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Paper clips, rubber bands and satay sticks

Zoltan Lewis Kerestes

Northern Sydney Cancer Centre, Medical Oncology Department, Royal North Shore Hospital, St Leonards, Sydney NSW 2065

Abstract

This is a personal article about the lasting influence the late Professor Jak Kelly has had over the course of the author's varied career. His influence was especially pronounced when the author was under pressure and had to confront a difficult and unusual situation. Some of these situations are illustrated in this article. It is hoped that the article showcases in parts Professor Jak Kelly's sense of humour. Professor Jak Kelly was a mentor and a long term friend of the author.

"Most people say that it is the intellect which makes a great scientist. They are wrong: it is character." Albert Einstein

Introduction

The day I met Professor Jak Kelly was the day I did something that was totally out of character: I declined an offer to have graduation drinks at the 'White Horse' with fellow students from Sydney University. Instead, I headed to the School of Physics at UNSW to enquire about a teaching position with postgraduate research work. In those days it was a 'buyers market'. You went around to all the departments, had a chat with the Heads and then decided which group to join. On first meeting, Jak was enthusiastic and passionate about science. He also seemed to have a wicked sense of humour and the research work he was engaged in was of a vision with an exciting and useful future. The decision to join his group was a foregone conclusion when he took me to view the impressive 1.25Mev Cockcroft-Walton accelerator, standing a storey high inside a former Electrical Transformer Building.

Every Friday afternoon Jak made it a focus for all his postgraduate students to gather together on the grounds of the Accelerator to present our progress of the week. We discussed problems we had encountered and freely shared ideas. These discussions were always accompanied by great food and increasingly better quality wines. It was at these meetings with Jak and fellow students that Jak inspired in me to look at the world not just with a scientific eye but with a broad vision; to try to think differently, to challenge accepted dogma, and to consider historical perspectives. Jak's great strength and drive was to apply ideas across many disciplines. Jak was also a great orator and showman and his formal lectures were legendary.

Lesson 1: "Curb your enthusiasm!"

Jak valued genuine intention first and foremost. If then the result turned out disastrous his Irish humour helped to ease the pain and embarrassment.

My PhD project involved the study of sputtering. This is the process of ejection of atomic material from the surface of solids during bombardment by energetic atomic particles. The experimental setup that I used to study the phenomenon had a small oven that produced the energetic particles.

This oven was cooled by water. It was easier to connect the water to the mains than to the 2000 litre storage on the roof.

One late Saturday night, after completing a full day's experimental run, I headed home, forgetting to switch off the water cooling. I was barely awake the next morning, when I received the call, "You better come right now. The School of Physics is flooded." I was in a nightmare. It was not until I drove down High Street that I saw a triangle of water spanning two floors – at its apex, the window of my lab. After I entered the School of Physics, reality very quickly asserted itself. As I rushed in to go up the main staircase, a perfectly formed waterfront cascaded down over the stairs. On the First floor, the Head of the School's dog darted out at full speed towards me. It immediately registered the mini lake in front of it and with a terrified, desperate look in its eyes, it tried to stop. You could even pick up the Doppler shift in its desperate cry and yelp as it water-skied past me, haunches on the ground, front leg outstretched, forming a perfect wake.

Next I entered the library and there an equally surreal image confronted me: the School of Physics' librarian holding an umbrella in the downpour from the ceiling above, desperately trying to save as many books as he could. I felt bad about the disaster I caused but I felt worse about the books. They took months to dry out.

At the end of that Sunday, with as many helpers as we could muster, we managed to clean up the water. We all then gathered at the Head of School's campus residence for a beer. Jak knew that his group would receive a fine for the downpour and the damage it caused. As was his way though, he pulled me aside and said, "Zoltan, my boy, you must curb your enthusiasm!"

I believe that in the years that followed there were a few 'enthusiasts' like myself.

Lesson 2: "Have you done your experiment correctly?"

This was the question that Jak always drummed into us, even when the experimental results seemed to confirm our expectations and especially when faced with an anomalous results.

The first time I heard him ask me this question, he followed it as usual with an anecdote about the time he was working at Harwell Atomic Energy Establishment in the UK. He noticed that experimental results taken before lunch were quite different to those taken after lunch. Could it be that when he, Paul Chatterton and other members from the lab would go out to lunch, which would of course have included some ale or wine with the meal, this may have somehow influenced the measurements? Jak being a true scientific sceptic, dismissed this hypothesis on the grounds that in his experience, up till then, he found that insights and experimental measurements usually were improved by a glass or two but only when not imbibed in excess of course. He then noted that not all laboratory members joined them on their usual lunch break. In fact there was a young technician, a teetotaller who never joined them. On questioning the young man, the mystery was solved when it became evident the he used the vacuum chamber to warm up his curry at lunch time. Thus the experimental anomaly was not due to the effect of wine but rather due to the left over residue from curry vapours.

After completing my PhD thesis in 1979, I worked for a brief period at Sydney Hospital with Dr Leopold Dintenfass. His interest was studying the factors affecting the viscosity and aggregation of red blood cells. He was preparing an experiment to go aboard the space shuttle 'Discovery' as at the time NASA was also interested in red blood cell aggregation under zero gravity, aggregation being the process whereby red blood cells stack together to form linear and three dimensional structures. Dr Dintenfass, was at the time, the first Australian scientist to have an experimental project accepted by NASA. The proposed experiment used an automated slit-capillary photo-viscometer. This instrument consists of a set of two highly polished glass plates, with a gap of 12.5μm. Using an infusion pump, blood samples could be introduced into the slit-capillary. Two types of experiments were planned. The first was to take micro and macro photographs of static blood in the slit. In this case, the pump introduces the sample into the slit and then is stopped to allow for the formation of aggregates. Photographs were then taken. The second experiment was to take blood viscosity measurements. I was asked to investigate the anomalies found within these measurements.

One day when I was in the workshop with the glass polisher, I noticed the monochrome light source he had to check the flatness of the glass plates he was polishing. I instantly had a hunch. I went back to him with one of our slit viscometers and put it under the light. I used water to inject into the slit and the resultant interference pattern showed that the glass plate assembly was deforming under pressure of the liquid being injected into the slit. A quick high school calculation from the measurement of the fringes, revealed that the gap between the plates near the centre, more than doubled. The main source of the anomaly was found. Unfortunately it was too late to redesign the glass plate and assembly and to resubmit the proposal to NASA.

There were two NASA shuttle flights in 1985 and 1988 where the equipment was only used to obtain photographs of red cell aggregation. The results of both flights showed significant changes in red blood cell morphology and a reduction in the size of aggregates in native plasma.

Lesson 3: How useful is a paper clip and rubber band?

There are times when an urgent solution necessitates unorthodox methods and tools.

After working with Dr Dintenfass I was offered a contract with the CSIRO's Mineral Physics and Nuclear applications group facility in North Ryde. My work included working in the field in Western Australia, at Kalgoorlie, and at a remote station at Yeelirrie, where the nearest town, Waluna, was 70 kms away. I learned in Jak's lab the importance of self reliance and of having a detailed knowledge of your experimental equipment. These skills were paramount in my success in that isolated environment.

In 1983 near the end of my four year term with the CSIRO, I was involved with the assembly and testing of the recently acquired 2.7Mev Tandem accelerator. The accelerator was to be used as a microanalytical system in geochemical and geochronologic studies. The accelerator was thoroughly tested the night before the facility was due to be officially launched. In the control room, The Honourable Minister

for Science Barry Jones was to push a big red button which would turn on the accelerator. An ion beam would be produced that travelled down inside a vacuum tube be bent around by an electromagnet. It would then travel down a straight section of the vacuum tube into a small chamber. The chamber contained a remotely controlled mechanism with a small target that would flip into and intersect the beam showing a glowing spot. This glowing spot was picked up by a video camera and would then show up on a television screen next to the red button that initiated the whole sequence. The glow was a visual confirmation that the accelerator worked.

The Minister, along with dignitaries from the Government and the CSIRO and a news crew had been invited to witness and record the event. All tested well the night before the launch but the situation changed by morning. We all showed up early and everything was working, except for the target which would not flip into the beam. We isolated the target chamber, brought it up to atmosphere, opened it, tested the remote signal all okay. I had a very careful look and used my finger to flip the target holder and noticed that a fine spring got caught in the mechanism and had twisted and finally had broken loose. There was no time to take it out and repair it. Again I drew on Jak's teachings, think the unthinkable. A paperclip and a rubber band. The shape of the paper clip was reconfigured to fit into the mechanism with a slight counter tension and the rubber band supplied the opposing tension. Within five minutes the target was working again, more smoothly than ever before. In the jubilation some exclaimed "we should patent this".

The chamber's top was quickly bolted down, the vacuum pump turned on and when its gauge showed the required vacuum had been reached for operations the final thumbs up signal was given just as everyone entered the control room. There were only three of us who knew about the fix. We quickly left the experimental hall where the accelerator and the beam tubes were housed and joined the dignitaries in the back of the throng, with our hands behind our backs, fingers crossed. Judging from the applause, as we couldn't see from the back, we figured that my "low tech" solution must have worked.

Lesson 4: How to change careers and survive

My association and friendship with Jak and his family had continued over the years. During our association Jak advised and helped me greatly in making a major shift in my career path.

I had an offer from the Department of Medical Oncology to work in Clinical Trials at Royal North Shore Hospital. Even though I knew the work would be interesting, challenging and rewarding the fact was that I was no longer going to be practising Physics. Jak helped me over some of my doubts by having faith in my abilities and by pointing out that just because he is working in another area a Physicist never stops practicing the methods and attitudes that he has been trained with. He also pointed out that succeeding and finding reward in another area is in fact the ultimate endeavour.

He was right.

The Head of the Department of Medical Oncology was Professor John Levi, who

was a founding father of chemotherapy trials in Australia. He wanted someone from pure research, outside of Medicine, to help with the design of the trials, to ensure the trials' data integrity and quality and to provide help in statistical analysis of results. Software and hardware support for his Department was also a requirement.

During my first six months of probation I had a challenge that I never expected to face: a visiting doctor who was involved in a chemotherapy trial was attempting to apply 'what-if-scenarios' to the data. I could not understand this. In trials, there is always a struggle with patient recruitment. It is critical because, with small numbers, the statistical power is weak. Furthermore, the patients are usually further divided by different treatment modalities thus further diminishing the statistical power. I found that Medicine is so much more difficult than Physics because individual humans are varied in their biological responses and genetic makeup. All one can do in a clinical trial is to identify as many patient factors that may be of relevance and to then analyse the response of the cohorts. In this case there are no 'what-if-scenarios'. I explained the situation to the doctor but he kept insisting that what he was attempting to do was valid. I felt that my new career was going to finish even before it started. The doctor hadn't actually crossed the line of 'changing data integrity' but I felt very uncomfortable with his attitude. The issue of intellectual honesty never really came up in our research in Physics, since we spent so much time ensuring that we had all the factors effecting measurements identified and their importance evaluated. A measurement was only real if it could be reproduced. In clinical trials I have seen now that a statistically significant result in one trial was quite often nullified by a similar trial at another centre. Many years later, by pooling results from many centres and applying methods of meta-analysis, helped to firm up results.

In my situation with this doctor, I had no other course except to defend my stand and to ensure that the 'line' was never crossed. I kept my job and I have been with the unit now for almost thirty years, he left medicine a few years later after this incident.

Lesson 5: Unconventional Solutions

Clinical trials are now conducted by the drug companies and my interest turned to the use of information systems in Medicine.

When Internet technology began to mature in the mid 90s I rapidly saw just how useful it could be to disseminate information efficiently. In a hospital setting what was required was to set up an Intranet. I also realised that quality and version control of documents were crucial to its successful implementation. The final tool to make the process useful was software that became available to convert word processing files into HTML. If those documents were properly styled, then those styles could be turned into a linked table of contents. I was seconded to the Information Technology Department of the Hospital to lead a team to develop an Intranet as well as policies and procedures for document authoring and version control. The project was highly successful and I was asked to give a presentation of our work to the Department of Health. The night before my talk, I was going to put the final touches to my PowerPoint presentation. To turn my laptop on, I pushed on the sliding power switch located on its side. It broke. I couldn't turn the power on and to my horror, I didn't have a backup. It was at

this desperate point that again the experiences and attitudes I gleaned in Jak's lab illuminated me: do not give up, examine the problem thoroughly and most of all of seek answers outside the conventional realm. There was a small opening where the switch broke that I could push some pointed tool in and possibly throw the power switch on. However in this situation, I could not use my all purpose paper-clip tool as I might short the laptop and make a bad situation even worse. Light bulb moment, a satay stick! A mad dash to the kitchen drawers and within minutes I had the laptop come alive, made a quick backup and finished the presentation and backed that up also. As the talk took place early on in the morning, I didn't have time to get another laptop. I had to use the one I had. I didn't feel too good about using a satay stick at a presentation where I knew there were going to be some senior members from Health Department of Health. Even though I came up with a working solution and practiced turning the laptop on and off so at least it looked like a smooth operation, I still thought it was tacky but there was nothing to be done.

Once again finding myself in an unusual circumstance Jak's influence helped. Next morning I turned up to give my talk. I pulled out my laptop, placed it on the lectern and made sure that my audience could see that I had used a 5 cm long transparent tape to stick two satay sticks to the cover. I could see that most people were quite intrigued. They have never seen anything quite like it.

Don't hide the facts, emphasise them.

I began my talk by explaining what occurred the previous night and how I came up with the solution. I then took one of the satay sticks and, with a confident flourish, I turned on my laptop. A few people applauded. I then asked the audience whether anyone could tell me why I had two satay sticks. "No idea? No guesses?" I teased. "Clearly …the second satay stick is for backup."

That bought the house down.

Conclusion: "People in the cheap rows, at the back, can you hear me?"

A week after my presentation with the satay sticks I was offered one of the most rewarding projects of my career. A project that would especially help all health professionals in NSW in the far flung areas of the west of the state. At the time, Broken Hill Hospital did not even have a medical library.

The Clinical Information Access Program (CIAP) was a project of the NSW Department of Health, initiated in 1997 and driven by the Clinical Systems Steering Committee. Its principal aim was to use the Internet to bring to the point of care, clinical information for all health professionals working within the NSW public health system. The clinical information and the resources was to support clinical best practice, education and research.

I was asked to make the CIAP a reality by identifying and purchasing an initial pool of data sources and associated search engines, to contact every major medical library in the state and inform them of this soon to be delivered resource, and to obtain feedback and create the web structure for delivering the information resources purchased.

The website was launched on July 4, 1997 and the year after the CIAP received the Data Management Association (DAMA) Australia Achievement Award for Excellence in Information Management and the Australian Library and Information Association (ALIA) NSW Branch Merit Award for Services to Rural and Remote Users and the Community.

After the launch one of the many emails I received from the rural doctors was, "This is the best thing that has happened since a bail of clover in a drought."

Thus, thanks to Jak's legacy, I too managed, in my own way, to get the message to the "people at the back".

Zoltan Kerestes

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