 5th September 1975. I had been invited to give a keynote lecture at the 6th African Regional Conference in Durban, South Africa. A small group of us had the privilege of participating in a pre-conference tour starting in Pretoria, driving eastwards to the Kruger National Park, south to Swaziland and then south west to Durban. The small party included Professor Kevin Nash (Secretary General of the ISSMGE) and his wife Mel, George and Daphne Donaldson, Andy Robertson (who acted as our leader) and his wife Renée. The de Mellos were due to join us in Swaziland.

We set out from Pretoria on Wednesday 3rd September reaching the eastern Transvaal town of Nelspruit (famous for growing delicious oranges) that evening. The next day we entered the Kruger National Game Park and were thrilled by the wide variety of birds and game that we saw including hippopotamus and elephant. The evening was warm and we had a braaivleis (barbecue) under a clear sky, heavy with the stars of the southern hemisphere and serenaded by the croaking of frogs and the chirping of crickets. We were a cheerful and friendly group. Kevin Nash teased us saying that tomorrow, when the de Mellos joined us, things would change. This sounded a little ominous so we pressed him further but he simply said, somewhat conspiratorially, *wait and see*.

I had been at the 1969 Mexico City International Conference when Victor de Mello had presented his weighty State of the Art Report on Foundations in Clay (de Mello, 1969). It was an impressive document presented with flair and panache. I was far too shy too introduce myself but was hugely delighted to see that he had referred to some of my work. I was keen to meet Victor because I had been invited to prepare a State of the Art Report on Foundations and Structures for the 1977 Tokyo International Conference with Victor, Bengt Broms and Jacque Florentin as co-authors. I had managed to get together with the latter two but so far had not had contact with Victor.

On the Friday at 6:00 a.m. in the morning, and in high spirits, we headed south to towards the exit of the Kruger Park at Crocodile River with the Bushveld looking lovely in the early morning sun. We saw many types of antelope and even a pack of wild dog. We then had a long, hard, hot drive to Mbabane in Swaziland where we stopped for lunch at the Holiday Inn. We were relaxing around the swimming bath when Victor and Maria Luiza arrived - both wearing large floppy sunhats. Immediately the whole atmosphere became vibrant, there was non-stop conversation and we laughed, joked and even sang. It wasn't that Victor and Maria took us over - they galvanised us and we were all drawn in to this new experience. Once or twice Maria Luiza scolded Victor

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for showing off and he took it like a lamb! In my vote of thanks to Victor's 1977 Rankine Lecture I referred to this meeting and the fact that for the rest of the trip, and for some weeks afterwards, we were all living at what can only be described as a state of 'heightened intensity' (Burland, 1977).

During the next two days we drove south west to Durban, visiting various civil engineering projects on the way. At each site Victor subjected the engineer in charge to intense interrogation, not just in relation to the technicalities of the scheme but the economic and social aspects as well. It was done with good humour but with an obvious breadth of experience and a remarkably quick and incisive mind. In between, during our bus journey and in the evenings, our conversations ranged widely over almost every conceivable subject.

During one conversation Victor expressed concern about the dangers of developing countries relying on the advice of experts imported from developed countries - a theme he returned to frequently in his lectures and writings. Referring to the classical story of the siege of Troy by the Greeks he would use the phrase *Beware the Greeks bearing gifts*. A modern adaptation of the phrase, when you are being offered computer soft-ware is: *Beware of geeks bearing gifts*! Learning from these conversations with Victor, I tell my students from developing countries not to believe that the sophisticated developed countries have all the answers: *Remember that your own special challenges are just as intellectually demanding as ours*.

As we approached Durban we passed through the seaside resort of Umhlati where I had holidayed in 1950 as a boy of 14. On mentioning this to Maria Luiza she insisted that we stopped. We went onto the golden sands and danced to celebrate my return after 25 years. Maria Luiza referred to this occasion in her farewell address at the 1985 San Francisco Conference (de Mello, 1985): *I recall a beautiful night dancing barefoot with John Burland on a beach in Durban. Brother John, that night was unforgettable*.

3. Sixth African Regional Conference

And so we arrived in Durban for the 6th African Regional Conference. Here for the first time I was able to watch Victor in action at a conference, both formally and informally. He participated as a Panel Member in a number of the technical sessions; two in particular made a profound impression on me. The author of one paper was attempting to correlate the coefficient of subgrade reaction K from plate loading tests with relative density as determined from the Standard Penetration Test. Victor completely demolished the paper using the arguments that he had developed in his classic 1971 State of the Art Report on the Standard Penetration Test (de Mello, 1971).

What interested me particularly was how upset Victor was that this well known author made no reference to this SOA Report (indeed Victor pointed out that there was no reference later than 1967 in the paper). I quote:

> *I excuse myself for repeating my own earlier work: I would have been quite satisfied if the authors had quoted it as a reference and had curtly stated their disagreement with such and such. I am sure that there is much room for disapproving and correcting some of my preliminary claims; but, since they were offered with the best of intentions and were aimed at avoiding unnecessary effort and pitfalls, the thing that I find quite disconcerting is that four years can pass without agreement or contestation but only a disparaging silence!*

This intervention taught me that Victor loves debate and goes out of his way to seek it. He is quite prepared to revise his views in the light of that debate. But he thoroughly disapproves of any work that does not take due regard for previously published results - particularly when they appear in a major international forum.

On another occasion he spoke of the dangers of over-reliance in indirect indicators of soil properties as deduced from the deepsounding static cone penetrometer with friction sleeve. At the 6th International Conference in Montreal he had warned strongly of the dangers of replacing careful inspection and description of representative soil samples with an indirect indicator in the form of the friction ratio (de Mello, 1965). He referred to this intervention as follows:

> *I took the liberty to submit a discussion decrying the introduction of mechanistic practices that would wipe out the painstaking gains of the fundamental principle of Soil Mechanics of requiring first the determination of the nature (classification) of the soil type by direct sampling, and not by indirect inference*.

Victor's contributions certainly livened up the sessions!

But it was Victor's keynote address that impressed me most. The title of his lecture was: Some Lessons From Unsuspected, Real and Fictitious Problems in Earth Dam Engineering in Brazil (de Mello, 1975). During his opening remarks he reminded the audience that we should never forget the primordial precedence of values: human being first - engineer second - specialist third:

> *But I am compelled to state, right from the start, that in my experience it is principally in the connection between Soil Mechanics and the overall field of Civil Engineering, and in our obligations as members of society, that the greatest challenge and chances of creative vision beckon us and lead us forward.*

During the lecture he described the evolution of his experiences of the design and construction of over 50 major earth dams in Brazil and elsewhere in Latin America using residual soils and saprolites in particular.

In true de Mello style he began his lecture with a Latin quotation. The whole statement is worth repeating:

> *If a geologist declares that at a given site the joints strike unfavourably in an upstream-downstream direction and tend to open to a significant depths, and therefore the site should be abandoned, as a Civil Engineer I would say:*
>
> (a) *accept the first part of the statement, as the information comes from the appropriate source,*
>
> (b) *challenge it ("so what") to the point of requiring and achieving some quantification, and*
>
> (c) *as regards the concluding affirmative, do not hesitate to say 'ne sutor ultra crepidam' - the consequence and decision are part of an overall Civil Engineering optimization, and should be so assessed.*

The Latin quotation is a rebuke said to have been addressed by the famous Greek artist Apelles to a shoemaker who pointed out some errors in the painting of a slipper in one of the artists works and then went on to criticise other parts of the picture. *The shoemaker should not go beyond his last* (*i.e.* mould) retorted Appelles or perhaps more bluntly, *stick to shoe making*.

Victor was warning of the grave dangers and distortions that can result if a specialisation is permitted to drive the project. The overall balance and coherence of the project needs to be maintained with each specialisation playing its part. Excessive domination of specialisations can also obscure the chain of responsibility, which is a very serious matter. He also warned of the grave dangers of importing technical *know-how* from western temperate zones to geological settings which are outside the expertise and experience of the experts. He called it the import of technical *don't know how*. The micro-structures of residual and saprolitic soils are very different from those of classic sedimentary soils, even when compacted. Also, climatic factors are usually very different. This means that transfer of experience using the empirical indicators of Atterberg Limits etc. is extremely simplistic and likely to lead to grossly misleading advice, particularly in relation to permeability and hence pore pressure responses.

Towards the end of his lecture Victor described the case of the Paraibuna Dam which had been designed on the basis of local experience and had been successfully completed - see the upper section in Fig. 1. Immediately prior to

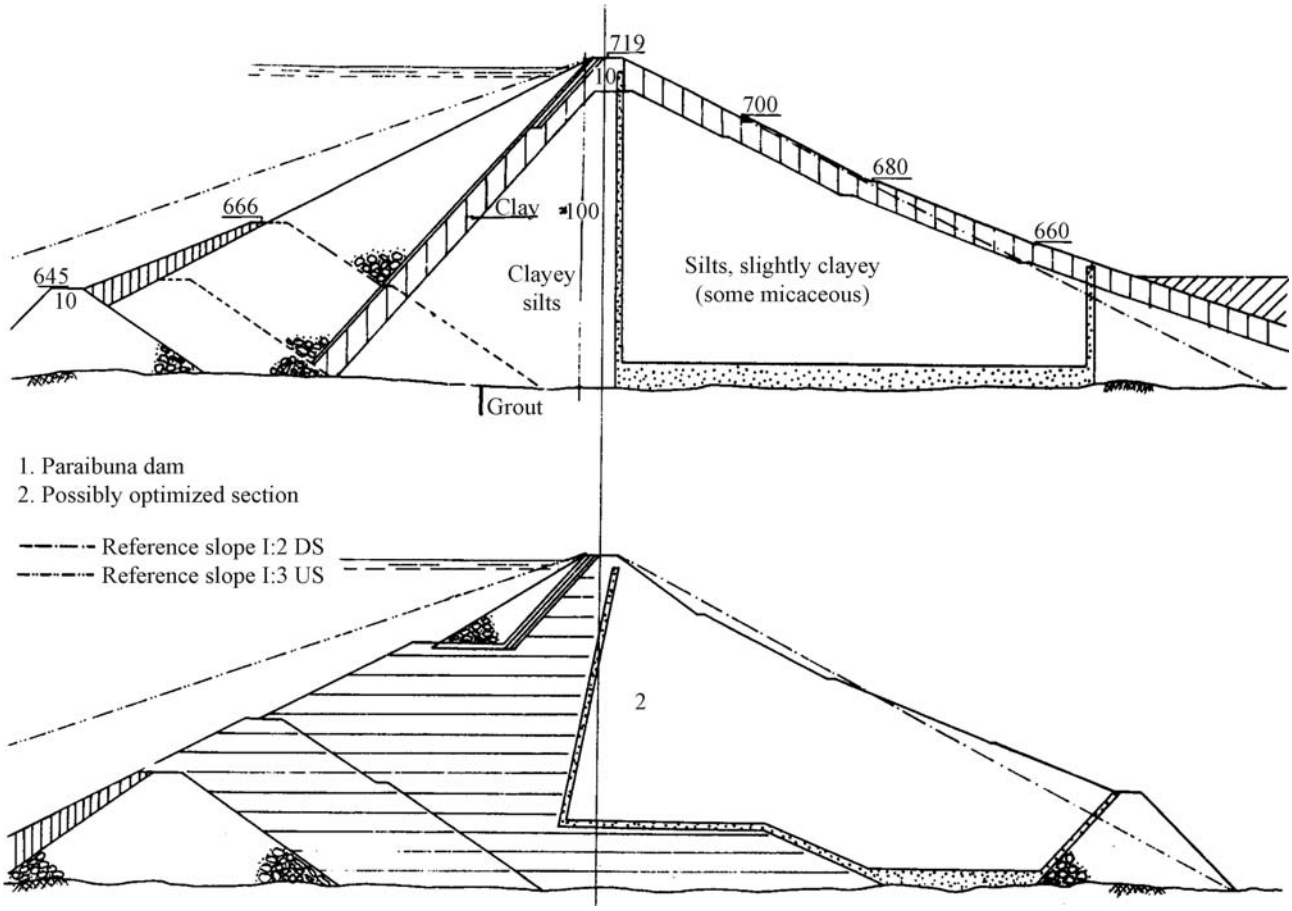

Figure 1 - Paraibuna Dam and suggested optimised section.

filling, it was considered prudent to appoint a special consultant to review the design. The expert had not worked with saprolites before and recommended the use of residual strengths and high pore pressures in the downstream shoulders. The downstream clayey face (which had been placed to limit rain erosion during construction) was to be ripped up with drainage trenches. The final conclusion and recommendation was that the downstream slope should be reinforced by compacted rock fill reducing the slope from 1:2 to 1:2.5.

When asked to intervene Victor recommended that filling should commence without these suggested measures and with careful monitoring of the extensive instrumentation in the dam. Its performance proved to be outstanding. In Victor's view the dam truly represented a considerable advance on the more traditional empirical designs that were being used at the time. The lower section in Fig. 1 shows Victor's schematic ideas for improving the dam design still further by means of an inclined upstream chimney filter and a central clay blanket. He enlarged on these ideas in the Seventeenth Rankine Lecture. It is worth noting that he always made a point of attempting to improve even a successful design in the light of the experience gained - a valuable pointer for a young aspiring civil engineer.

Victor's keynote lecture to the Sixth African Regional Conference was packed with engineering wisdom and philosophy, challenging conventions and expressed in complex, poetic and colourful English. It was truly inspiring. What is the genesis and the background of this remarkable person whom I had just encountered?

Figure 2 - The de Mello family. Victor is standing in front of his father.

4. Biographical Notes

In preparing these notes extensive use has been made of the contribution prepared by Moreira and Décourt (1989) for the *De Mello Volume*. Victor Froilano Bachmann de Mello was born in Pangim, Goa on 14th May, 1926 and is one of six children - see Fig. 2. His Father, Indalencio Froilano de Mello, was Indo-Portuguese and was a renowned bacteriologist specialising in tropical diseases. His mother, Hedwig Bachman was Swiss German and had been head of a secondary school in Switzerland. A chance meeting with her future husband on a Paris to Lisbon train brought her from Zurich to Pangim. The early education of the six de Mello children was undertaken at home by their parents. They each learned a musical instrument in addition to the piano and were taught painting, languages (French, German and Italian) and literature. They were also encouraged to take part in sports including swimming, tennis, horse-riding etc.

Victor's parents had planned for their children to be educated in Europe but the impending 2nd World War caused them to send their children to study at British boarding schools in India. At the age of eleven Victor went to Bishop Cotton Boys' School in Bangalore (photograph in Fig. 3). Here he excelled, winning many prizes both for academic and sporting achievements. At the final public examinations he was ranked first out of 2000 candidates for the Mysore State High School examinations and he won high distinctions among more than 40000 candidates for British Empire Senior School Certificate. The school awarded him the Kothavala Cup in recognition of Best All-rounder.

Victor gained admission to the ETH in Zurich but he was unable to travel there because of the War. He sought admission to various top Indian Engineering schools such as Rorkee, Poona etc. But, despite his outstanding achievements at school, he was denied entrance because the system would not countenance a Portuguese Goan. Instead, through the family's contact with a famous American missionary surgeon, he joined the Interscience Course of Ewing Christian College at Allahabad in January 1942, a 36 hour train journey from his home. Once again he performed brilliantly in his examinations.

In order to complete his 3rd year he had to move once again, this time to Lahore in present day Pakistan, to the Forman Christian College. Because of his musical ability he used to play the organ in Chapel. One day, while he was practising the piano at the Principal's home, the Principal stopped him and asked him what profession he intended to follow. Victor explained that he wanted to study civil engi-

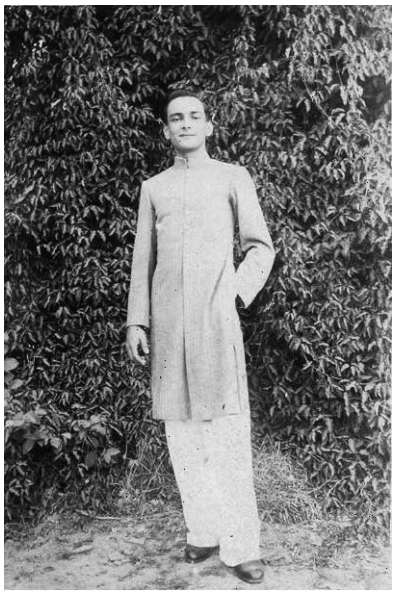

Figure 3 - At Bishop Cotton Boys' School, Bangalore.

neering but, as he was unable to travel to Zurich, he was filling in time by his studies. The Principal, Dr C.H.Rice, aware of his first term grades, responded: *Why don't you go to MIT? It is an engineering school of the highest ranking*. It turned out that Dr Rice was the brother-in-law of Karl T. Compton, President of MIT. Dr Rice wrote a letter to Karl T. Compton and some weeks later a telegram arrived, simply stating *Victor de Mello admitted July 1, 1944, Karl T. Compton*.

And so, with a quick trip to bid his home and family farewell, Victor travelled to Bombay and sailed out of Bombay in April 1944 on the S.S. Mariposa, a few hours before "The Great Bombay Explosion" razed the docks. Forty days later he arrived in Boston via the Pacific, Australia and the Panama Canal. Once again Victor's academic achievements were outstanding. By accelerating his studies, he obtained his BSc degree in June 1946 (Fig. 4) and completed his MSc in September 1946. He had planned to move to Brazil having been offered a contract by COBAST-LIGHT. However he was persuaded by D.W. Taylor to stay on as his Research Associate to conduct the new Soil Solidification Research Contract from the U.S. Corps of Engineers. The collage shown in Fig. 5 was taken at this time.

On completion of his Doctorate Victor began work on a new research contract on the shear strength of clays. But after seven months, and in spite of Donald Taylor's attempts at dissuading him, Victor ended his five-year association with MIT. He wanted the action and creativity of real civil engineering and its service to society. In particular the challenges of the brave new world of Brazil beckoned him. He arrived in Brazil under contract on 14 August 1949. From 1951 to 1967 Victor was successively, Chief Design Engineer, Technical Director and Superintending Director

Figure 4 - MIT Graduation with BSc degree.

of Geotécnica, Inc., which at the time was by far the largest company for consulting and special services in geotechnical engineering in Latin America. Figure 6 shows a delightful picture with his father taken around this period.

From 1968 he has operated as a private consultant concerned with a significant proportion of the major civil engineering projects in Brazil, involving expenditure of billions of dollars per year on tunnels, railways, industrial and mining projects. In addition to his consulting work Victor took on the mantle of teacher and scholar as well. In 1957 he was appointed Professor of Soil Engineering at Mackenzie University in São Paulo and in 1967 he became Professor of Soil Engineering at São Paulo University. In addition he had been president of the Brazilian Society of Soil Mechanics (of which he is a founding member), the first recipient of its Terzaghi Prize, Vice President of the International Society of Rock Mechanics for Latin America and Vice President of the International Society of Soil Mechanics for Latin America. This was the man I had met in South Africa in 1975.

5. Tokyo International Conference State of the Art Report

As mentioned previously, I had been invited to prepare a State of the Art Report on Foundations and Struc-

Figure 5 - Selected photographs of Victor at MIT which include Casagrande and Terzaghi.

Figure 6 - Victor with his father, Indalencio Froilano.

tures for the 1977 Tokyo Conference with Victor, Bengt Broms and Jacque Florentin as co-authors. I must confess that I approached the task with some trepidation, not only because of its magnitude but also knowing that Victor's writing is colourful and requires a lot of concentration to unravel. Ideas and concepts come tumbling out and I found the task of capturing these and doing them adequate justice quite daunting. I invited him to draft the Preamble - Chapter I. At first my heart sank. His first draft contained sentences ten or more lines long, sometimes one full-stop per paragraph. But slowly I began to attune myself to his writing and to realise how to approach it.

Victor paints word pictures and he loves word play. Some years later I attended a conference in Brazil with him and he spoke in Portuguese. The translater broke down in the middle of his presentation and explained that she could not translate what he was saying *because he was playing with words*. The following are some examples of his play on words:

We need not look for new tasks, but merely look at the tasks newly

I may be described as specializing in being a practising generalist

Water has an unfortunate habit of seeping through every theory

Choose your love and love your choice

The way to understand an oil painting is not to examine each brush stroke in detail but to stand back and to take in the whole. This is particularly so of the flamboyant and zestful impressionists. I learned that the way to understand and read Victor's writings is to savour his figures of speech, his word play, his zest and to try to absorb a whole paragraph or even a whole section at a time.

That is the way Chapter 1 of our Tokyo State of the Art was written (Burland *et al.*, 1977). I will not quote from it but anyone who is acquainted with Victor's writing will immediately detect his hand in it. It may be easier to understand than the original but it lacks the bold colours and inspiring vistas which is vintage, uninhibited Victor.

6. The Seventeenth Rankine Lecture

Victor delivered the Seventeenth Rankine Lecture of the British Geotechnical Society on 10th March 1977 having the title Reflections on Design Decisions of Practical Significance to Embankment Dams - see Fig. 7. The first few pages of the paper form an illuminating and thought provoking treatise on the fundamental principles of engineering design and are well worthwhile close study and discussion (de Mello, 1977).

Characteristically Victor de Mello begins with a Roman Legend. During the long-running war between Rome and Alba Longa it was agreed that settlement of the war would depend on the outcome of a battle between the Horatii triplets from Rome and the Curiatii triplets from

Figure 7 - Delivering the 17th Rankine Lecture.

Alba Longa, both sets of triplets being the same age (Fig. 8). In the battle, the three Curiatii were wounded, but two of the Horatii were killed. The last Horatii feigned flight and enticed the Curiatii to pursue him. Because they were wounded the Curiatti became spread out and this allowed Horatius to slay them one by one.

Victor argued that it is in Horatius that we find a real engineer. Rather than face, by full frontal assault, the uneven odds of direct attack he chose to feign running away from the problem, thereby sub-dividing it into components that were individually tackled with ease. He stated that good engineering design is founded on the ability to make creative and ingenious decisions which minimise or avoid the uncertainties at reasonable cost.

Then followed a fascinating discussion on the role of prediction in design. With the modern emphasis on developing sophisticated methods of testing and of numerical modelling there is an understandable tendency to believe that good design requires advanced analysis and prediction. Indeed many undergraduates leave our schools of engineering believing that you cannot design something until you can analyse it. Lambe (1973), in his Rankine Lecture emphasises that prediction is at the very heart of the practice of civil engineering. One must not only predict, but make decisions and take actions on the basis of the prediction.

Victor turned this approach on its head. While accepting that prediction is a necessary vehicle for adequate decision he pointed out that often: *Our ability to predict what will happen is poor compared to our ability to predict what will not happen*. This is a profound statement. What it means is that, wherever possible, good design should aim at avoiding reliance on precise predictions. It should aim at

Figure 8 - The oath of the Horatii.

developing design solutions that cut across the uncertainties. Personally, I find all over the world that there is an increasing reliance on powerful computer packages and, worryingly, an increasing tendency to accept the output at face value. Beware of geeks bearing gifts indeed! Hugh Golder summed it up very nicely when he stated: *Any design that relies for its success on a precise calculation is a BAD design*.

It might be helpful to illustrate Victor's perceptive and important point with an example from soil-structure interaction which draws on an analogy with a three and a four legged stool. The analogy was first put forward by the late Edmund Hambly (1985), a colleague of mine at Cambridge, a brilliant creative civil engineer. It has come to be called Hambly's paradox (Heyman, 1996).

Figure 9 shows two stools, one with three legs and one with four legs. Imagine that each must support a milkmaid who weighs 60 kg, and who always sits with her centre of gravity directly over the middle of the stool. The problem is to determine how much load must be carried by each leg of the stools. The three-legged stool is straight for-

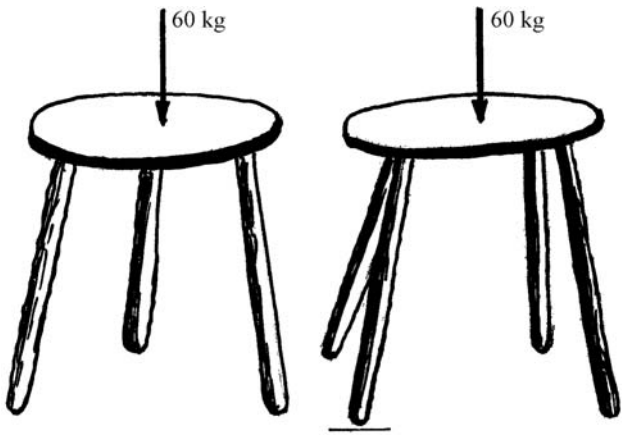

Figure 9 - Hambly's paradox.

ward in that one third of the milkmaid's weight must go down each leg *i.e.* 20 kg. For the four-legged stool the answer of 15 kg is wrong! Careful inspection of Fig. 9 shows that one of the four legs does not quite touch the ground, either because the leg is slightly short or because the ground is uneven, consequently the leg is not carrying any load. To satisfy equilibrium the opposite leg will not be carrying any load either. Thus we find that all of the weight is carried by two legs, *i.e.* 30 kg per leg, instead of being shared by the four legs. Hence the paradox - the addition of a fourth leg to a three-legged stool can increase, rather than decrease, the force for which each leg has to be designed. So what load should the legs be designed to carry?

It is here that concepts of ductility and robustness come in and the illustrative model can be extended to include material properties (Burland, 2006). If brittle material is used for the three-legged stool then accidental overload, due perhaps to a very heavy milkmaid or the cow kicking out at the stool, can easily result in total collapse. Clearly high factors of safety are required to deal with this design. It could be decided to opt for four legs but this may be of little help. The design load for each leg would have to be 1.5 times higher than for the three-legged design. Moreover accidental overload may cause loss of one member and there is then a risk of progressive collapse. In other words the structure is *fragile*.

If ductile properties are chosen there is little likelihood of catastrophic collapse if one of the three legs is damaged. Moreover, with four legs there is scope for redistribution of load once the carrying capacity of a leg is reached. Even accidental removal or serious damage to one member is unlikely to give rise to progressive collapse.

This simple example is very profound and can be extended to other aspects of structural behaviour and design including buckling and ground-structure interaction. Above all, it illustrates the importance of ductility, robustness and redundancy. It is useful to quote Heyman's conclusions to his study of Hambly's paradox (Heyman, 1996):

> *Hambly's four-legged stool stands, of course, for the general problem of design of any redundant structure. It has long been recognised that, in order to calculate the 'actual' state of a structure under specified loading, all three of the basic structural statements must be made - equilibrium, material properties and deformation (compatibility and boundary conditions). However, the calculations do not in fact lead to a description of the actual state. Boundary conditions are, in general, unknown and unknowable; an imperfection in assembly, or a small settlement of a footing, will lead to a state completely different from that calculated. This is not a fault of the calculations, whether elastic or not - it is a result of the behaviour of the real structure... There is no correct solution to the equations, but one solution that will lead to the greatest economy in material.*

The important message seems to be that, in the process of structural modelling, the inherent uncertainties are such that the precise state of the structure cannot usually be calculated. The art of structural engineering is to use the process of modelling to produce a design that is robust enough to safely cope with the uncertainties, at reasonable cost and which is fit for purpose.

In summary: The state of stress within most redundant structures is both unknown and unknowable - it is not the fault of the engineer and no calculation method will change it. It is because of the inevitable uncertainties of the real life situation. These uncertainties are dealt with in design by the incorporation into codes of practice appropriate ductility and robustness. Our structures stand up, not because the engineer has calculated the stress distributions precisely, but because the lower bound theorem of plasticity, or safe theorem, is harnessed - knowingly or unknowingly.

Victor set out a checklist of five design principles for embankment dams which aid decision taking in the face of uncertainty. In doing so he distinguished between mechanical behaviour which results from an integration of average properties (statistics of averages) and behaviour that is triggered by some type of local phenomenon (statistics of extreme values). He set out a check list of five design principles which I have generalised as follows:

DP1: Aim to 'design out' any risk from behaviour triggered by local phenomena *e.g.* piping; tension cracking; internal erosion. ROBUSTNESS

DP2: Use a dominant feature to cut across uncertainties *e.g.* a full-height chimney filter drain; downstream drainage blanket. CHANGE THE PROBLEM

DP3: Aim at homogenization *e.g.* long seepage paths; single, well-graded filter transitions. REDUNDANCY

DP4: Minimise rapid uncontrolled loading. Use pre-loading *e.g.* by permitting high construction pore pressures and observe the response. OBSERVATIONAL CONTROL

DP5: Question each design assumption and the consequences of departure from it. *e.g.* what happens if the permeability is ten times different?. ASK 'WHAT IF' QUESTIONS

These five design principles can surely be applied, not only to all aspects of ground engineering, but also to other fields of engineering endeavour.

Victor finished his *tour de force* with the following Arab proverb:

> *He who knows not, and knows not that he knows not - He is a fool, shun him.*
>
> *He who knows not, and knows that he knows not - He is simple, teach him.*

He who knows, and knows not that he knows - He is asleep, wake him.

He who knows, and knows that he knows - He is wise, follow him.

Recently he and I agreed that the last line should be re-written and a further line should be added as follows:

He who knows, and knows that he knows - He is insufferable, use him.

He who knows, and knows when he knows not - He is wise, follow him.

7. Visits to Brazil

Following the Rankine Lecture I worked with Victor on a number of projects and experienced the de Mello's way of life. As far as I could ascertain Victor would wake early and work. He would then arrive for breakfast as fresh as a daisy. We would then engage in the day's activities, be they work or relaxation. After an evening meal and a relaxed stroll we would all retire to bed and Victor would return to his study and work into the small hours. On one occasion I calculated that he must be averaging four hours sleep a day! Figure 10 is a photograph of Victor, Maria Luiza and their daughter Lucia taken during a visit to Rio de Janeiro in 1980.

One of the projects that we worked on together was the crossing beneath the River Tietê in São Paulo of a 4.5 m diameter interceptor sewer tunnel, for which we were both members of the Advisory Board. The ground consisted of hard closely fissured Tertiary clays. The crown of the tunnel was only 2.5 m beneath the river bed. Figure 11 is a photograph taken while I was inspecting a trial shaft with Victor's son, Luiz Guilherme, looking down the shaft anxiously. The tunnel was successfully driven under compressed air of about half an atmosphere. (Pan & Oliveira, 1983 and de Mello, 1983)

It was on Monday 27th April 1981, while we were working on the Tietê River project that I had a phone message telling me that Professor Kevin Nash, Secretary General of the ISSMGE, had died. The following morning I spoke to his wife Mel who had already spoken with the President, Masami Fukuoka. Would I take over as Secretary General at least until the end of the Stockholm International Conference which was due to take place in the middle of June? So it was that I came to be a very close witness of Victor's election as President of the International Society of Soil Mechanics and Geotechnical Engineering in Stockholm.

Figure 10 - Victor, Maria Luiza and Lucia in Rio de Janeiro.

Figure 11 - Trial shaft for the River Tietê tunnel.

8. President of the International Society

Prior to the 1981 Stockholm International Conference Victor had been on a consulting project in Mauritius. He had intended to attend the Executive meeting at which the election would take place. But he experienced a whole series of delays. We were kept posted on his progress towards Stockholm and the tension became almost unbearable. Maria Luiza was distraught and it is no secret that she carried out a fair amount of lobbying of delegates on Victor's behalf.

In dramatic fashion Victor arrived to cheers all round just in time to hear the results of the vote. There was no argument about it, Victor was elected President by a very

clear margin. The result was announced on Saturday 13th June 1981 at 5 pm. Exactly 35 years to the very hour since President Compton of MIT gave Victor his BSc Diploma. Figure 12 is a photograph showing Victor with the President's gavel.

It is worth recalling Victor's acceptance speech in Stockholm for, once again, it reflects his primordial order of values: human being first; civil engineer second; specialist third (de Mello, 1981):

> *Indeed, we embrace a profession in order to better fulfil ourselves as human and social beings. Within our profession of civil engineering we delve into a specialisation in order to better fulfil ourselves as professionals: we may even need to restrict ourselves within geotechnique to a subspecialisation, but only in order to further fulfil ourselves within our calling as human beings. Let us never loose sight of the order of priorities in such allegiance, since specialisations are meant for the betterment of Society, through us and despite our deficiencies, and never to the detriment of our fulfilment as world citizens. Geotechnical Engineering is of service to all civil engineering.*

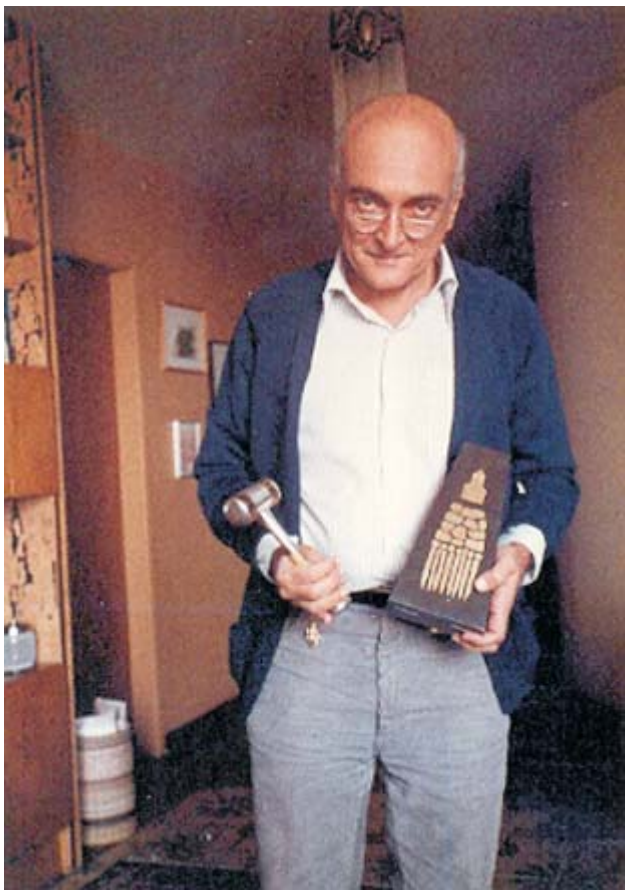

Figure 12 - With the President's gavel.

He then threw himself wholeheartedly into the service of the International Society. The first thing he did was to initiate a route and branch revision of the Statutes. He then expanded local and regional activity by encouraging an expansion in the number and diversity of the Technical Committees.

During his Presidency he travelled to over thirty countries to attend conferences and congresses. What is so remarkable about this is not simply the amount of travelling he undertook but the number of lectures and papers he gave. Working through his list of presentations reveals that he never repeated a title. And so often at his side was his inspiration and encourager - Maria Luiza. In parallel with this activity he was as active as ever in his consulting - mainly advising on the design and construction of earth dams but also slopes, tunnels and major foundations.

The International Conference is of course the climax of the President's term of office. The San Francisco Conference was no exception. But first there was a meeting of the Steering Committee (now called the Board) with the new Statutes to agree. Then there was the meeting of the Executive Committee which takes place over a two day period. The new Statutes were approved at this meeting. The photographs in Figs. 13 and 14 were taken during the days immediately before the San Francisco Conference.

During his Presidential Address to the Conference (de Mello, 1985) Victor referred, somewhat prophetically for me, to the Pisa Tower. He said that he found in the wide range of solutions offered for stabilising the Tower an object lesson in engineering. He then showed us 25 different solutions of which only four are shown in Fig. 15. He had concluded that:

> *When faced with a problem of high ratio of responsibility to feasibility, it is not in better analytical work that engineers seek solutions, but rather in different statistical universes in order to set aside, quite definitely, the possible histogram of degrees of undesirable behaviour.*

This is an application of Design Principal 2 given in his Rankine Lecture and referred to previously. He then went on:

> *Have you not often woken up in the middle of the night with a flash of a brilliant solution to a problem that only becomes fuzzy during the day? If you are somewhat uncertain of being awake, I am with you: In the figure it does become certain that dreams and nightmares intermingle, requiring careful selection.*

For me the nightmare commenced in 1990 when I was invited to work on the Commission for stabilising the Tower. But, of course, that was all in the future.

Towards the end of his Presidential address Victor made another prophetic statement which we should all aspire to:

Figure 13 - Victor and Maria Luiza at the San Francisco International Conference.

Figure 14 - John Burland, Dick Parry and Victor reading the statutes before the San Francisco Board meeting.

I submit that the most important question facing the geotechnical engineer is for him to reassume a position as the foundation instrument of every civil engineering orchestra, and for the civil engineer himself to reassume his position as the most influential element of human society in affecting the environment.

9. Maria Luiza and Maria

The San Francisco Conference was over all too quickly and my close association with the ISSMGE, which had begun in Brazil in April 1981, came to an end. Victor launched into re-building his consultancy and his work, particularly with dams, continued. We continued to meet at Conferences and wonderful re-unions they were - see Figs. 16 and 17.

From the middle of 1988 Maria Luiza's health began to deteriorate and it was a terrible blow to us all when we heard of her death on 17th August 1990. Bravely Victor came to the European Conference in Firenze in May 1991. After the Conference he, my wife Gill and I had a most memorable two days as tourists. We exhausted ourselves visiting the major art galleries, museums and churches. Victor had the wonderful knack of discovering superb restaurants where we revived and talked endlessly late into the evenings.

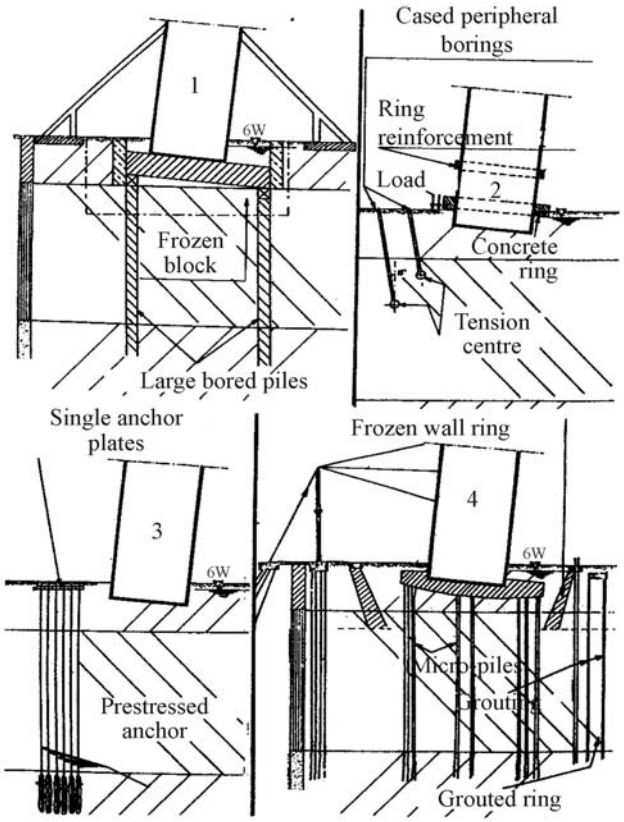

Figure 15 - Four examples of solutions for stabilising the Leaning Tower of Pisa.

Figure 16 - A reunion.

We were thrilled to receive the photograph in Fig. 18 with the news that Victor and Maria had married on 17 February 1995. In June 1995 Victor brought Maria to Pisa and they both sat in on one of the Commission meetings. We were all together again in Istanbul in 2001 and my last meeting with Victor and Maria was at the Skempton Memorial Conference in 2004. We have of course corresponded frequently.

10. Epilogue

Many of you will know that Victor is no longer in good health and finds it difficult to communicate. I want to share with you the most recent exchange of letters that I have had with him. On 28th September 2007 Victor sent me the following e-mail:

Maria wrote this note as you know I cannot move, eat or speak. The only movement left to my muscles is the closing and opening of my eyes by which I agree or disagree with what is posited to me. And it works! Silence is eloquent!

What Maria wrote here is what I communicate to her that I wanted you to know:

In my final times in this life I can assure you that one can reach other levels of reality and consciousness and open oneself to dimensions not accessed by our rationality, no matter how brilliant it might be; and the expression of Good, Beauty and Truth is in them.

I read every word of what Maria wrote, and I blinked my eyes assuring her that what is written here is exactly what I wanted to tell you.

Most affectionately and grateful for our so close, enriching and valuable friendship during these years.

Victor de Mello

Figure 17 - Maria Luiza with past Presidents Michele Jamiolkowski and William van Impe.

Figure 18 - Maria and Victor dancing at their wedding on 17 February, 1995.

In an e-mail dated 1st October 2007 I replied as follows:

In my vote of thanks to your Rankine Lecture (was it really thirty years ago? - it seems so recent) I said how much it would provoke thought and discussion and this has indeed been the case and will continue to be with your magnificent contributions. I have been honoured to give the first lecture in your name in Coimbra next year and I propose to devote it to promulgating your approach to engineering and to life.

Also in the vote of thanks I referred to the 'heightened intensity' that you have brought to our lives. Your wonderful letter reminds me of the words of Elizabeth Barrett Browning:

'Earth's crammed with heaven

And every common bush is afire with God

But only he who sees takes off his shoes

The rest sit around and pick blackberries'

So profound yet with a delightful touch of humour.

Dear, dear brother, thank you for all that you have brought to our lives and to our profession. With our profound gratitude and love.

I feel sure that you will agree with these sentiments.

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