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School of Engineering Commencement Address

Emery H. Rogers
Hewlett-Packard Foundation

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BOB HAMERNIK

Robert L. Heyborne
DEAN - SCHOOL OF ENGINEERING
UNIVERSITY OF THE PACIFIC Stockton, California

July 10, 1985

Bob,

I thought you might enjoy having a copy of
Dr. Emery Rogers' Commencement Address.

Best wishes,

Bob H.

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You will
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century Viennese debutante as they busily hire, along with the caterers and
other necessary services, the cheaply-bought skills of a rather odd young
composer to dash off a few catchy original tunes for her glittering coming-
out ball. Two hundred years later the party, which had the whole city agog,
is long forgotten, but the Divertimenti of Mozart lives forever. I dare
say, the contemporary assessment of relative importance was 180 degrees
away from the eventual relentless judgment of history.

This kind of humbling failure to perceive future big truth at the moment of
its humble beginnings was brought home to me forcibly as a consequence of a
chance encounter with a phonograph-record display being featured in a
Stockholm department store in 1964. The photos on the record jackets
depicted singers with strange hair-dos. The enthusiastic young Swedish
salesperson answered my casual inquiry by extolling the creative musical and
lifestyle virtues of a quartet from Liverpool called the "BAY-AT-LAYS".
Only my teenaged daughter back in America would solve the mystery for me by
deciphering the perfectly valid Swedish pronunciation of a brand new word,
and by patiently explaining her own acute sensitivity to the front end of
the Beatles Revolution --- a revolution which was widely ignored and then
mis-assessed by my generation at its inception.

Turning to the field of world affairs, classic examples of obscure catalysis
abound. A pompous white traveller had the youthful brown-skinned Mohandas
Gandhi ejected from his South African train compartment, thereby quite
unwittingly releasing a torrent of subsequent events which shook an empire
to its foundation.

Thirty years ago, an alert Austrian diplomatic mission quietly noticed a
tiny shift in the official Soviet reception protocol during its arrival
ceremony at a Moscow airport, instantly decoded the silent signal, quickly
seized the precisely correct moment for treaty-making, and deftly managed
to get out from under an onerous divided country, divided city yoke, the
painful analog of which burdens its larger German-speaking northern
neighbor to this very day. It is ironic that "The Sound of Music" comes
to our American minds when we think of picturesque Austria. I'm quite
convinced, however, that we'll have to accept history's judgment that what
happened on 5.5.55 ranks far higher on the importance scale as one of the
shrewdest win-win acts in the annals of peaceful diplomacy.

COMMENCEMENT ADDRESS

School of Engineering
University of Pacific
Stockton, California
Sunday: May 26, 1985

Graduating engineers; faithful underwriters of graduating engineers; President McCaffrey; Dean Heyborne; distinguished guests:

I am deeply honored to be invited to the celebration which honors you graduates.

The vast, heaping mound of human history is salted with contemporaneously obscure and mis-assessed incidents which eventually turn out to have permanent significance. Only the subsequent irrepressible surge of time and truth brings these originally hidden catalysts to widespread regard.

You will have your list of favorites, and I mine. For example, I find it instructive to contemplate the understandably proud parents of an 18th century Viennese debutante as they busily hire, along with the caterers and other necessary services, the cheaply-bought skills of a rather odd young composer to dash off a few catchy original tunes for her glittering coming-out ball. Two hundred years later the party, which had the whole city agog, is long forgotten, but the Divertimenti of Mozart lives forever. I dare say, the contemporary assessment of relative importance was 180 degrees away from the eventual relentless judgment of history.

This kind of humbling failure to perceive future big truth at the moment of its humble beginnings was brought home to me forcibly as a consequence of a chance encounter with a phonograph-record display being featured in a Stockholm department store in 1964. The photos on the record jackets depicted singers with strange hair-dos. The enthusiastic young Swedish salesperson answered my casual inquiry by extolling the creative musical and lifestyle virtues of a quartet from Liverpool called the "BAY-AT-LAYS". Only my teenaged daughter back in America would solve the mystery for me by deciphering the perfectly valid Swedish pronunciation of a brand new word, and by patiently explaining her own acute sensitivity to the front end of the Beatles Revolution --- a revolution which was widely ignored and then mis-assessed by my generation at its inception.

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Thirty years ago, an alert Austrian diplomatic mission quietly noticed a tiny shift in the official Soviet reception protocol during its arrival ceremony at a Moscow airport, instantly decoded the silent signal, quickly seized the precisely correct moment for treaty-making, and deftly managed to get out from under an onerous divided country, divided city yoke, the painful analog of which burdens its larger German-speaking northern neighbor to this very day. It is ironic that "The Sound of Music" comes to our American minds when we think of picturesque Austria. I'm quite convinced, however, that we'll have to accept history's judgment that what happened on 5.5.55 ranks far higher on the importance scale as one of the shrewdest win-win acts in the annals of peaceful diplomacy.

Now let us turn to the world of high technology, and to an unheralded publishing event which burgeoned gradually into furious debate among a few academics, and then eventually spread from there into admittedly somewhat grudging worldwide understanding and acceptance.

Perhaps now that "The Jewel In The Crown" has run its extraordinary course on PBS TV, some of you may be watching in its place on Sunday nights a serialized drama entitled "Strangers and Brothers". The play is based on an 11-volume novel written by the English author C. P. Snow. But who was Charles Percy Snow, and what on earth could he possibly have to do with graduating engineers at the University of the Pacific? It is my contention that a particularly discerning insight of his carries basic practical importance, like it or not, for your and my lives.

Being a scientist by training and a novelist by profession, Snow, born in 1905, became fascinated by the remarkable differences between the two intellectual worlds in which he, uniquely enough, lived and worked quite comfortably. He decided to submit a paper on his observations, and it appeared in England without any fanfare whatsoever in the October 6, 1956 issue of the "The New Statesman" under the title "The Two Cultures". It is instructive to quote from its opening paragraph: "'It's rather odd', said G. H. Hardy one afternoon in the early Thirties, 'but when we hear about intellectuals nowadays, it doesn't include people like me and J. J. Thomson and Rutherford.' Hardy was the first mathematician of his generation, J. J. Thomson the first physicist of his; as for Rutherford, he was one of the greatest scientists who has ever lived. Some bright young literary person ... putting them outside the enclosure reserved for intellectuals seemed to Hardy the best joke for some time. It does not seem quite such a good joke now. The separation between the two cultures has been getting deeper under our eyes; there is now precious little communication between them, little but different kinds of incomprehension and dislike."

Snow went on to say that "Most scientists would claim that you cannot comprehend the world unless you know the structure of science, in particular of physical science ... Not to have read 'War and Peace' ... is not to be educated; but so is not to have a glimmer of the Second Law of Thermodynamics."

Sad but true, some well-intentioned papers in learned journals can work their unwilling way to the ash heap of history. This particular one most decidedly did not. It was met by a gathering storm of debate, culminating in the now famous 1959 Rede lecture at Cambridge in which Snow expanded upon his concept of the two separate societies, comprised of scientists on the one hand, and non-scientists on the other. Among his closing remarks, he warned: "All the arrows point the same way. Closing the gap between our cultures is a necessity in the most abstract intellectual sense, as well as in the most practical. When those two senses have grown apart, then no society is going to be able to think with wisdom."

Perhaps you, as graduating engineers, will want to find out more about this great issue, and about its evolution. In the view of many these days, it still pervades the world in which you and I function. And it comes directly home to you, because I submit that it is quite valid to use the terms "engineer" and "non-engineer" in place of Snow's terms "scientist" and "non-scientist".

Pursuing this course, let us examine a few of the unfortunate practical consequences of the still significant gaps in mutual understanding between the two cultures. Until more attractive bridges are devised, none of us can fully escape those consequences. (Incidentally, it is a supreme irony of history that Snow died in 1980, deploring the hostilities and misunderstandings between the two cultures, precisely at the time the word processor application of the computer was emerging on the scene. This exceptionally effective bridge has been a heartwarming success in generating good willed, animated conversation at faculty club tables between technical people on the one hand, and literary people on the other. The mutually beneficial connection between bytes and Byron did it.)

Looking first at the gap from the science side, we can make a perhaps arrogant observation. If you could take a poll among the audience at a play, an opera, a symphony or a ballet, you would hardly be surprised to find a substantial number of engineers and scientists enjoying, and understanding, often more than superficially, the performance going on before them. A similar poll taken among the throng on any given day at San Francisco's marvelous hands-on science museum -- the Exploratorium -- would probably not reveal the presence of anyone whose primary profession was the performing arts. A Charles Percy Snow would regret that two different kinds of beauty, but beauty nevertheless, could not be appreciated from both sides with similar enthusiasm.

Continuing with this first view of the gap from the science side, an analysis of the professional background of legislators would reveal a heavy preponderance of lawyers, and a striking scarcity of scientists and engineers. It should be terribly unsettling to have to vote on a critical technological issue without any first hand knowledge whatsoever of the language, principles and methods of engineering and science. Entire reliance would have to be placed second hand on outside witnesses; on technically literate staff, if it even existed; or far worse, on vocal demagogues with wide popular appeal, but with no credentials earned the long hard way in the laboratory itself. And yet such complex issues can be just as important as many non-technological issues which the experienced engineer would, self-admittedly, be less competent to handle than the professionally trained lawyer. We may have here what Aldous Huxley labeled fatuous ignorance: you know that you don't know, but you think that doesn't make any difference.

At Hewlett-Packard some years ago, we learned the hard way about the gap. Many of you are aware of the sensational success of the first hand-held calculator with transcendental mathematical functions -- the HP 35. It exceeded our wildest sales forecasts by ten to one because engineers and scientists all over the world instantly perceived its groundbreaking usefulness in their specialized endeavors. Then, relying on the enthusiastic recommendations of in-house HP businessmen/engineers, we rushed out with a second version of this pioneering hand calculator tailored specifically to the pressing mathematical needs of the one-tenth of its conservative sales forecasts. We learned then that the businessman's culture simply was not tuned at that time to the same exciting signals received loud and clear by engineers in their particular

cultural environment. As you well know, the business community has now made great progress in becoming technically sophisticated, and this story would not be repeated today. It is, however, sobering to hear stories about illustrious banks in the early 1940's which refused to lend money to Bill Hewlett and Dave Packard when they were struggling to get their fledgling technical enterprise off the ground.

Turning to another, quite disquieting, aspect of the culture gap problem, the unwillingness of non-engineers to broaden their horizons to include more than a superficial understanding of the technical world can lead to what the science/engineering side sees as irrational behaviour. The editor of a major metropolitan newspaper turned down the request of an astronomical society for an astronomy column on the sincerely-believed grounds that his paper already had one. He was, of course, referring to the widely read astrology column. And one of our large American companies has just found it prudent to abandon its cherished logo because a noisy segment of the 1985 American citizenry associates the symbol with Satanism.

Irrationality may have a certain bizarre fascination, but unfortunately, when any human grouping, large or small, succumbs all-out to irrational siren songs, that closed circle soon seems to find it necessary to turn to its more practical outside neighbors to pay its day-to-day bills, or otherwise pick up the pieces.

Now will you look with me in the other direction? What happens when a scientist or engineer refuses to make meaningful side forays into the far larger world of non-scientist, of the non-engineer? Or, putting it affirmatively, what values can accrue to the engineer who not only keeps right up with his or her noble profession, but also dares to expand personal horizons, lifelong, beyond that crucially important central career?

As a starter, I might suggest sharpened front end awareness and thoughtful self-confidence as initial benefits stemming from the culture-bridging process. We freedom loving Americans will often spend far more time and resources on getting out of a catastrophe that engulfs us than we will in heading it off in the first place. I might put it this way: it is a lot easier to detect a step function Pearl Harbor than it is an adiabatic, or slow release, Pearl Harbor. Everyone sees the sudden, catastrophic event and acts in unison in response to it. (Incidentally, if you question whether this could ever happen in a wide open, pluralistic democracy like ours, I refer you to the Letters to the Editor Column in, say, Time magazine, for the month just before December 7th, 1941, and then for the month just after. All opposing vectors were instantaneously aligned by massive common perception. Perhaps this was the last time that such remarkable unity ever occurred in the multi-opinioned U.S.A.)

It is clearly worth the personal effort to develop truth seeking detectors through expanding awareness of other cultures. Because adiabatic Pearl Harbors are so difficult to assess accurately at their inception, they lend themselves readily to all kinds of radically differing future scenario predictions by diametrically opposed extremists. Quiet self confidence about the ability to extrapolate calmly and rationally from small beginnings can be a rewarding personal asset. Front end insight based on culture bridging can help us avoid making gung-ho cause

commitments based solely on emotion, or chance of upbringing, or fiery demagoguery.

Humility might comprise a second benefit accruing to the culture expander. When a person from the technical world laughs at the historian who doesn't know a volt from an ohm from an ampere from a watt, that person might be surprised to learn that the historian is silently wondering whether his tormentor has the faintest inkling of the lives and times of four gentlemen from four different countries: Alessandro Volta, Georg Ohm, Andre Ampere, and James Watt. There is little chance that we are going to persuade others to learn about our field unless we show genuine interest in theirs. Sir Isaac Newton merits eternal honor for giving the world his laws of gravity and motion; but so does the anonymous mid-twentieth century historian whose flash of insight and subsequent painstaking research demonstrated that there has never been a war in history between two independent nations, each of which had a freely elected government constitutionally compelled to stand for regular, freely conducted re-election!

In the needed humility context, the following little revelation could be sobering: a German employee of Hewlett-Packard's big plant near Stuttgart confessed, in a rare moment of frankness, that it is really quite irritating to her and to her colleagues to find that the presence of only one American among thirty Germans at a company meeting automatically demands switchover to English as the language for the day. She had never seen the opposite occur when the meeting participation ratio was inverted.

Inhabitants of both the non-science and the science worlds are often surprised by unintended consequences which can ensue from actual implementation of strongly held theoretical concepts. Culture bridging can go a long way towards enhancing anticipatory skills, and instilling a sense of humility about travelling blithely along the future time axis.

Few motivators are stronger than sincere recognition and appreciation, particularly across cultural lines. The spirit of Edwin Howard Armstrong, the remarkable inventor of frequency modulation, must be glowing in the knowledge that many listeners to National Public Radio member station KUOP are busily stamping letters with U.S. stamps bearing his countenance, fifty long overdue years after he fought his heart out almost alone to give the world the glories of static-free, high fidelity FM. And I must confess a certain inner satisfaction when I observe the non-invasive diagnostic benefits of magnetic resonance scanners in hospitals many years after I had the great good fortune of serving on the science team that brought the NMR phenomenon to original practical reality for earlier applications. As you come up with your particular technical contributions, simple recognition and appreciation will play a big part in determining the health of your morale. We forget this need only at our peril in conducting technical enterprises.

Another benefit of bridging the cultures of the engineer and the non-engineer is welcomed far and wide: the process can most decidedly help contribute to the kind of realistic understanding which must precede the devising of workable win-win solutions for intractable world problems. Let me explain through a very recent classic example involving some Columbia University Russian Studies class members who

teamed up with a fellow electrical engineering student. This bright young person lashed together an ingenious rooftop rig whose receiving antenna is focused on a USSR satellite which broadcasts daily domestic television to the Soviet people. Here we see Engineering and Russian Language Studies combined brilliantly to allow real world monitoring, in New York, of certain aspects of life on the other side as it is routinely experienced by the Russians themselves. This kind of direct awareness would seem to me to be vastly more effective than that derived from scholarly English language books on the subject which originate from within our own American setting. (Incidentally, if Soviet students were ever permitted by their ruling authorities to set up a rig for use in the reverse direction, what would Olga and Dimitri make of "Dallas" and deodorant commercials?) In any case, you engineers on this side have it within your professional power to play all manner of creative variations on this sort of theme.

Someone has pointed out that the average American is watching seven hours of television a day, while the average Japanese is building seven TV sets a day. In keeping with this tragicomic observation, let us see how culture bridging fits into the picture.

The newspapers recently reported that the two-way trade between Japan and California alone has reached 28 billion dollars. This looks rosy until you learn that Japan ships 20 billion dollars worth of products to our fair state, while we Californians export only 8 billion dollars worth of goods in the other direction. And, because our own world renowned high tech no longer carries the day in this relationship, it is only our good farmers out here in the great Central Valley who keep this gushing hemorrhage from reaching even more catastrophic proportions. I use the word "catastrophic" here because our side cannot possibly afford this staggering imbalance forever, and because Japan cannot possibly afford to break its own best customer. A clever questioner at a Commonwealth Club speech referred to present day America as an economic colony of Japan: we ship out agricultural products and raw materials to the "mother country" and receive in return a flood of sophisticated finished products which we "natives" cannot resist buying.

I certainly don't want to be denied the right to acquire a perfectly functioning Casio watch like this one, and you may feel the same way about your Walkman or Toyota. Yet we are heading for massive artificial controls if both sides aren't smart enough to head off a mutually disastrous trade war.

In the midst of many win-lose and lose-lose solutions proposed to regain equilibrium, let me ask the one question I never hear asked about two advanced countries which possess essentially equal technical sophistication and which trade vigorously with each other. If each of those friendly countries has developed superior technical cadres, but only one has, in addition, gone all out to understand the other's marketplace psyche through laboriously learning its spoken and written language, who is going to sell the most to whom? I do not presume that most English-speaking Japanese engineers have ever heard of C. P. Snow, but he would surely be applauding them mightily for their heroic culture bridging triumph as they trundle off to the bank.

It has been said that people can be divided into three categories: those who make things happen; those who ask "what happened?"; and those who didn't know that anything happened at all. I see before me a fine class of well trained engineers graduating from a great University, the combined effect of which is to give you every likelihood of being in the first much needed category. But as you move on out ahead, please remember the infinitely wise words from a venerable popular song: "These will be the good old days, twenty years from now".

Thank you, warmest congratulations, and Godspeed.

Emery H. Rogers