TO PH.D. OR NOT TO PH.D.? THAT IS THE QUESTION!

Victoria S. Schoenfeld (Chair), Old Dominion University
Ronald G. Shapiro (Co-Chair), IBM
Megan L. Brown, Thomson Consumer Electronics
Dieter W. Jahns, SynerTech Associates
Anthony D. Andre, Interface Analysis Associates and San Jose State University
Arnold M. Lund, U.S. West Advanced Technologies
F. Thomas Eggemeier, University of Dayton
Nancy J. Cooke, New Mexico State University

Is a master's degree sufficient for a successful career in human factors, or is a doctoral degree necessary? This question has been a recent cause for discussion, especially among graduate students. In order to address this issue, the Old Dominion student chapter of the HFES developed some questions regarding the relative advantages of both degrees. Panelists were selected based on their experience with differing degrees. Megan Brown and Dieter Jahns are both practitioners who have master's degrees. Dieter is also Executive Director of the Board of Certification in Professional Ergonomics. Anthony Andre and Arnie Lund are practitioners, but both have doctoral degrees. Anthony is also an Adjunct Professor of Human Factors and Ergonomics at San Jose State University. In addition, Nancy Cooke and Tom Eggemeier are faculty members who have doctoral degrees. Tom teaches at a master's level institution while Nancy teaches at an institution that offers both master's and doctoral degrees. At the HFES panel session, panelists will focus on answering questions from the audience.

JOB OPPORTUNITIES

What different job opportunities are given to an individual with a master's as opposed to a doctorate?

Megan. This depends on the amount of previous work experience. Typically, without experience, regardless of the degree, one should expect to be working under the direction of someone with more experience. However, a Ph.D. level individual with work experience would be expected to lead programs, involving design, specification, and testing of the product, or research projects. This individual is expected to understand the User Interface issues at a much higher level than a master's level person.

Dieter. It must be recognized that the Ph.D. degree is generally either a "specialization" degree for researchers, theoreticians and/or college professors or a "professional degree" in such domains as psychology, sociology, economics, etc. For example, Woods and Wilkinson (1987, p. 2) point out: "One career not open to the psychology graduate with a B.A. is that of psychology. American psychology has clearly made the decision that the Ph.D... is the entry-level qualification..." However, Parsons maintains in Woods and Wilkinson (1987, p. 52) that human factors work "usually requires at least a master's degree". In industry, performance and continual learning are more important than the academic degree. For a research career, the Ph.D. is the "meal ticket".

Anthony. In some organizations, only Ph.D.s can hold certain positions. For example, some government primary investigator positions (e.g., NASA) are only open to Ph.D.s. In other organizations, the level one is hired into is dependent on the degree; Ph.D.s are typically hired into more senior-level positions from the start. Nonetheless, as a whole, the job market is very open to master's-level persons.

Arnie. With experience and demonstrated success, the jobs may not differ. Straight out of school, a master's level person can expect to be working under the direction of a more senior person (often with a Ph.D.) and will be more likely to be working on usability testing than design. Getting a doctorate involves deriving the "big picture" from a more comprehensive view of research in the field and developing skills in approaching ambiguous problems, identifying issues, and developing and executing a plan to resolve those issues. These skills will be exploited in project assignments. Someone with a doctorate is more likely to be assigned to a project team and told to figure out what needs to be done to ensure the best design possible. The negotiation and execution of roles will largely be up to the person, and he or she will be expected to do whatever is necessary to achieve success.

Tom. Certain positions (e.g., academic) have traditionally been open only to those with a doctorate. It is likely that initial assignments within larger industrial organizations or government R&D laboratories will involve research team leadership positions for those holding a doctorate. However,

master's level individuals, particularly those with experience, often assume a great deal of responsibility for directing research and applications projects. Therefore, it is difficult to give a firm answer. Outside of academics and larger R&D organizations, the answer will likely depend upon the employment setting and the individual's capabilities. Analyses of recent HFES Placement Service employment opportunities (Moroney, Anderson, & Soest, 1997; Moroney, Proulx, & Parker, 1997) suggest that many of the doctoral position openings listed are found in academic or government settings. Although care must be exercised in interpreting these data (they pertain only to a specific time period and positions offered by the HFES Placement Service), the trends are consistent with the expectation that a doctorate will be more critical for academic and R&D laboratory positions than for other employment opportunities. Analyses of position openings in industry, consulting, and government/military sectors (Moroney, Anderson, & Soest, 1997) indicate that the master's degree was the minimum stated degree requirement in over 50% of these positions. However, these data reflect the minimum stated degree, and do not necessarily indicate the qualifications of the individuals actually hired.

Nancy. A doctorate is typically required for most academic positions. Although someone with a master's may be hired as a lecturer, jobs that involve research and graduate student advising require a Ph.D. Based on my indirect experience (through consulting, contract work, and student placement), it seems less clear cut in industry and government.

GROWTH POTENTIAL

Once in a job, what is the difference in growth potential for these two types of individuals?

Megan. Once in a job, there is typically no difference. A newly hired Ph.D. may initially receive a higher salary; however, a master's level candidate with work experience may be hired at a higher salary than a Ph.D. with none. Upward mobility in terms of promotions to new levels, new assignments, management, etc. is the same.

Dieter. Upward mobility as a function of highest academic degree varies with the industry in which the person is involved. For manufacturing industries, where the issues may be occupational safety and health and/or productivity, a lower degree with good understanding of work systems and processes may lead to being advised for a MBA degree for advancement. For advanced technology industries and in complex systems development, a Ph.D. may help, given that business practices are understood. The closer the issues are to cognitive ergonomics, the more important a suitable Ph.D. will be.

Anthony. Typically, the Ph.D. will have greater *initial* responsibility, pay, and room for upward mobility. However, once in a job, degrees are forgotten, and each person's personality, skills, and effort usually determine whether or not he or she advances. If the letters after your name are the only thing that keeps you from advancing in a company then find a new job!

Arnie. There is typically no difference in growth potential. In many companies, however, there will be an extra step that may be more difficult to take than completing the Ph.D. once one has a master's degree. The new Ph.D. will typically start as something equivalent to a Member of Technical Staff (MTS), while the new master's degree person will typically start as something equivalent to an Associate Member of Technical Staff (AMTS). The person with the master's degree, therefore, will have to demonstrate consistent performance that exceeds his or her peers over several years before being considered for promotion. In my experience, for those who have stayed in the same job in companies where I have worked, salaries tend to converge over time, independent of the degree (although a newly hired Ph.D. may start with a higher base salary than the newly promoted AMTS).

Tom. A considerable amount of growth potential will depend upon the organization and the individual. This is especially true as an individual accumulates more experience. Some employers may wish to hire at the master's level and permit individuals to grow into positions of increased responsibility. Recent survey data (Lovvoll, 1997) reflect some differences in salaries between doctoral and master's level individuals. Generally, salaries tend to be higher and increase at a faster rate for those individuals who hold a doctorate.

Nancy. There seems to be more upward mobility for the person with the doctorate (e.g., management and research-lead positions). I do not perceive that there are correlated monetary differences, however. Much of this depends on the precise job and then experience in the job. For instance, many of my students starting out in the software industry with a master's degree make more than my colleagues or I make in academia with years of experience. One major difference between those with master's and those with doctorates seems to be that the latter tend to be the leaders in the field or at least thought of as experts. That is, those with doctorates innovate and chart new directions for those in the field.

TIGHT TIMES

When times are tight, which type of individual is more likely to be hired?

Megan. Typically, when looking at resumes, I look for the complete package, not just the degree. I would not eliminate candidates because they either had a Ph.D. or did not. If we had a strong candidate with a Ph.D., I could justify the higher salary.

Dieter. When times are tight, R & D efforts usually get hit first and hardest. So, those individuals with the best promise to "make a buck" for the employer have the best chance of getting hired. Being "practical" rather than "theoretical" in

ergonomics analysis, design and testing/evaluation provides the best opportunities (see Simonelli, 1989, pp. 116-118).

Anthony. When companies are financially strapped, they might not be able to afford Ph.D.s and therefore are willing to accept master's degrees. On the other hand, when a company can only hire one person, or less than they desire, they might want only Ph.D.s to fill those positions.

Arnie. For companies like the ones for which I have worked, higher salaries typically do not drive hiring choices. Since there are many Ph.D.s looking for work, I will often look there first before looking at the resumes of people with master's degrees. This is a practical matter of starting a search where there is the greatest likelihood of finding a qualified candidate. Ph.D. candidates often have the additional advantage of resumes containing more relevant experience and evidence of accomplishment. I know that some companies just starting human factors programs are more sensitive to the salary issue and may hire a person with a master's degree primarily so they can pay less as they experiment with the idea of adding human factors to their company.

Tom. This is somewhat dependent upon the organization that is hiring and the requirements of the position. If the job requires doctoral skills, organizations will likely pay for those qualifications. When requirements are not as clear, master's level individuals may have an advantage in a tight economy if the skill set of the individual is appropriate. Initial differences in salary may not be of great consequence to some organizations; the most significant differences may be the support provided (e.g., laboratory, assistants).

Nancy. In my experience, when the job market is tight, neither type of individual is likely to be hired, although I am sure it depends on the immediate needs of the company. In the software industry, positions are eliminated or frozen, and individuals are only hired on a temporary basis. This greatly increases the number of student intern positions available.

FACILITATION OF EDUCATION

Do companies who hire an individual with a master's degree encourage him or her to get a doctoral degree? In what ways is that education facilitated?

Megan. If an individual is self-motivated and would like to pursue an additional degree, we encourage this. However, the degree could be an additional master's degree in a related field or a doctorate. We currently support each of our programs with multi-disciplinary teams. I believe this strengthens the team. For example, if the entire team was comprised of Ph.D. level Human Factors engineers, we would be lacking the creativity needed for design.

Dieter. Most companies are more interested in their employees staying current within career knowledge and technologies than in having them get a doctorate. Those who want their employees to get advanced degrees use a variety of incentives. These vary as a function of industry and size of the employer.

Anthony. While master's degrees are often encouraged and/or paid for, it is rare for a private company to encourage or pay for a Ph.D., primarily because: a) it is doubtful that the optimal doctorate program is in the same local area as the job, b) the commitments and requirements of the Ph.D. program will always interfere with a full-time job, and c) the time to obtain the degree is too long.

Arnie. For today's companies the encouragement is to continue education and the growth of skills. Courses are typically paid for by the company but must be worked around the work program of the group. People with exceptional performance may be "rewarded"/"developed" by being sent off for higher degrees. Since such programs temporarily reduce the ability of the person to do the work for which he or she was hired and since the cost can be very high, it is pretty hard to qualify for one of these programs today.

Tom. The needs of the organization for those trained at the doctoral level will clearly have an impact. I am not aware of any general trend in industry to encourage those with master's degrees to enroll in doctoral programs. It is my impression that both government and industry no longer have the funding to support as many long-term training opportunities as in the past. However, there is considerable interest in ensuring that an individual maintains knowledge of current information and practices in his or her field. Tuition reimbursement would be typical for such training. Usually, tuition reimbursement and leave would be afforded an individual chosen to return for doctoral work.

Nancy. This too seems to vary widely. Some companies do not seem to care if the person has a doctorate or not. Others make attaining a doctorate a stipulation during hiring. Regardless of whether the company encourages or requires a doctorate, there is a range of support offered to achieve that goal. Some companies leave the individual to complete the requirements on his or her "own" time, making it a nearly impossible goal. Others offer some support in terms of leave time to complete the requirements. More rare is the company that permits the individual to combine dissertation work with job-related activities. Some government programs (e.g., the United States Air Force's Palace Knight program) provide extensive support in terms of tuition, a stipend, and time at a University to complete the work. In return the individual agrees to go to work in a designated Air Force lab once the doctorate is attained. In my experience, many individuals who are already in the workplace and decide to work toward a doctorate, end up terminating employment in order to do so.

DIFFERENCES IN PROGRAM PHILOSOPHIES

What are the differences in philosophies of master's and doctoral programs?

Anthony. The classic difference is in the nature in which research is addressed. The doctoral student must demonstrate

autonomy in ALL phases of the research process, including selection of the topic and related research questions. Further, the doctoral process allows students to develop more meaningful relationships with their professors and others in the field.

Arnie. In my experience, the focus of the master's degree is to teach the candidate the state of the art in a given topic. The focus of the doctoral program is to equip the candidate to advance the state of the art.

Tom. Differences in philosophy between terminal M.A./M.S. and doctoral programs are somewhat dependent upon the particular programs. Many human factors doctoral programs in psychology utilize the "scientist/practitioner" model that affords training both in the scientific basis of the discipline and in its applications. The terminal M.A. program at my institution is also based on this philosophy and has the objective of preparing a student for either employment or entry into a doctoral program. Our master's program places a heavier emphasis on the practitioner aspect of the model than many doctoral programs. In general, doctoral programs include more emphasis on conceptualizing and conducting research than terminal master's programs and provide more opportunity for in-depth treatment of particular areas of specialization.

Nancy. For either a M.A. or Ph.D. in our program, it is important that the student gain the background and skills to be a good experimental psychologist. In the case of a Human Factors or Engineering Psychology specialization, it is also important that the individual develop skills relevant to applied work (e.g., task analysis, rapid prototyping, testing and evaluation). At the master's level, the student should demonstrate the ability to conduct independent research that reflects such knowledge and skills. At the doctoral level the individual must go beyond the demonstration of these skills to make an independent contribution to the area.

DIFFERENCES IN TEACHING STYLES

Are individuals taught differently in master's and doctoral programs? If so, what are the differences?

Dieter. As I pointed out in my HFES Bulletin Article (Jahns, 1991), current educational program structures need major revisions. Right now ergonomics/human factors is taught backwards from other, related career fields.

Anthony. Between schools there are differences, but more due to the nature of the professors and university than to the degrees offered. Within a given school that offers both programs, rarely are master's students approached differently than doctoral students in terms of the way they are instructed. And they should not be, since it is often the goal of the University to prepare and encourage master's students to obtain a Ph.D.

Arnie. I went to a school that did not have a terminal master's program. I received a master's as a milestone toward my doctorate. In that structure, it was not a matter of being taught differently; it was a matter of what courses were taken when. The courses that were designed for post-master's degree students were designed to help the students synthesize what they had learned, identify unresolved issues, creatively approach those issues, and learn the thought processes required to successfully put together arguments. Side skills of programming and an understanding of how to build prototypes and instruments were also taught post-master's degree. Another way to think about it was that the master's degree student was prepared to be a technician, while the doctoral student was being prepared to be a scientist.

Tom. Doctoral programs provide the opportunity for more extensive training in specific areas and in the development and implementation of research programs than will terminal master's programs. Also, some terminal master's programs place a heavier emphasis on applications than do many doctoral programs.

Nancy. In the programs I have had experience with, master's and doctoral students attend the same classes. Training differences are mostly relevant at the one-on-one advising level. Doctoral students are more often "on-their-own" compared to master's students.

DIFFERENCES IN AREA OF STUDY

What are the differences between obtaining a doctorate in a broad area (e.g., I/O Psychology) and obtaining a master's in Human Factors? What are the advantages and disadvantages of both?

Megan. For the most part, I have not been limited by my master's degree. Initially I was given smaller programs that were not as "high profile". After about a year, my workload was consistent with that of Ph.D.s. The main advantage was that I was able to use the time after getting my master's to get work experience in an applied setting. The disadvantage is that I will not be able to become a researcher or professor.

Dieter. This issue is one of required topical breadth versus depth. There are a limited number of contact hours that can be expected in a degree program. Few programs have yet found a proper core, augmented by electives to meet most industry requirements (see Pearson, 1976; Van Cott & Huey, 1992).

Anthony. I see no relation between the two. It is a myth that I/O Psychology and Human Factors have much to do with each other, and rarely does a person trained in one of these fields cross over to the other field with success. A student should not have to choose between a broad degree and a focused degree, as both can be obtained. If you know that you want to practice Human Factors then it is best to obtain a Human Factors degree. But, at the same time, you will be doing yourself a favor by taking some courses outside of the focused program, that provides a broadened exposure to the larger field of psychology (or engineering or design).

Arnie. A master's degree in Human Factors would be most useful in narrow domain areas (e.g., working in industrial

ergonomics ensuring a safe, healthy workplace). As the software industry continues to evolve, it becomes clear that a group that is homogeneous in its skill set is typically not as effective as a more diverse group. For the individual, the more diverse the skills and the broader the knowledge and experience base, the more valuable one is. In general, broader would provide more opportunities than narrower.

Tom. Generally, I expect that the doctorate and training across the I/O discipline would provide a greater range of career opportunities than would a master's degree. The choice of which type of degree to pursue depends upon the individual's goals and interests.

Nancy. The I/O and Human Factors fields are related, but I do not see one encompassing the other. If forced to do so, I would suggest that I/O is a subset of Human Factors. It is generally the case that students specialize more, not less, at the doctoral level in order to become an expert. For instance, New Mexico State University offers a master's in Experimental Psychology and doctorates in three areas within Experimental Psychology.

ADVANTAGES OF CPE

What are the advantages of being a Certified Professional Ergonomist (CPE)? Is it more or less valuable depending upon the degree one has?

Megan. Currently, in our industry, there is no value to being a CPE.

Dieter. The CPE designation and associated voluntary assessment procedures were developed by the Board of Certification in Professional Ergonomics (BCPE) to recognize Ergonomics/Human Factors as a distinctive career field (Pearson, 1976). By creating a standard, practitioners seek to define themselves independently from company job descriptions and academic degree programs (Barnhart, 1994). There are about 65,000 members in APA whose interests are spread over 45 divisions; engineering has over 18 specialty areas practiced by about 135,000 engineers, and the health care fields are staffed by numerous levels of practitioners in over 58 specialties. Obviously, not every one with a degree in these fields of study is qualified in ergonomics. Increasingly industry, government, and the general public are recognizing that a CPE is an individual with broader, and in some respects deeper, knowledge and skills than are exhibited by many people from the root sciences. Thus, the biggest advantage is that employers and clients can quickly determine what that means and how it fits into their needs. The broader, or more general, the academic degree, the greater the benefits (see www.bcpe.org). Also those aspiring to a job as a "practitioner" may find more benefits than those aspiring to a research or teaching career (see Klemmer, 1989, pp. 48-51).

Anthony. Currently, the advantage is limited to legal consulting and government contracts which dictate certification. This might change in the near future as the certification process keeps improving and the members of the profession come to a consensus as to what constitutes certification. Regardless of the future economic or regulatory necessity of becoming certified, it will never carry much practical meaning, nor will it assure the public of the ability or integrity of any given individual. Nonetheless, for someone with a master's degree, it may prove a useful mechanism for advancement.

Arnie. In my industry there is currently no value in being a CPE. The skills required are assessed directly when considering candidates. Since many of the diverse skills needed may come from people hired from outside of the mainstream, a requirement to have a CPE could even be counterproductive.

Tom. The importance of the CPE designation will be dependent upon the type of position that the individual wishes to pursue. Some position announcements now include CPE status or eligibility as selection criteria.

Nancy. I have never heard any potential employers requiring a CPE for a job or even inquiring about it. It seems to be most relevant to cases in which human factors professionals testify as expert witnesses (to enhance their credibility) or by those doing consulting (for similar reasons).

REFERENCES

Barnhart, P. A. (1994). Guide to national professional certification programs. Amherst, MA: Human Resource Develop. Press Inc.

Jahns, D. W. (1991). The education and certification of ergonomists: A practitioner's perspective. Human Factors and Ergonomics Society Bulletin, 34 (8), 4-6.

Klemmer, E. T. (Ed.). (1989). Ergonomics: Harness the power of human factors in your business. Norwood, NJ: Ablex Pub. Corp.

Lovvoll, D. R. (1997). 1997 HFES salary survey. Human Factors and Ergonomics Society Bulletin, 40 (9), 1-3.

Moroney, W. F., Anderson, B. M., & Soest, J. I. (1997). Placement opportunities for human factors engineering and ergonomics professionals part II: Industry, government/military and consulting positions. Proceedings of the Human Factors and Ergonomics Society, USA, 41, 478-482.

Moroney, W. F., Proulx, N. L., & Parker, C. W. (1997). Placement opportunities for human factors engineering and ergonomics professionals part I: An overview, and academic and internship positions. Proceedings of the Human Factors and Ergonomics Society, USA, 41, 474-477.

Pearson, R. G. (1976). Ergonomics education - Towards the 21st century. Paper for NATO-Symposium on University Curricula for Ergonomics/Human Factors Engineering, Berchtesgaden, F. R. Germany.

Simonelli, N. M. (1989). Product design and human factors diversity: What you see is where you come from. In E. T. Klemmer (Ed.), Ergonomics: Harness the power of human factors in your business. Norwood, NJ: Ablex Pub. Corp.

Van Cott, H. P., & Huey, B. M. (1992). Human factors specialists? Education and utilization - Results of a survey. Washington, DC: National Academy Press.

Woods, P. J. (Ed.) & Wilkinson, C. S. (1987). Is psychology the major for you? Washington, DC: American Psychological Association.

Note: The views expressed in this paper are those of the individual participants only and do not necessarily reflect the views of their employers, other panelists, the Board of Certification in Professional Ergonomics, or the HFES.