Human Factors and Ergonomics Society

FELLOW PROFILE

Name: Richard Pew

Degrees, certifications, etc.: Bachelor of Electrical Engineering Cornell Univ. 1956
AM Psychology Harvard Univ. 1960
PhD Psychology Univ. of Michigan 1963

Current status: Semi-Retired; part-time irregular at Raytheon BBN Technologies

Biography (How you got involved in the field, your major career activities and milestones):

As an electrical engineering student at Cornell I had to produce a senior thesis. Looking around for a topic, I knew I didn't want to design circuits the rest of my life. I came across an article in an Inst. Of Radio Engineers journal concerning man-operated continuous control systems. It captured my attention because it was using control engineering (called servomechanisms at the time), a course I had just completed, to understand human perceptual-motor performance **(**Birmingham, H. P., & Taylor, F. V. (1954). "A design philosophy for man-machine control systems." *Proceedings of the Institute of Radio Engineers 42(1954): 1748-1758).* I started reading more about engineering psychology, as they termed it. After explaining this new interest of mine, to my E.E Advisor, I asked him if he would let me do my E.E. thesis in the Psychology Department at Cornell. Surprisingly, he said yes, if I could find a sponsor there. Equally surprisingly, Professor Julian Hochburg, a well known perceptual psychologist agreed to take me on and he gave me an interesting experiment to do concerning the usefulness of combining of auditory and visual inputs to increase human information bandwidth. I loved designing the apparatus and conducting the experiment. I was also an Air Force ROTC student at the time, scheduled to enter the Air Force in July 1956. In the course of my reading I learned that Dr. Julian Christensen was the Director of an Air Force Laboratory at Wright Patterson AFB called the Psychology Branch of the Aeromedical Laboratory. I wrote him a letter, out of the blue, explaining my background and interests, and asking if he could get me assigned to his lab. He wrote back promptly that he could not influence my assignment to Wright-Patt., but if I could accomplish that, he could offer me a "slot" in the lab. I managed to accomplish that by February 1957 (in the spring of 1956 I qualified for the U.S. Olympic Fencing Team and the Air Force first assigned me to Mitchell AFB in Garden City, L.I. for six months to train in New York City and compete in the Olympics in Melbourne, Australia).

The opportunity to work in the Psychology Branch was the opportunity of a lifetime for me and after that I was committed to make a career of Human Factors Engineering. While there I worked on engineering models human performance in closed-loop pilot-flight control systems. I met many of the luminaries of the field, some of whom worked in the Lab – besides Christensen there was Melvin Warrick, Walter Grether, Dean Chiles, Darwin

Hunt, Jack Kraft, but many others who came to visit the Lab, including Alphonse Chapanis, Paul Fitts, John Lyman, Earl Alluisi, Stanley Roscoe, Duane McRuer, Frank Taylor, Henry Birmingham. In 1958, when my Air Force ROTC commitment was over, Ralph Queal, a laboratory colleague recommended me to J. C. R. Licklider at Bolt Beranek and Newman (now Raytheon BBN Technologies, hereafter abbreviated BBN) as a potential employee with the caveat that it was going to be important for me to continue my education in psychology if I wanted to have a future in the field.

I spent 2 1/2 years at BBN, with a one-year interlude at Harvard as a first year graduate student in Experimental Psychology. I was very happy at BBN – it was a stimulating, innovative place where Licklider wrote "Man-Machine Symbiosis" and, with his influence, psychology and engineering/computer science were teaming up to lay some of the foundations for human-computer interaction, artificial intelligence and the revolution that ultimately brought computers to the individual workplace. I was less enchanted with Harvard and although I learned a lot of psychology, I left with a terminal master's degree. If I were to seek further education it would be elsewhere. Elsewhere turned out to be at The University of Michigan where I completed a PhD in Experimental Psychology with a specialization in Engineering Psychology under Professor Paul Fitts in 1963. My intention was to return to BBN, however, as I was finishing, Prof Fitts, Arthur Melton, Ward Edwards and others were forming the Human Performance Center to conduct fundamental human experimental research that was potentially relevant to human-machine systems. I stayed on in a research position to support the Center for a couple of years and then, tragically Paul Fitts died of a massive heart attack at age 54. His loss left a large hole in the Department and the Chairman asked me to stay on, as an Assistant Professor, to take over some of Paul's teaching responsibilities and to continue to contribute to the Center. In the end, I stayed at Michigan for nine more years, eventually as a Full Professor, teaching, supporting graduate students and conducting research on human motor-skills – particularly building control engineering models of skilled performance in collaboration with Prof. R. M. Howe, then Chairman of the Aeronautical Engineering Department under a NASA grant. He taught my psychology students control engineering and I taught his students how to design and conduct experiments on people. At the invitation of Ray Nickerson, I finally returned to BBN in 1974 and have been there for the rest of my career.

Employment History (List top 5 positions):
2nd Lieutenant, U.S. Air Force 1956-1958
The University of Michigan Department of Psychology 1960-1974
Bolt Beranek and Newman (now Raytheon BBN Technologies) 1958-1960; 1974-present

What were your significant contributions to the field?
At The University of Michigan my research was on human motor skills. In my PhD thesis I showed that with practice individuals are able to detect regularities in skilled task requirements and reorganize their task execution to produce better performance by taking advantage of higher levels of organization in the task. Together with Prof Howe in Aeronautical Engineering and students we developed a methodology for estimating the human performance parameters of a continuous control task model in real time while the individuals were conducting the task. Together with Prof. Tourtellotte of the Medical School and students we developed skilled performance tests that were used in evaluation of the effectiveness of drug treatments for multiple sclerosis. I published a Review Chapter on Human Skilled Performance that was assigned widely to psychology graduate students nationally as a part of their curriculum.

At BBN colleagues and I developed a tool to simplify interactive programming activities that would later be termed a user-computer style guide. At Social Security Headquarters we set up one of the earliest human-computer usability laboratories before that term was being used. For

the Electric Power Research Institute we completed one of the earliest studies that would later be called Cognitive Engineering in which we analyzed four critical incidents at U. S. Nuclear Power Plants using task analysis, decision analysis and interviews with participants to identify the potential sources of human error that might be supported with decision aids. Carl Feehrer and I designed the user control panel for the first commercially produced digital music synthesizer, the Kurzweil 250.. I published a definitive chapter on the history of Human-Computer Interaction for a widely used Handbook on the subject.

Throughout my career I have been identified with integrated modeling of human performance, beginning with the classical control theory models explored during my tour in the Air Force, including chairing a widely cited National Research Council comprehensive study of the state-of-the-art in human performance modeling that was published in 2005, and culminating in the BBN-managed Air Force sponsored project, Agent-Based Modeling and Behavior Representation (AMBR). In that study, in collaboration with colleagues from four different organizations, we conducted a comparison of the performance of four different computer-based integrated cognitive architectures for representing the behavior of controllers in a simplified, simulated air traffic control task.

For more than 40 years I served as the Chair of the two-week University of Michigan Human Factrors Summer Course

I was elected President of the Human Factors and Ergonomics Society, 1977-78 and President of Division 21, of the American Psychological Assn., the division concerned with Engineering Psychology, 1985-86.

Did you receive any notable awards or recognition during your career?

Paul M. Fitts Award of the Human Factors Society for outstanding contributions to Human Factors Education, 1980.

Franklin V. Taylor Award of Division 21 of the American Psychological Association for outstanding contributions to Engineering Psychology, 1981.

U. S. Air Force Decoration for Exceptional Civilian Service. 1993.

Arnold M. Small President's Distinguished Service Award, Human Factors and Ergonomics Society, 1999.

Professor Judith Olson held the title of Richard W. Pew Professor of Human-Computer Interaction at the University of Michigan (2001-2008).

Which articles in the journal *Human Factors* would you say were the most influential to you and your research or practice?

Knowles, W. B. (1963) "Operator loading tasks." Human Factors, , 5, 155-161.

Parasuraman, R., Sheridan, T.B., Wickens, C.D. (2008) "Situation "Awareness, Mental Workload, and Trust in Automation: viable, empirically-supported cognitive engineering constructs." Journal of Cognitive Engineering and Decision Making, 2, pp. 140–160.

What advice would you give someone considering HF/E as a profession?

Go for it! The profession provides a stimulating career that has to potential to combine engineering and social science in research and/or application and the opportunity to apply your skills in many different subject matter domains. There is always something new.

There is a lot of serendipity in the directions your career takes, but, when you figure out what you want to do, you can create opportunities for that serendipity to take you in the directions you want to go.