

# I'M GRADUATING, NOW WHAT? A COMPARISON OF WORK IN ACADEMICS, CONSULTING, GOVERNMENT, INDUSTRIAL RESEARCH, AND INDUSTRIAL DEVELOPMENT<sup>1</sup>

Ronald G. Shapiro, IBM Development  
Barry Beith, Monterey Technologies  
Joseph H. Goldberg, Pennsylvania State University  
Joe Hale, Marshall Space Flight Center, NASA  
John F. ("Jeff") Kelley, IBM Research

The purpose of this panel is to familiarize students and faculty members with what Human Factors Professionals do in a variety of settings including academics (Joe Goldberg), consulting (Barry Beith), government (Joe Hale), industrial research (Jeff Kelley), and industrial development (Ron Shapiro). This panel compares some of the advantages and disadvantages of various career options to help student determine where they best fit, and to help them prepare for interviews.

## INTRODUCTION

This panel focuses upon addressing basic questions to familiarize students with a variety of working environments: academics, consulting, government, industrial research, and industrial development.

There are seven key questions that each of the panelists addresses:

- What are typical job responsibilities?
- What are the rewards?
- What are the frustrations?
- What skills does one need?
- How do you make contact with people?
- What is an interview like?
- What contributes to success/failure?

An overall summary of the way in which each of us addresses the basic questions follows.

## TYPICAL JOB RESPONSIBILITIES

### *Academics*

Running your own 'business' under the label of an academic department. Responsibilities include teaching, research, scholarly development, advising, and service/committee work. Most programs also tolerate external consulting as well.

### *Consulting*

Responsibilities in the consulting/private research contracting venue revolve around providing clients with up-to-date technical support on a broad range of topics. Responsibilities can include everything from general marketing and proposal writing, planning and support implementation, project management, staffing, and project activities ranging from data collection to reporting. The consulting and contracting environment is a "soup to nuts" reality in which all aspects of business and profession are interleaved.

### *Government*

You generally work as a member of a multi-discipline team, serving as an advocate for the end user which in this case is usually an astronaut. Because of a matrix organizational structure, you may be "working" several different projects simultaneously. Depending upon the project and/or phase of a project, your responsibilities may include analysis, design, and/or test and evaluation. Analysis would include functional and task analyses, anthropometric analyses, and requirements and standards development. Design includes concept and preliminary design development and operations development. Your involvement in detailed design is primarily through technical interchange with the designers and during design reviews, since much of

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the "Phase C/D" design work is contracted out. Test and evaluation include simulation as well as empirical studies.

#### *Industrial development*

Work with a team of designers and developers to build a product that is easy to learn to use, easy to use, and is judged as easy to use by our customers. Typical responsibilities are task analysis and customer interviews to determine what needs to be built, interface design to make the product conform to human needs, interface prototyping to display and test the design, interface testing, and follow-up surveys.

#### *Industrial research*

I can only speak for my own particular setting in the IBM Research Division. That division has the general goal of being famous for its Science and Technology and vital to its parent corporation. To achieve this goal we perform to four basic, principle requirements:

1. Excel technically, innovate
2. Understand the needs, strengths, and weaknesses of the parent corporation
3. Know the technical world
4. Provide technical leadership within and without.

We work in an interdisciplinary team to choose projects where we will have the strongest opportunities to capitalize on our technical innovations, define project objectives, invent solutions, assign responsibilities, and mutually assure success. This often requires stepping outside of the more traditional roles of Human Factors practitioner and applying that professional perspective to the solution of unique problems.

### REWARDS

#### *Academics*

The major reward is **control** over your own work, and extensive interaction with students and colleagues. There is generally a certain openness to new, innovative ideas, without considering economic or other constraints. Achieving tenure can be a stressful experience over several years, but these days, the job security can't be beat.

#### *Consulting*

Consulting provides the professional with more control and degrees of freedom than most environments. There is no limit to the professional and financial rewards for those who are successful. The range of topics which can be addressed is very broad and the ability to select new areas of endeavor, pursue new opportunities, and address issues from one's own perspective provide many potential rewards to the professional.

#### *Government*

The biggest reward is being a part of state of the art programs (in my case the space program). Much of the work is applying "standard" human factors engineering to new environments. The work is challenging, the missions are exciting, and your peers are well educated, motivated, and professional. There is also the chance to work with new technologies and, if you are a self-starter, the opportunity to garner in-house resources to define and develop innovative applications of these new technologies.

#### *Industrial development*

There is a great deal of job satisfaction in seeing one's ideas built into a product. Working with the teams of people we interact with is very enjoyable. Doing design work is fun.

#### *Industrial research*

HFE people are full partners with extremely capable colleagues from other disciplines in various design teams that form for particular project needs. This sort of partnership provides an opportunity for contribution at the very beginning of the problem definition and design phase. As individuals and as a group, we are responsible for our own success. I find it a satisfying mixture of control over my own agenda combined with the scale of achievement possible when many smart folks are working on the same problem.

I also find it very rewarding to be working in a group where the emphasis is so strongly centered on good human-computer systems design that the mechanisms for assuring that result are built into the very fabric of the tools we use to construct applications.

There is some benefit to the cachet of association with a large, successful corporation when we are negotiating some new outside contact for per-

forming Research in the Marketplace.

## FRUSTRATIONS

### *Academics*

Stress from trying to do to many things at once is very frustrating. Also, there is a general trend for students to be less prepared as the years go by. Students who need to be "spoon fed" along every step of the learning process can be very frustrating.

### *Consulting*

The old cliché "It's a jungle out there!" is alive and well in the consulting/contracting arena. Business is more difficult today than it has been in the past. Budgets are tighter and human factors are still treated in my areas as a soft overhead activity which is not mainstream to a project. It often seems that business etiquette is scarce and, in general, establishing trust and rapport is difficult. Potential clients often have a jaundiced view of consultants and based on past experiences, justifiably so.

### *Government*

One frustration is knowing about all of the infinite number of details that must be addressed and successfully accomplished for a mission, but reading only of the troubles in the popular press. Another is the difficulty to influence a design within an environment that is constrained by inertia, resources, schedule, and politics.

### *Industrial development*

Products which one has worked on for a long time may be cancelled. One's great ideas may be cut out of a product due to budget cutbacks.

### *Industrial research*

In any industrial research environment, there is always the necessity of educating a sometimes-large hierarchy to the value of the work done by a group. To borrow (and corrupt) a phrase from Hollywood: "you're only as good as your *next* application!" We have been fortunate in my own group to have a few recent and ongoing noteworthy successes and, in this environment, good work gets recognized.

Externally, there is a constant need to educate

customers to force them to commit business to beyond-state-of-the-art innovations. This can be frustrating at times, but it's all part of doing what we do.

## SKILLS

### *Academics*

The major skill for success is **focus**. One must be able to ignore outside distractions, and continuously reprioritize to be successful. Creativity is also a very useful skill for success in this field.

### *Consulting*

An individual needs a unique set of skills to survive, much less thrive, in consulting. First one must be intellectually flexible, willing and even eager to learn new areas of the business quickly. One must often work harder to stay up on the literature and maintain the breadth of knowledge needed. One must possess some level of business skill even in a one-person consulting shop because between the invoicing and the Internal Revenue Service (IRS, the U.S. tax agency), there are many pitfalls. One must have marketing skills and a bit of the salesman in them, not to mention a "thick" skin to overcome the infrequent but inevitable rudeness of some contacts and the rejection sometimes encountered.

### *Government*

A necessary skill is a solid grounding in human factors engineering. However, this is basically useless unless you can clearly document and cogently present your position. Thus, good writing skills and the ability to logically and persuasively express yourself is very important. Finally, being a self-starter, tenacious, and flexible are important attributes. Very little will be handed to you, but opportunities abound for someone who will proactively choose a path and actively pursue it. Tenacity and flexibility, together, can keep you on the path towards your basic goals while adjusting your methods in response to changes in the environment.

### *Industrial development*

One needs to be very competent technically, be effective working with teams of people to generate products, have a good business sense, and be able to build effective business cases. It is necessary to work on many projects at the same time, to be able

to make rapid decisions based upon incomplete information, and never to miss any deadlines. Effective communication/sales skills are a must.

#### *Industrial research*

The foremost attribute required is more of an attitude than a skill: a commitment to excellence and a willingness to pay the price.

To work in a team such as ours requires the ability to address (and become enthusiastic about inventing solutions to) a wide range of problems, often in parallel. There is a continuing need to balance the compelling needs of the moment against the necessity having a long-range vision and making continued progress toward it.

Most successful members of our group have high competency in the basic technological skills involving text editing, composition, file management, electronic communications, cooperative work, programming and/or graphic design.

Every member of our group has the sense of humor required to survive under the pressures to excel that are our constant companions.

### MAKING CONTACT

#### *Academics*

Mostly through conferences. Other contact is made through review panels and joint research projects.

#### *Consulting*

Consulting and contracting require constant contact with both other professionals and potential clients. The need to "mingle" and meet people is mandatory. The maintaining of contact records is vital since one often does not know when a casual meeting might lead to a cooperative effort, a referral, or a future client. Professional meetings, organizational meeting, tradeshow, and a plethora of marketing activities are the constant diet of the consultant, especially early in one's career.

#### *Government*

The best approach is direct. A letter, with resume, followed by a phone call can start a dialog. Suggest a face-to-face meeting with, perhaps, a tour of facilities. There are also a variety of programs in place to facilitate contact and involvement, such as

Cooperative Education and Graduate Student Researchers Program. At this writing, however, it should be noted that there is a hiring freeze at NASA.

#### *Industrial development*

Attend local HFES meetings and get to know people, talk with people at this conference, make contacts using the HFES directory as well as the placement service.

#### *Industrial research*

Attend paper sessions, posters, and demos at HFES (and ACM SIG-CHI) talk to the authors.

### INTERVIEW

#### *Academics*

An intense day or two of 30 minute meetings with all faculty in the department. A seminar is given, which can be quite stressful if some don't like your work. There are additional meetings with the dean, associate deans, and other administrative personnel. Meetings with the department head are usually quite mundane. Meetings with current graduate students can be very enlightening. Both your depth and breadth of knowledge will be explored in these meetings.

#### *Consulting*

Interviewing for positions in consulting or contracting is a "mixed bag." Obviously, consulting on one's own doesn't require it but small firms can run the procedural gamut of interview processes. In general, a candidate must demonstrate the personality as well as professionalism needed to contribute to a small operation. The ability to work alone as well as cooperate is vital. Questions will focus as much on what kind of person you are as much as what you know. Your ability to adapt, timeshare, and persist will be explored.

#### *Government*

One of the primary paths to securing a permanent professional position is working for a government agency as a cooperative education student. In one sense, this is an extended interview. It allows the agency to take a good look at your skills and abilities and also allows you to take a good look at the agency. Following graduation, provided the

agency is hiring, a "co-op" can be "converted" to a full time employee non-competitively. Trying to enter directly, on the other hand, is very competitive. Your credentials weigh heavily in the screening process. Interviews are informal and wide ranging. They can include anything from more details about your credentials to evidence of self-motivation to career and technical goals and objectives.

#### *Industrial development*

Our job candidates meet with almost everyone in the department to learn what we do, and to discuss ways in which the job candidate might approach certain problems. Additionally, the job candidate is usually asked to give a 1 hour presentation on thesis or similar research or development project.

#### *Industrial research*

A 60-90 minute presentation about the applicant's own work is followed by a couple of days of one-on-one discussions with potential colleagues and managers in whichever groups might be a good match. These discussions are as much for the applicant to learn about the work as it is for the interviewer to assess the applicant's technical and communication skills and interests.

### SUCCESS

#### *Academics*

**FOCUS!** You have to be able to take a project and carry it through to completion, including publishing. This includes direction of graduate students, who may have primary objectives other than yours or the project's.

#### *Consulting*

Provide clients with the necessary support they need at a fair price. Demonstrate integrity and an honest desire to assist the client in succeeding. Make your client look good and, when they desire, help them work yourself out of a job. Provide breadth and depth of knowledge, but never forget that the client knows their business better than you.

#### *Government*

You succeed by providing solid human factors technical expertise in a timely and cogent manner.

You must integrate your agenda with those of other team members and search for a satisfactory, feasible solution. As resources allow, you may work towards refining that solution.

#### *Industrial development*

Contribute solid technical ideas to projects as a team member. Be willing to work together to design product which will meet all parameters (e.g., usable, inexpensive, made quickly...) Work quickly, and be able to answer questions as required (usually within a few minutes to a few days).

#### *Industrial research*

By inventing outstanding and innovative solutions to interesting and important problems and then by explaining, refining, defending, refining, implementing, refining, and proving those ideas.

### FAILURE

#### *Academics*

You can fail by straying too far from the balance that you need to establish between all of the activities you must perform. That is why a continuous reprioritizing is necessary.

#### *Consulting*

Be arrogant and assume that you can "buffalo" the client with "smoke and mirrors." Don't follow through and fail to demonstrate integrity and courage. Concede to the client's wishes when you know that it is not right or even harmful without letting them know it for their own good. Overbill and underprovide. Extend schedules and manipulate through criticism. Become a professional bully. Hide how you know what you know instead of helping to educate your client.

#### *Government*

Clearly, providing incorrect or unsupportable human factors input will eventually tarnish your technical credibility and detract from your influence and your ability to contribute. Untimely inputs, even when correct and supportable, lose some of their luster and ability to influence. Failure to work cooperatively and productively with the other team members, likewise will muffle your influence.

#### *Industrial development*

Miss deadlines. Present ideas poorly. Insist on your way. Not make technical contributions.

#### *Industrial research*

By becoming disconnected from the day-to-day urgencies associated with turning interesting ideas into concrete artifacts.

### PROFILES

#### *An academic environment by Joe Goldberg*

An academic working environment is for those who are clearly self-motivated, and desire control over their working projects. An academic department is really a set of "kingdoms", with each faculty member in charge of his/her own constituency. Those who thrive in academia must be used to conducting many simultaneous projects at once; typically, one must teach, conduct research, advise students, and perform various service activities. More emphasis is typically placed upon the quality of output, as opposed to quantity, but this varies highly by institution.

The academic life is one of extreme activity, followed by extended breaks. Summers, as well as winter and spring breaks are great times to catch up, or make progress in research. However, others times may bring on significantly more activities than one could ever be expected to handle, so that a balancing act is required. Those who spend too much time on one project will often sacrifice quality on another project; this give-and-take and constant priority reassessment seems to be a necessary part of academic life. Those who cannot perform under the peak then trough demands of work will not enjoy academic life.

As each faculty member can be said to run his/her own kingdom, there is a tremendous opportunity to excel for those who are assertive in gaining new projects or teaching courses in new ways. While the same work may earn an individual a greater income in outside industry, the other advantages of academia tend to make up for this.

#### *A Consulting Environment by Barry Beith*

Consulting and contracting in Human Factors/Ergonomics is a vast and unique environment for the professional. Often or eventually, the

professional must decide their own course both in interest area and methodologies. The opportunities are endless but they are rarely handed to you easily. You must convince potential clients that you have the skill and knowledge to assist them, and then you must follow through and do just that. The ability to learn quickly, adapt readily, timeshare constantly, and maintain a professional attitude in the face of tight budgets and short schedules is required.

The individual who chooses this venue must be prepared to travel, give presentations, work long hours at times, and market for themselves or their company. The consultant/contactor exists in a schizophrenic state in which both criticism and praise can occur in the same day, success and failure are coexistent, and the line between feast and famine is never clear.

The professional who can deal with the ups and downs yet never lose confidence or cool will find more degrees of freedom than in most other venues. The ability to pursue your own interests is great even if sometimes tempered by the reality of today's "hot topic."

Consulting/contracting is "trial by fire" for a young person just entering the field, but those who accept that challenge and meet it, find a rich venue for practicing Human Factors and Ergonomics.

#### *A Government Environment by Joe Hale*

Working for the government has advantages and disadvantages. In general, it is a huge bureaucracy with burdensome rules, forms, and regulations. Promotions and raises are driven, in large part, by the amount of time since your last promotion, rather than by your performance. Salaries, in many cases, are lower than in the private sector. Job security, on the other hand, is generally better. Working for NASA is challenging and rewarding. Its charter is grand and inspiring, its workforce is well educated and motivated, and its technologies and capabilities are broad and often state-of-the-art. While it's true that you must deal with a governmental bureaucracy, you eventually learn how to work within the system to accomplish your objectives. Most of the work is unstructured. Although initially disconcerting, this does give you the freedom to structure your own time to accomplish your assignments and, for self-starters, it provides ample opportunities to seek out and pursue special

technical interests. The latter is encouraged and can often be supported by "in-house" funding. It requires you to develop an idea or concept, "package" it, and sell it. If bought off, you must then implement and report it. This enhances your technical expertise and credibility for "regular" work assignments, plus it is fun. It also helps to build a technical base upon which to pursue other technical interests. Much of the work is sedentary -- at a desk, in front of a computer, or in meetings -- although you are occasionally involved in building and assessing mock-ups in both one- and simulated micro-gravity environments. Travel is intermittent and usually to other NASA centers and contractor sites within the U.S. Travel to international locations is infrequent.

*An Industrial Development Environment by Ron Shapiro*

Working in an industrial development environment provides an opportunity to apply what one learns in graduate school to make a usable product which anticipates, and exceeds customer's needs. It is very satisfying to see products one has designed in use by a variety of customers and fun to design and develop them.

One usually spends most of their time designing products, building models or prototypes of the products. This work cannot be done in isolation. Instead, it is necessary to work with designers, planners, accountants, engineers, and marketing personnel to assure that the designs are implementable in a cost effective manner, and that they will be implemented. It is necessary to work quickly. Oftentimes a question must be answered in a few seconds in industry, whereas in graduate school one might have spent days, weeks, or even months deriving an answer to a similar question.

Knowledge of Human Factors, the companies product line, competitive product lines, and customer needs are prerequisite to being successful. In addition, business skills, finance skills, business presentation skills, a general knowledge of the objectives of each department you interact with, some knowledge of how each of these departments does their job, and a general ability to work well with others are absolutely essential to being successful. Since it is virtually impossible to do everything one wants to do or even everything one "really should do", the ability to prioritize is key.

If one likes to design, prototype, test, negotiate,

and present to business colleagues and management in very fast paced environment a career in industrial development will be very rewarding. On the other hand, an individual wanting to do basic research, who would rather do detailed analysis before responding to questions, publish information for human factors colleagues, and present at human factors conferences would probably be better off in an academic or a research environment.

*An Industrial Research Environment by Jeff Kelley*

I can only speak for my own idiosyncratic experience in my own group. The ITS group at IBM Research is continually re-inventing new ways in which it can increase its value to the parent corporation, IBM, and to the technical community. I'm fortunate to be a member of a team populated with an outstanding collection of scientists that are all leaders of their respective technical fields.

Our shared vision revolves around the importance of involving users from the design population at the very beginning of the design process and continuing the iterative improvement of an application all the way up to and beyond shipment of the first instance. We accomplish this by building our applications with ITS, a toolbase that encourages iterative design, facilitates shared contribution by members of a multidisciplinary team, and permits *Research in the Marketplace*.

While the work is fun, the *pace* of the work is not relaxed. There are frequently multiple projects going on that claim varying proportions of a member's time. Deadlines associated with real-world projects are inflexible and no member of the team would ever let down the others by compromising on quality.