Tall Poppies of Control

Flamed in public, praised in private was my summary of responses to getting involved with an, at times, intemperate debate about fuzzy logic control in 1993 by writing one of a number of letters to *IEEE Control Systems Magazine*. This was a time of significant self-evaluation in the IEEE Control Systems Society (CSS), which was piqued by a singular event—the appearance in *IEEE Spectrum* of an article about control (in this case, adaptive fuzzy control). The cut and thrust of such debates became a minor skirmish played out in the magazine. In December of that year, I ran into Mike Athans at the IEEE Conference on Decision and Control (CDC) in Tucson, Arizona. He was presenting the (fifth-ever) Bode Lecture. The lecture is always delivered around midday on the final day of the CDC.

Elegantly draped over a chaise lounge in the corridor, Mike mentioned parenthetically, "Bob, I will talk about your work in my talk on Friday. You will have to come to hear what I say." "Um, okaaay," I tentatively responded, not sure what to expect because I had been a bit player in the adaptive control wars of the 1980s, one side of which was marshaled by Mike. I had also been a member of the editorial board of *IEEE Transactions on Automatic Control* (operating under the darkly Goebbelsian title of information dissemination committee) from 1984 to 1986, when Mike led a reformation of the board, taking it from 12 people to something closer to its current structure. We had some form, in the sense of *Oxford English Dictionary* definition 16.c, but had always been amicable.

In his inimitable style, Mike took on many aspects of control, not the least fuzzy, where it was easy to find loose approaches based on assertion, wishful thinking, or faith as opposed to hard theory.

ZEYNEL CEBECI (CC BY-SA 4.0) FROM WIKIMEDIA COMMONS.

Mike's presentation—the only Bode Lecture for which the recording has been lost (some would suggest, suspiciously)—touched ever so briefly (and positively) on my fuzzy letter. However, he used the forum to launch an animated, no-holds-barred defense of formality and rigor in the field of control. In his inimitable style, Mike took on many aspects of control, not the least fuzzy, where it was easy to find loose approaches based on assertion, wishful thinking, or faith as opposed to hard theory. His concern was not to prove or score a point but to alert the community of the risk of falling in too readily behind semantically attractive (and perhaps well-funded) subjects without also bringing to bear our requirements for rigor and structure. His closing for the lecture went something like, "We owe it to our students to protect the primacy of rigor in our research."

I cite this (for me, formative) event as a lead-in to my comments about tall poppies. A *tall poppy* in my native tongue, Strine, is a conspicuously successful person, and *tall poppy syndrome* is the tendency to disparage such people. Mike's willingness to devote his prize lecture to exhort the control community to identify the strength of our field and ensure that this remains a core tenet moving forward was a great example of leadership from a tall poppy. His capacity to see his own role in the arc of the field and his perception that rigor was the key to vigor and vitality for the future generation had a major effect on me.

From February to August 2018, I was delighted to spend a sabbatical half-year at the Norwegian University

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of Science and Technology in Trondheim, working with Morten Hovd in the Department of Engineering Cybernetics. This department was founded by Jens Balchen (originally as Reguleringsteknikk and one of the first such departments in the world) and built to prominence over the ensuing years. Jens was a legend within Norway and the International Federation of Automatic Control (IFAC) as a tough negotiator and champion for the field—another tall poppy, whose influence is still felt. I point to Jens for two reasons: his capacity to build national strength and my recent brush with his recognition.

Included are two renditions of Jens, which I photographed in Trondheim and in Oslo. Figure 1 is an oil portrait of Jens hanging in the Tesknisk Kybernetikk Department office, with him sporting his Commander of St. Olav's regalia. In 2012, he was voted by a popular committee to appear on the tail fin of a Norwegian Airlines aircraft (see Figure 2), a Tail Fin Hero alongside people such as Edvard Grieg, Niels Abel, and Henrik Ibsen. Of the 64 heroes, he is the sole engineer so honored.

FIGURE 1 Jens Balchen.

The control field attracts many leaders. Antonio Ruberti was a systems engineering professor at La Sapienza in Rome before entering politics to become the Italian minister and then European commissioner covering science and technology. There have been and continue to be many university rectors, including Ruberti (La Sapienza), Vincent Blondel (Louvain), Lino Guzella (now president of ETHZ), and Jacques Willems (Ghent). I occasionally ponder whether there is a link between the nature of the subject and its forcefield of attraction for clear-minded scholars with a bend toward the broader societal picture.

My closest brush with a tall poppy of control has been with Brian Anderson (see Figure 3), with whom I have been closely involved since arriving at his office door as a pugnacious prospective graduate student on a day we both remember vividly, November 11, 1975, the day that the Governor General of Australia sacked the sitting government of Gough Whitlam. I think neither of us recall what we talked about, but we remember the date.

When I met Brian (who, of course, became my research advisor), he was a member of the Australian Research Grants Committee (then the Aussie equivalent of the National Science Foundation in the United States). He was a major figure in the national research landscape and, immediately upon his arrival from Stanford University in 1966, launched a provincial university electrical engineering department on the path to international recognition. His move to the Australian National University was as head of the first engineering department in the Institute of Advanced Studies. It took an engineer of Brian's stature among the scientists for this to be an incontrovertible venture with the purists. Brian went on to serve four years as an activist and highly effective president of the Australian Academy of Science, surely an engineering fox in the scientists' henhouse. Recently,

FIGURE 2 Jens Balchen as a Tail Fin Hero.

the building constructed to house the research school he spun out was named in recognition of his contributions.

These are examples of tall poppies of control. I could add many more. However, the unifying trait of these exemplars is that they combined vision with technical excellence and, to a person, saw themselves as organization builders, which required accepting the people side of the profession and being role models (not simply technical wizards looking to promote their work). The singular aspect of these individuals, for me, has been to observe their readiness to inquire about the work of others, particularly that of newer and younger researchers. I have benefited tremendously from buttonholing leaders such as Petar Kokotovic, Tamer Basar, Sagar Vidyasagar, Bruce Francis, and others at our conferences.

FIGURE 3 Brian D.O. Anderson with Elanor Huntington, dean of Engineering and Computer Science at the Australian National University, outside the building named in his honor. (Photo courtesy of the Australian National University.)

So, after dragging you through such a picaresque collection of hero stories, what is the president's message? Talk to the big wheels at the CDC, the American Control Conference, the Conference on Control Technology and Applications, and (dare I say it) IFAC events. They got there by paying attention to what was happening at the leading edge of control. Usually, they were eager to meet the next group of heroes. However, as you submit your nth paper, where n is apparently an unbounded integer, keep an eye on the opportunities to build a group and acquaint yourself with and support the work of others. It is how our field prospers and all of us along with it.

My real message (mostly to myself): Stick to telling stories about interesting people and stop patronizing and pontificating. Control people are smart enough to work it out for themselves.

Bob Bitmead

IEEE CSS

First Digital Process Control

The Ramo-Wooldridge RW-300 reportedly was the first digital computer ever used on closed-loop process control (put into operation on March 13, 1959 on a Texaco refinery at Port Arthur, Texas). The unit in the Museum, serial number A8, is an exact duplicate of this computer. It was employed to control an ammonia process at the Luling, Louisiana, plant of the Monsanto Co. Since the computer functions in a digital language, while the measuring instruments and control devices of the process communicate in analog signals, a separate input–output unit serves as interpreter between the process and the computer. In contrast to analog controllers, the digital computer operates not continuously but intermittently. It samples all process variables at regular intervals, calculates on this basis the required control signals, and, if necessary causes corrective action. The sampling intervals, chosen according to the needs of the process, range in length between a few seconds and several minutes.[121]

[121] "Computer Runs Refinery Unity in Texas," *Business Week* (4 April 1959); A. L. Giusto, R. E. Otto, T. J. Williams, "Digital Computer Control," *Control Engineering* (June 1962).

—Otto Mayr, *Feedback Mechanisms in the Historical Collections of the National Museum of History and Technology*. Washington, DC: Smithsonian Institution Press, 1971.