



**Human
Factors
and
Ergonomics
Society**

FELLOW PROFILE

Name: Barrett S. Caldwell, PhD

**Degrees,
certifications,
etc.:** PhD (Psychology), MA, Univ.
California-Davis; S.B. (Aeronautics
& Astronautics), S.B. (Humanities),
MIT

Certified Human Factors Professional
(by review)

Fellow, HFES

University Faculty Scholar, Purdue
Univ., 2011-2016

Current status: Professor, Industrial Engineering /
Aeronautics & Astronautics (by
courtesy), Purdue University;
Director, Indiana Space Grant
Consortium



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

I have to admit that I was not aware of the Human Factors Society (as it was called then) before I began my faculty career at Wisconsin in 1990. For that, I must thank my mentor Mike Smith, who hired me as an assistant professor. However, without knowing it, my background was an especially good multidisciplinary training ground for a human factors engineer. My primary interest was in space flight systems engineering, with a focus on the design of space vehicles and missions for long-duration spaceflight. I picked my undergraduate school (MIT) based on that interest, but it was during my sophomore year that I realized that most of my classmates were interested in specific spaceflight systems, but not in the systems integration required to address the psychological and social needs of groups in spaceflight environments. I took a year of study at Wisconsin in 1982-83 to learn additional psychology and sociology, and ended up with a second undergraduate major (in Humanities, which was the only appropriate department for such a focus on social psychology and group dynamics) at MIT. Also as an undergraduate, I had a workstudy job working with an Oceanography researcher doing projects for NASA's Goddard Space Flight Center. I did a lot of computer programming and data analysis, and even came up with a novel method of displaying "state-space analysis" for some of my analyses conducted on a PDP 11 (ask some old person who might remember these!). I showed this to my supervisor, who gave me a ticket from Boston to Baltimore to present my work to NASA folks. At this point, I thought that research and graduate degrees were both a good match and a wonderful application of my interests.

I picked my graduate school program based on one simple criterion: I searched out someone in a department of psychology who was interested in group dynamics in long duration spaceflight. (I had won an NSF Graduate Fellowship, so I had a lot of flexibility here.) I could only find two people, and picked one: Al Harrison of the University of California, Davis. My MIT professors

were kind of confused by this choice—one even wrote that he didn't "know exactly what Barrett's plans are, but I think he'll be pretty good at it". Even after my Master's and Doctorate in Psychology, I had one ongoing "critique" that I was too much of an engineer, and "too empirical". Instead of a faculty position in Psychology, I was hired at Wisconsin in 1990 in Industrial Engineering—this is a far better fit for me. I'm a systems engineer, whose subsystem of focus and expertise is humans in teams.

My research lab is known as GROUPER, for Group Performance Environments Research, when I was looking for a name to describe what I wanted to emphasize as a research focus. My first grant was from the Ameritech Foundation, and I found that I was most interested in factors that influenced information technology use in organizations. We studied situational effects and delay tolerance across a range of technologies during a very exciting time of development—I even saw Marc Andreessen present a demonstration of the first Mosaic web browser while he was still a student at Illinois. In 1997, I was able to win a grant (with a colleague, Mary Waller) to study information technology use of NASA Flight Controllers at Mission Control Center in Houston, and I was finally back to where I had meant to go—systems engineering for spaceflight operations. I've been involved with NASA research, outreach, and education projects continuously ever since. The GROUPER lab is now known for its study of "How People Get, Share, and Use Information Well".

I remember meeting a range of HFS / HFES luminaries between 1990-1993 while I was still an assistant professor, and folks like Gunilla Bradley, Hal Hendrick, Neville Moray, and Tom Sheridan were very encouraging, enlightening, and supportive. Each of them (and many others) have played a major role in how my career has evolved and achieved some measure of success. I hope that I can offer as much to future generations of HFES folks as people like that have done for me.

Employment History (List top 5 positions):

Purdue University (Associate Prof, 2000-2010; Prof, 2010-present)

Indiana Space Grant Consortium (Director, 1992-present; elected member of Executive Council, National Council of Space Flight Directors, 2007-2011)

University of Wisconsin-Madison (Assistant Prof, 1990-1997; Associate Prof, 1997-2000)

What were your significant contributions to the field?

(I hope I'm not done yet...)

I'm very pleased and proud of the dozen (as of 2011) PhD students, and the 30 or more MS students, I've advised through thesis or dissertation, and graduation. They have all contributed to the recognition and standing of GROUPER in the community.

Serving as General Sessions Chair, and then Program Chair, for the HFES Annual Meeting. When I first became GS Chair in 2001, the submission process and publication was completely paper-based. When I stepped down as Program Chair in 2008, it was completely electronic, with a searchable CD proceedings.

Research areas for which I and GROUPER are known:

- Development of nonlinear models of user tolerance for information flow delays
- Determinations of use rates and duty cycles of voice loop utilization for NASA mission control center flight controller communication channels, and requirements for future spaceflight mission operations
- Team performance, quality improvement, and sociotechnical study of radiation therapy medical processes

- Information alignment and coordination of team-level information flow and knowledge sharing

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

National Science Foundation: Graduate Fellowship and Minority Research Initiation awards

National Academy of Engineering, Frontiers of Engineering (US, 2003; German-US, 2006; Track Chair, Cognitive Engineering, 2008)

University Faculty Scholar, Purdue University, 2011-2016

Marquis Who's Who (Science & Engineering; America; The World)

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

Caldwell, B. S., & Uang, S.-T. (1995). Technology Usability and Utility Issues in a State Government Voice Mail Evaluation Survey. *Human Factors*, 37(2), 305-323. (This article was my first published in HF, and was significant in my growing recognition and later tenure decision.)

Hancock, P. A., & Caird, J. K. (1993). Experimental Evaluation of a Model of Mental Workload. *Human Factors*, 35(3), 413-430. (Based on this article, I started the first of a series of wonderful and enriching interactions with Peter Hancock).

Jagacinski, R. J. (1977). A Qualitative Look at Feedback Control Theory as a Style of Descriptive Behavior. *Human Factors*, 19(4), 331-348. (This was the first article I read that showed that my passion for feedback control systems engineering could be married with my interest in psychology and human performance, not just for manual control behavior.)

Moray, N., Dessouky, M. I., Kijowski, B. A., & Adapathya, R. (1991). Strategic Behavior, Workload, and Performance in Task Scheduling. *Human Factors*, 33(6), 607-630. (When giving people ever more complex rules, performance degrades, even to zero. A fundamental life principle.)

Please provide any links to your online articles, essays, blogs, Wikipedia pages, etc., that pertain to your research, publications or practice.

<https://engineering.purdue.edu/GrouperLab>

<http://web.ics.purdue.edu/~bcaldwel/>

<http://www.insgc.org>

Coming soon: The GROUPER Blog

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

Do not expect a single path or well-crafted grand strategy will get you exactly where you want to go, in a short linear connection. It's far more important to find something that you're passionate about, and is enough to feed you during the inevitable painful periods.

By the way, I don't ever feel the need to apologize or feel inadequate for my area of expertise and research. There are very few engineering systems that don't have humans as important components, and information is one of the primary flows affecting knowledge, performance, problem solving and understanding. I'm a systems engineer. Humans are where I apply that knowledge. That's neither soft, nor tangential, even if some of the variables are fuzzy.