

## General and Personal Reflections on Succeeding as a Woman Science Researcher

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**Abstract** – In 1991 the Parapsychology Foundation sponsored a conference on *Women in Parapsychology*. In my paper for that conference (Utts, 1994) I discussed research identifying multiple factors that contributed to gender inequity in research careers in science, with a focus on academia. These factors included cultural norms, institutional barriers to success for women, implicit biases, and social pressures that deterred women from entering and succeeding in careers in science. In the past three decades, progress has been made on some of these factors, but not all of them. The first part of this paper discusses the extent to which the situation has improved (or not) for seven of the factors identified in the earlier paper, citing a combination of research and personal observation. The second part of this paper discusses multiple avenues of research showing the impact of subtle influences throughout childhood and early adulthood on career success. For example, cultural norms depicting scientists as men have gradually improved over the years, but children are still more likely to draw a man than a woman if asked to draw a scientist. Role models, as well as encouraging mentors, are important factors in determining whether a woman will pursue a career in science. Many successful women in science can identify a single mentor whose encouragement was a major contributing factor to her success. A sense of meaning in ones' work, and a supportive community are additional factors contributing to success. The final part of the paper is autobiographical, illustrating how the factors documented by this body of research played a role in my life. In a narrative starting from childhood and continuing through my career, I identify individuals and circumstances that contributed to my success. One significant factor was the welcoming parapsychological community, and details of how I was led to work with that community are discussed. The paper provides suggestions for specific actions that individuals and communities can take to encourage more women to succeed in careers in science, including in parapsychology.

*Keywords:* women in science – parapsychology – salary equity in academia – gender bias in academia – women's career success

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## Allgemeine und persönliche Überlegungen zum Erfolg als Wissenschaftlerin

**Zusammenfassung**<sup>2</sup> – Im Jahr 1991 veranstaltete die Parapsychology Foundation eine Konferenz zum Thema *Women and Parapsychology* [Frauen in der Parapsychologie]. In meinem Vortrag für diese Konferenz (Utts, 1994) erörterte ich Forschungsergebnisse, die mehrere Faktoren aufzeigten, die zu einer ungleichen Behandlung von Frauen und Männern in wissenschaftlichen Laufbahnen beitragen, wobei der Schwerpunkt auf dem akademischen Bereich lag. Zu diesen Faktoren gehörten kulturelle Normen, institutionelle Erfolgsbarrieren für Frauen, implizite Vorurteile und sozialer Druck, der Frauen davon abhielt, eine wissenschaftliche Laufbahn einzuschlagen und dort erfolgreich zu sein. In den letzten drei Jahrzehnten wurden bei einigen dieser Faktoren Fortschritte erzielt, aber nicht bei allen. Im ersten Teil dieses Aufsatzes wird erörtert, inwieweit sich die Situation bei sieben der in dem früheren Papier genannten Faktoren verbessert hat (oder nicht), wobei eine Kombination aus Forschungsergebnissen und persönlichen Beobachtungen angeführt wird. Im zweiten Teil werden mehrere Forschungsansätze erörtert, die zeigen, wie sich subtile Einflüsse in der Kindheit und im frühen Erwachsenenalter auf den beruflichen Erfolg auswirken. So haben sich beispielsweise die kulturellen Normen, die Wissenschaftler als Männer darstellen, im Laufe der Jahre allmählich verbessert, aber Kinder zeichnen immer noch eher einen Mann als eine Frau, wenn sie gebeten werden, einen Wissenschaftler oder eine Wissenschaftlerin zu zeichnen. Vorbilder und ermutigende Mentoren sind wichtige Faktoren, die darüber entscheiden, ob eine Frau eine wissenschaftliche Laufbahn einschlagen wird. Viele erfolgreiche Frauen in der Wissenschaft können einen einzigen Mentor oder eine Mentorin nennen, dessen bzw. deren Ermutigung wesentlich zu ihrem Erfolg beigetragen hat. Das Gefühl, dass die eigene Arbeit einen Sinn hat, sowie eine unterstützende Gemeinschaft sind weitere Faktoren, die zum Erfolg beitragen. Der letzte Teil des Papiers ist autobiografisch und zeigt, wie die in diesem Forschungsbericht dokumentierten Faktoren in meinem Leben eine Rolle gespielt haben. In einer Erzählung, die mit meiner Kindheit beginnt und sich über meine gesamte Laufbahn erstreckt, zeige ich Personen und Umstände auf, die zu meinem Erfolg beigetragen haben. Ein wichtiger Faktor war die einladend-offene parapsychologische Gemeinschaft; ich werde einige Details berichten, wie es dazu kam, mit dieser Gemeinschaft zu arbeiten. Der Beitrag enthält Vorschläge für spezifische Maßnahmen, die Einzelpersonen und Gemeinschaften ergreifen können, um mehr Frauen zu ermutigen, eine wissenschaftliche Laufbahn einzuschlagen, auch in der Parapsychologie.

*Schlüsselbegriffe:* Frauen in der Wissenschaft – Parapsychologie – Lohngerechtigkeit in der Wissenschaft – Gender Bias in der Wissenschaft – Karriereerfolg von Frauen

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2 Eine erweiterte deutsche Zusammenfassung befindet sich am Ende des Artikels.

### *Introduction*

In 1991 I wrote a paper titled “Social, Institutional and Cultural Influences of Gender on Science” for the *Women and Parapsychology* conference sponsored by the Parapsychology Foundation (Utts, 1994). In that paper, I identified over a dozen problems that hindered the careers of women research scientists. In the decades since then, progress has been made to ameliorate some of those problems, but others persist. Why women still lag behind men in most of the traditional measures of success in research careers is not entirely clear. Some reasons are easier to document and address than others, such as the fact that there are fewer women than men available to serve as role models for aspiring young women scientists. But some reasons seem to be elusive, such as why women tend to lose self-esteem in their college years, while men seem to gain it (Widnall, 1988).

This paper is divided into two parts. In the first part I enumerate and provide commentary on seven problems that were identified in Utts (1994). Examples of more recent research on those topics are provided as part of the discussion.

The second part of this paper discusses factors that lead to career success for women, and then provides an autobiographical account of the individuals and circumstances that led me to have a successful career as a woman research scientist. By providing that account I hope to illustrate how even small actions by influential individuals and groups can make an enormous difference in someone’s career. Many of the issues identified in the first part of the paper could have hindered my career had it not been for the benefit I received from the actions of others.

## **PART I**

### **Revisiting the Social, Institutional, and Cultural Influences of Gender on Science**

Although conditions for women in STEM (science, technology, engineering, and mathematics) have improved since 1991, there remain significant disparities between men and women. According to a 1991 report (National Research Council, 1991) in 1989 in the United States, only 17.5% of STEM faculty were women, while only 12% of associate and full professors (a proxy for those with tenure) were women. Singh (2020) reports that in 2019 women represented 34.5% of STEM faculty in the United States, and they represented 28.2% of tenured STEM faculty. The percentages for 2019 are roughly double what they were in 1989. However, both casual observation and ongoing research indicate that much more progress could be made and that those numbers do not convey the full story.

In what follows, I list 7 problems that were discussed in Utts (1994) and provide my opinion on their current status. In each case, I provide references to the original sources of the 1991 discussion. Much of the commentary on whether things have changed since then is based on my informal observations, but in some cases, I cite more recent research to support my remarks.

**Original observation #1:** Science is a cumulative enterprise and often moves forward because of informal networks in which ideas are shared and discussed. Women are less likely to be part of those networks because men are uncomfortable including them (Angier, 1991; Sandler, 1986).

**Current status of observation #1:** It is my observation that these informal networks are now much more inclusive of women. As more women participate in scientific research, men seem to be more comfortable working with them and serving as mentors. Additionally, there are networks of women supporting each other as more women are available to do so. In 1991 many academic science departments had at most one woman on the faculty. That situation would be rare now. And in 1991, e-mail and the Internet were in their infancy. Now, with the abundance of blogs, e-mail distribution lists, and online discussions, it is easier for everyone to receive information, even if they are shy about or do not feel comfortable contributing to the discussions.

**Original observation #2:** Men and women act and are treated differently when they speak. As noted by Utts (1994: 30), "...people are more attentive when men speak than when women speak, women are more likely to be interrupted than men, and people are more likely to respond extensively to men's comments than to those made by women." Sandler (1986: 2) used this as one example of what she referred to as "the chilly climate for women on campus."

**Current status of observation #2:** These trends persist, and I have observed them numerous times in meetings and seminars. In a recent study, researchers examined whether the chilly climate still exists in classrooms (Lee & McCabe, 2021). They summarized their findings as follows:

Almost 40 years ago, scholars identified a 'chilly climate' for women in college classrooms. To examine whether contemporary college classrooms remain 'chilly,' we conducted quantitative and qualitative observations in nine classrooms across multiple disciplines at one elite institution. Based on these 95 hours of observation, we discuss three gendered classroom participation patterns. First, on average, men students occupy classroom sonic space 1.6 times as often as women. Men also speak out without raising hands, interrupt, and engage in prolonged conversations during class more than women students. Second, style and tone also differ. Men's language is assertive, whereas women's is hesitant and apologetic. Third, professors' interventions and different structures of classrooms can alter existing gender status hierarchies. (p. 32)

In another study, Heffron et al. (2021) examined whether men and women enrolled in a joint MD/Ph.D. program had differing experiences. They reported the following findings.

Male and female students were equally likely to present at the annual program symposium, but faculty ( $p = 0.001$ ) and keynote ( $p = 0.012$ ) presenters were more likely to be male. Compared with their male counterparts, female students asked fewer seminar questions ( $p < 0.005$ ), and female speakers received more questions ( $p = 0.03$ ). Female students perceived less support and differed from men in reasons for asking or not asking seminar questions. Free text responses described repeated small acts of discrimination toward women with cumulative impact. (p. 90)

Given my observations and the above research, the problem clearly persists and probably always will. The best remedy is to educate both men and women about these behaviors.

**Original observation #3:** Women publish less than men, their publications are not taken as seriously, and they are less frequently cited (Utts, 1994: 30).

**Current status of observation #3:** Obviously, publication rates and reactions to publications cannot be observed casually; they require data. And in this case, it turns out that the situation is complicated. The number of overall publications is a poor measure of productivity because some fields include authors even when they have little input on the publication, such as when they are involved in a multi-center grant. Some counts of publications give a 1 to each publication regardless of the number of authors, while others assign  $1/n$  to a publication with  $n$  authors. In some disciplines, the primary author is listed first, while in other disciplines, it is understood that the last author listed is the primary one.

However, a few studies, while imperfect, seem to tell the same story. While actively publishing, women and men seem to be almost equally productive. But women tend to drop out more readily and earlier in their careers. One study found that “women seem to be somewhat less likely to continue their career as publishing researcher than men, but the difference is small. We also observe that men produce on average between 15% and 20% more publications than women.” (Boekhout et al., 2021, preprint) Another study found that overall productivity is less for women than for men, but “men and women publish a comparable number of papers per year and have equivalent career-wise impact for the same total number of publications. This suggests the productivity and impact of gender differences are explained by different publishing career lengths and dropout rates.” (Huang et al., 2020: 4609)

**Original observation #4:** When identical credentials are presented but the name given on them is clearly male or female, reviewers give lower ratings to the work with the female name. In Utts (1994) the example presented was for ratings of an article allegedly authored by John T. McKay, Joan T. McKay, or J. T. McKay. Both men and women rated the work alleged to be by Joan much lower than that alleged to be by John, with that of J. T. in the middle.

**Current status of observation #4:** The problem persists. In a 2012 study (Moss-Racusin et al., 2012), a sample of college professors was asked to evaluate a candidate for a lab manager position. Unbeknownst to them, half of them (randomly assigned) received materials with the name Jennifer, and the other half received the same materials, except with the name John. Moss-Racusin et al. reported the following disturbing results.

Faculty participants rated the male applicant as significantly more competent and hireable than the (identical) female applicant. These participants also selected a higher starting salary and offered more career mentoring to the male applicant. The gender of the faculty participants did not affect responses, such that female and male faculty were equally likely to exhibit bias against the female student. Mediation analyses indicated that the female student was less likely to be hired because she was viewed as less competent. (p. 16474)

Apparently, the only trait for which “Jennifer” was rated more highly than “John” was likeability.

**Original Observation #5:** In academia, women receive lower salaries than men and are less likely to be promoted. Various sources in Utts (1994) provide data to support this.

**Current status of observation #5:** I have learned through personal experience that it is very difficult to analyze salary data for gender differences because there are so many variables that contribute to salaries. In 1994, at the request of the Vice Chancellor for Academic Personnel, I conducted a statistical gender-equity study for my campus, the University of California, Davis. I found that women were systematically paid less than men with similar records, but part of that discrepancy was due to the lower starting salaries they received. After a two-year controversial battle in the faculty senate (described in detail by West, 2000), a resolution was reached about what to do with my findings. Every faculty member, male or female, could request an equity review or be nominated for one by their department or dean. As a result, 70 women were nominated for a review, and 38 (54%) were given a salary increase. Only 61 men were nominated, and 13 (21%) of them were given a salary increase. However, because a much higher proportion of women than men were nominated for a review, overall, about 1% (13 out of 1158) of the male faculty and 11% (38 out of 334) of the women faculty received salary increases.

Since that time, gender equity reviews have become commonplace on university campuses. I have participated (as a statistical expert) in a review at my most recent campus (University of California, Irvine) for multiple years. Every year a list of faculty members who appear to be underpaid is sent to each dean, who then discusses the individual cases with the department chair. A pool of funds is made available for equity adjustments. Therefore, one would hope that salaries have become more equitable, although I have no data to show that this is the case.

**Original observation #6:** Both men and women are unaware of their implicit biases and how they affect their attitudes and behavior. For instance, Utts (1994) reported on a survey of

members of the American Astronomical Association that found nearly 33% of the women who responded felt they had been discriminated against in promotions, while only 7.6% of the men who responded said they had witnessed such discrimination against their female colleagues.

**Current status of observation #6:** In the study quoted above, in which faculty rated the application of “John” more highly than that of “Jennifer,” both male and female faculty raters exhibited implicit bias against Jennifer. That study was done 10 years ago, so perhaps things have changed since then. Many universities require faculty members to take training courses in topics such as sexual harassment and implicit bias.

One interesting measure of implicit bias and stereotyping reported by Tenada (2019) is what happens when children are asked to “draw a scientist.” In the first such studies from 1966 to 1977, fewer than 1% of children drew a woman. But among young girls, that rose to 33% in 1985, and 58% in 2016. The overall average in studies from 1985 to 2016 was 28%, but that included both sexes and all age groups. Unfortunately, the studies have found that these numbers decrease with age. According to Tenada (2019: n.p.):

In kindergarten, children draw roughly the same number of male and female scientists – girls tend to draw more female scientists while boys tend to draw more male ones. But by the time they’re in high school, students – males and females combined – draw four times as many male scientists as female ones. The shift is more pronounced for girls: When asked to draw a scientist, 70 percent of 6-year-old girls draw a woman, while only 25 percent of 16-year-old girls do.

**Original observation #7:** Women are more likely than men to engage in collaborative, interdisciplinary research, but such research is not as highly valued as sole-authored research. In 1991 when I wrote my paper (Utts, 1994), I quoted a task force convened by the University of California system (consisting of 9 campuses at that time) to address issues related to affirmative action. One of the findings of the task force was that “Research has been too narrowly defined as ‘discovery research’ with little credit being given for integrating research areas across disciplinary lines.”

**Current status of observation #7:** In my opinion, this observation is the one for which the most progress has been made in the past 30 years. In my own discipline of statistics, collaborative research is now seen as more important than research leading to sole-authored publications, which is a complete reversal from when I wrote my paper in 1991. Perhaps the discipline of statistics is ahead of other disciplines in this regard, because the whole point of our profession is to use our methodology to advance knowledge in other disciplines. But I think this trend is very broad. Most research questions now require expertise from multiple disciplines, and it is a welcome change that research integrating cross-disciplinary knowledge is valued.

## PART 2

### My Journey as a Woman in Science

As noted in Part 1 of this paper, there are many societal influences that are detrimental to the success of women in science research careers. In this part of the paper, I review some literature addressing what factors might contribute to successful careers for women in science. I then describe how I benefited from small influences throughout my own career.

#### *Factors that Influence Women's Career Success*

Life is complex. Trying to design a study that uncovered what makes some people successful and others not would be almost impossible. Additionally, women who could easily succeed in a career in academia often choose not to pursue one. Qualitative research and interviews with women have uncovered some common themes related to why some women succeed in research science careers and others do not, including why some women decide not to even try to do so. Making no attempt to be thorough in my search, I uncovered three sources that include enlightening information on why some women successfully pursue research careers and others do not.

**Source 1:** In a commentary in *Nature*, a small collection of scientists from around the world with expertise in gender issues were invited to give one idea related to what could be done to achieve gender equality (Al Gazali et al., 2013). One of them, Eva Y. Andrei, gave as her idea “Inspire our daughters.” She wrote “When I polled my women colleagues, almost all agreed that a dearth of guidance and mentorship early on was the main reason for lack of female physicists.” (p. 37)

Another, Liisa Husu from Sweden, gave her idea as “Recognize hidden roadblocks.” She observed

It is not only the things that happen... it is also the things that do not happen: what I call 'non-events.' Non-events are about not being seen, heard, supported, encouraged, taken into account, validated, invited, included, welcomed, greeted or simply asked along. They are a powerful way to subtly discourage, sideline or exclude women from science. (p. 38)

**Source 2:** Another source of insight into why some women succeed and others do not, or do not try, is a 2013 *New York Times* article titled “Why Are There Still So Few Women in Science?” (Pollack, 2013). The author excelled in her undergraduate program in physics at Yale, but decided not to pursue a career in physics when she graduated in 1978. Her article is

an in-depth investigation of reasons that many women do not pursue careers in science (and she gives her own reasons), including interviews with many of her former professors and with current women faculty and students in physics at Yale. She summarizes her own decision not to pursue a physics career as follows.

At the end of four years [in 1978], I was exhausted by all the lonely hours I spent catching up to my classmates, hiding my insecurities, struggling to do my problem sets while the boys worked in teams to finish theirs. I was tired of dressing one way to be taken seriously as a scientist while dressing another to feel feminine... Mostly, though, I didn't go on in physics because not a single professor – not even the adviser who supervised my senior thesis – encouraged me to go to graduate school. Certain this meant I wasn't talented enough to succeed in physics, I left the rough draft of my senior thesis outside my adviser's door and slunk away in shame. Pained by the dream I had failed to achieve, I locked my textbooks, lab reports and problem sets in my father's army foot locker and turned my back on physics and math forever. (Pollack, 2013: n.p.)

As part of the research for her article (in 2013), she interviewed the professor who had supervised her senior thesis in 1978, and discovered that the very fact that she did an independent thesis was a major accomplishment. He had only supervised one or two other undergraduate research students throughout his career. The implication that it never occurred to him to recommend that she pursue graduate school was eye-opening for both of them.

Summarizing her lengthy investigation, Pollack concluded “The most powerful determinant of whether a woman goes on in science might be whether anyone encourages her to go on.” (ibid.) That statement is echoed by many of the successful women scientists I have talked with over the years. Almost all of them can identify one person who made a difference by encouraging them to continue.

**Source 3:** In 2015 the American Association of University Women (AAUW) published a lengthy (159 pages) report titled “Solving the Equation: The Variables for Women's Success in Engineering and Computing” (Corbett & Hill, 2015). The introduction to the report describes it as follows.

[This report] focuses on the underrepresentation of women in engineering and computing and provides practical ideas for educators and employers seeking to foster gender diversity. From new ways of conceptualizing the fields for beginning students to good management practices, the report recommends large and small actions that can add up to real change. (p. ix)

My purpose in reading the report was to determine what the authors thought were strategies for encouraging greater numbers of women to pursue careers as research scientists. Ideas are scattered throughout the report. Here are some of them:

Gender biases affect not only how we view and treat others but also how we view ourselves and the choices we make about our own futures. From early childhood, cultural stereotypes guide our choices and behavior, steering us toward certain careers that seem to be the best fit for our interests and abilities and away from others. (p. 43)

Evidence suggests that highlighting the communal aspects of STEM careers increases girls' interest in these careers. (p. 101)

One additional way to attract more women to engineering and computing programs is to couple degrees in these majors with degrees in other fields that allow individuals to pursue multiple interests. (p. 102)

A sense of belonging has measurable effects on an individual's physical and mental states. Even minimal indications of social connectedness can increase feelings of belonging ... For women in engineering and computing, having a strong sense of belonging has been found to help alleviate the stress that arises from stereotype threat. (p. 102)

Survey data and interviews with tenured professors identify a sense of community and the presence of a support network as some of the most important factors in job satisfaction and retention of female STEM faculty. (p. 103)

### *My Personal Journey*

In this section I provide a personal perspective on the individuals, communities, and life events that helped me overcome the hurdles many women face that keep them from successful academic careers. I hope my examples will illustrate the importance of one small act of encouragement or mentoring. I feel very fortunate that the right circumstances and individuals guided my path from childhood through a successful career. I have organized these comments by outlining some common themes that either encourage or discourage women from successful careers in science.

*Cultural stereotypes.* As quoted above, the report by the AAUW noted that "From early childhood, cultural stereotypes guide our choices and behavior, steering us toward certain careers that seem to be the best fit for our interests and abilities and away from others." (Corbett & Hill, 2015: 3) I was fortunate to have a mother who encouraged me to pursue a degree in mathematics, and who emphasized the importance of a career. She was one of the smartest people I knew, as evidenced by the fact that she briefly joined the "high IQ" organization Mensa, which accepts only people who test in the top 2% of IQs. (She dropped out soon after joining, claiming that they were too snobbish for her.) I think she did everything she could to give me the life, and successful career, that she wished she could have had, and would have had if circumstances were not so difficult for women of her generation. When it was time for me to apply for colleges, she learned which undergraduate schools had strong math programs, and then visited those

schools with me, asking the right questions of the tour guides and finding the information I needed to make a good choice.

*Recognition of abilities and encouragement from influential individuals.* As has been noted multiple times in this paper and elsewhere, encouragement from just one influential individual can make a big difference in whether a young woman decides to pursue a STEM career. In my case, the first of those individuals was my 9th grade algebra teacher, Richard Bessel. Early in the year, he asked the students in the class to raise their hands if they had received an A in math the previous year. When I did not raise my hand (for reasons I can't remember – perhaps I did not get an A!) he called on me. He said something like, “Jessica, why didn't you raise your hand? You're a natural at math!” I was startled, honored, and at the same time felt the imposter syndrome kick in. But he planted a seed that perhaps I could “do math” and from then on I excelled in my math courses.

The next influential individual was my college calculus teacher, Professor Prabir Roy. The summer before I started college, Professor Roy sent a letter to all students who had expressed interest in a math major, inviting us to apply to take his two-year honors calculus sequence. I do not know if he accepted all of those who applied, but in the first semester there were two classes of 30 students each. By the second semester, there were 30 of us left. The following fall there were six of us who had stuck it out, and by spring semester there were only four of us left. The attrition was not due to lack of success in the class; students chose to leave or stay. I do not know why I did not drop out like most of the others, but it turned out to be a wise decision. In year two, Professor Roy decided that the 6 of us remaining should each do a research project, and rather than lecturing us, each class period was spent with one or more of us presenting a progress report. Not only did this experience boost my self-esteem about doing research, but it turned out that Professor Roy was an excellent resource for information about graduate school. More on that later.

The third influential individual in encouraging me to continue on a successful path was the department head in my PhD program at Penn State University, Professor William Harkness. He encouraged me every step of the way throughout my career in graduate school. At one point when a book publisher came and asked Professor Harkness which of his faculty members would be good candidates to write a textbook, he told the publisher that none of the faculty would be, but that I would be. He sent the publisher to my graduate student office to talk with me about it, and that publisher kept after me for 10 years until I finally wrote the book.

*Opportunity to integrate dry formulaic material with interesting applications.* Some research has shown that women are more likely to pursue careers in STEM if they can see useful applications. In my case, this was true. I started college as a math major but I found it dry and boring. Many of my friends were psychology majors, and what they were learning sounded much more

interesting. So I started taking psychology courses, and eventually added psychology as a second major. That's where I discovered statistics. The math department at my university (State University of New York at Binghamton) did not offer any statistics courses, but statistics was a required course in the psychology department. By taking that course I realized that my math major could be put to good use in doing something more interesting than theoretical mathematics.

*Encouragement to continue to graduate school and then to academia.* Although it's hard to fathom now, when I was in college I had no idea what was meant by "graduate school." I thought all schools led to graduation! I had no idea about the difference between a master's degree and a PhD. Fortunately, I had friends who knew about such things. One in particular said something that was life-altering. He told me that if I did not get a PhD I would always have a boss who was not as smart as I was, but who had a PhD. That convinced me of the wisdom of getting a PhD. So I went to see Professor Roy, my honors calculus professor, to ask his advice about going to graduate school in statistics. As luck would have it, unbeknownst to me at the time, he was the son of a famous statistician! So he knew all about how to find out which graduate programs were a good fit for me, and he connected me with the executive director of the American Statistical Association to get advice.

*A sense of control over one's workplace environment.* For all workers, it is of course important to have a sense of control over working conditions. But sometimes that control is less attainable for women than for men. This can be especially true for assistant professors, who are often assigned the courses no one else wants to teach, or given other tasks that the more senior faculty prefer to avoid. When I graduated with my PhD in 1978 I received multiple job offers, including from prestigious universities – Harvard, Cornell, Carnegie Mellon and Rutgers. But I turned all of them down for a job at the University of California, Davis (UCD), a school which I had never heard of until I started applying for jobs. I did so because UCD was forming a new statistics department, and I was offered the opportunity to be a founding member. Most of the other founding faculty members were also relatively early in their careers. Together we needed to create many new courses, hire senior faculty, and establish the rules of the undergraduate and graduate programs. In addition to giving me a strong sense of control over my work environment, this experience also provided a strong sense of community with the other faculty and with the graduate students who had left the math department and joined our new department. This leads to the next topic.

*A strong sense of community in the workplace.* As noted in the AAUW report, "Survey data and interviews with tenured professors identify a sense of community and the presence of a support network as some of the most important factors in job satisfaction and retention of female STEM faculty." (Corbett & Hill, 2015: 103) In this area, I was very fortunate throughout my entire career. A few examples will illustrate this.

In her *New York Times* article explaining why she did not pursue a career in physics, Eileen Pollack (2013) describes how she struggled alone to work on her assignments while the boys in her class worked together in teams. When I was in graduate school I was the only woman in my PhD cohort. But rather than shun me, the men in my program encouraged me to study with them. The fact that I was a woman did not seem at all relevant, and in fact it was not until I was in the middle of the first semester of PhD coursework that I looked around and realized that I was the only woman in class! The other women who started graduate school with me had all graduated with master's degrees and left. (I was the first woman to get a PhD in the Penn State Statistics Department, and it was at least another five years before there was another one.)

I have described how the founding of a new department helped create a sense of community, but I still suffered from some of the same discrimination felt by other women at UCD. For instance, in those days we wrote manuscripts by hand, and gave them to the department's technical typist to type before we could submit them to a journal. I discovered that my manuscripts were taking months longer to be typed than those of the men. I brought this to the attention of the department manager, who discussed it with the typist, who admitted that this was indeed true. She had been raised to please men, not women. That is just one example of the systemic discrimination encountered by women faculty. But as a result, the women faculty at UCD decided to form a community group, called the Faculty Women's Research Support Group. The group met monthly in someone's home – there were so few of us that we could fit! There was some social time, some time to share stories and advice, and then one of the women gave a presentation of her research in terms that the rest of us could understand. When a new high-level administrator was hired, we would invite him or her to one of our meetings, and they usually accepted. This community was one of the most important factors in my career success. Even now, over 40 years later, I remain in contact with many of those women.

There is one more community that was extremely influential in my career – the parapsychology community. In the next section I describe the circumstances that led me to find it.

*The importance of finding communal meaning in one's work.* Various research studies have shown that working with and for the benefit of others is, on average, more important to women than to men. That has been true for me, and in the early years of my career I suffered from the hierarchy in statistics that placed sole-authored theoretical work above collaborative, applications-oriented work. However, once I had tenure I was free to pursue the interests that had led me to statistics, which originated with the applications I saw in my undergraduate psychology major.

Immediately after receiving tenure, I spent a year on sabbatical at Stanford University (1984–1985). With my newfound freedom to pursue interesting applications, I was looking for a new research area in which I could apply my statistical expertise. Within a month of arriving at Stanford, someone told me about the newly formed Society for Scientific Exploration,

started by a small group of Stanford professors. I was intrigued and went to visit the founding president, Peter Sturrock. From that visit, everything fell into place quickly.

In late October (1984) I attended the 3rd annual SSE conference in Princeton, New Jersey. At that meeting I met Hal Puthoff and Charles Honorton, both of whom were instrumental in my subsequent involvement in psi research. After returning from the Princeton meeting I started attending local Stanford area SSE dinners. It was at one of those dinners that Hal Puthoff and I had a chance to discuss statistical issues associated with the government-funded psi research he was conducting at SRI International, and he invited me to be a consultant. In particular, he was interested in learning more about using sequential sampling methods as a way of reducing the sample sizes needed to reach statistical significance. During the remainder of my sabbatical year I worked on various statistical issues as a consultant to the SRI program.

In August 1985, Dr. Puthoff left SRI and Dr. Edwin May became the project director. By then, I had a working relationship with Dr. May, and our first two publications together were presented at the August 1985 Parapsychological Association (PA) convention at Tufts University (May et al., 1985; Utts & May, 1985).

It was at that 1985 PA convention that I found the most important community of my career – parapsychologists. In addition to Drs. May and Puthoff, of particular note were Charles Honorton, Robert Morris, and Deborah Delanoy. Honorton invited me to visit his lab in Princeton and participate in a ganzfeld experiment. My parents lived a few hours away, and my father was intrigued, so he and I visited the lab together. He subsequently visited multiple times to participate in a 4-trial ganzfeld experiment. He was successful in choosing the correct target all four times, and as the sender in two of those experiments, I was astounded at the accuracy of his descriptions. That experience convinced me that the psi experimental results I saw reported were most likely not due to trickery or fraud.

Ed May and I continued to work together, and in 1987–1988 I took a leave of absence from UC Davis to work as a visiting scientist at SRI. I continued that role part-time the following academic year, and then continued as a consultant to the program. I remained as a consultant when the program relocated to SAIC, until the program was terminated in 1995.

In December of 1985 Robert Morris, who I had met at the Tufts PA convention the previous summer, was awarded the Koestler Chair of Parapsychology at the University of Edinburgh. I was interested in learning more about the various laboratories conducting psi research, and at Morris's invitation, I visited the laboratory there on a few occasions. As had been the case at SRI and at Honorton's lab, I was impressed by the quality of the experimental setup and the associated research. In 1994 I spent a sabbatical leave as a Visiting Senior Research Fellow at the University of Edinburgh. Dr. Deborah Delanoy, who was a researcher

in the program, invited me to live in her home during my stay, thus providing even more of a community connection.

As I got to know the researchers and saw the quality of the research, I decided that investigating the interface of statistics and parapsychology was the perfect career path for me. It fits with the enthusiasm I had in my undergraduate program for combining math and psychology, and it provided a community of devoted scientists who were welcoming and who were investigating what I consider to be one of the most important issues of our time.

### *Summary*

In the three decades since the Parapsychology Foundation sponsored the 1991 *Women and Parapsychology* conference, there have been major quantitative and qualitative improvements in the status of women in scientific research. Inequities still exist and probably always will. But there are now a myriad of programs that are trying to address these inequities. For example, in the United States the National Science Foundation ADVANCE program has invested over \$270 million at over 100 institutions since its inception in 2001. The stated goal of the program is “to increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse science and engineering workforce.” (<https://www.nsf.gov/crssprgm/advance/>) I am optimistic that the situation will continue to improve.

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## Allgemeine und persönliche Überlegungen zum Erfolg als Wissenschaftlerin

### *Erweiterte Zusammenfassung<sup>3</sup>*

Im Jahr 1991 veranstaltete die Parapsychology Foundation eine Konferenz zum Thema *Women and Parapsychology* [Frauen in der Parapsychologie]. In meinem Vortrag für diese Konferenz (Utts, 1994) erörterte ich Forschungsergebnisse, die mehrere Faktoren aufzeigten, die zu einer ungleichen Behandlung von Frauen und Männern in wissenschaftlichen Laufbahnen beitragen, wobei der Schwerpunkt auf dem akademischen Bereich lag. Zu diesen Faktoren gehörten kulturelle Normen, institutionelle Erfolgsbarrieren für Frauen, implizite Vorurteile und sozialer Druck, der Frauen davon abhielt, eine wissenschaftliche Laufbahn einzuschlagen und dort erfolgreich zu sein. In den letzten drei Jahrzehnten wurden bei einigen dieser Faktoren Fortschritte erzielt, aber nicht bei allen. Im ersten Teil dieses Aufsatzes wird erörtert, inwieweit sich die Situation bei sieben der in dem früheren Papier genannten Faktoren verbessert hat (oder nicht), wobei eine Kombination aus Forschungsergebnissen und persönlichen Beobachtungen angeführt wird.

Die sieben Faktoren, die ich 1991 angeführt hatte, lauteten wie folgt, wobei Entwicklungen in den letzten drei Jahrzehnten berücksichtigt werden:

Erstens waren Frauen seltener Teil der informellen Netzwerke, die die Wissenschaft voranbringen. Diese Situation hat sich in den letzten drei Jahrzehnten stark verbessert, vor allem durch das Internet und E-Mail. Diskussionslisten, Blogs usw. stehen jedem offen, der daran teilnehmen möchte. Zweitens haben Studien gezeigt, dass Männer und Frauen unterschiedlich wahrgenommen werden, wenn sie sprechen und Ideen präsentieren, wobei Männer ernster genommen werden. Dieser Trend scheint bis heute anzuhalten. Drittens neigten Frauen dazu, weniger zu veröffentlichen, und ihre Veröffentlichungen wurden nicht mit demselben Respekt behandelt. Neuere Untersuchungen zeigen, dass Frauen und Männer fast gleich viel publizieren, wenn sie aktiv publizieren, dass aber Frauen dazu neigen, häufiger und früher in ihrer Karriere mit dem Publizieren aufzuhören. Viertens haben Studien sowohl 1991 als auch in jüngerer Zeit gezeigt, dass bei identischen Referenzen, aber einem männlichen Namen, die Person größere Vorteile erhält, als wenn die Unterlagen mit einem weiblichen Namen verknüpft sind. Sowohl männliche als auch weibliche Prüfer tendierten dazu, die mit einem weiblichen Namen verknüpfte Referenz weniger gut zu bewerten. Fünftens erhielten Frauen im akademischen Bereich 1991 niedrigere Gehälter als Männer und wurden seltener befördert. Die Situation hat sich verbessert, da viele Universitäten inzwischen Studien zur Gehaltsgleichheit durchführen und die Gehälter entsprechend anpassen. Sechstens zeigten sowohl 1991 als auch

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3 Aus dem Englischen von Gerhard Mayer.

in jüngerer Zeit Männer und Frauen implizite Vorurteile gegenüber der Arbeit von Frauen. Und siebtens bevorzugten Frauen häufiger als Männer kooperative Forschung. Im Jahr 1991 wurde eine solche Forschung nicht geschätzt, aber die Situation hat sich erheblich verbessert. Da die Forschung komplexer geworden ist, ist die interdisziplinäre Teamforschung eher die Regel als die Ausnahme.

Im zweiten Teil werden mehrere Forschungsansätze erörtert, die zeigen, wie sich subtile Einflüsse in der Kindheit und im frühen Erwachsenenalter auf den beruflichen Erfolg auswirken. So haben sich beispielsweise die kulturellen Normen, die Wissenschaftler als Männer darstellen, im Laufe der Jahre allmählich verbessert, aber Kinder zeichnen immer noch eher einen Mann als eine Frau, wenn sie gebeten werden, einen Wissenschaftler oder eine Wissenschaftlerin zu zeichnen. Vorbilder und ermutigende Mentoren sind wichtige Faktoren, die darüber entscheiden, ob eine Frau eine wissenschaftliche Laufbahn einschlagen wird. Viele erfolgreiche Frauen in der Wissenschaft können einen einzigen Mentor oder eine Mentorin nennen, dessen bzw. deren Ermutigung wesentlich zu ihrem Erfolg beigetragen hat. Das Gefühl, dass die eigene Arbeit einen Sinn hat, sowie eine unterstützende Gemeinschaft sind weitere Faktoren, die zum Erfolg beitragen. Der letzte Teil des Papiers ist autobiografisch und zeigt, wie die in diesem Forschungsbericht dokumentierten Faktoren in meinem Leben eine Rolle gespielt haben. In einer Erzählung, die mit meiner Kindheit beginnt und sich über meine gesamte Laufbahn erstreckt, zeige ich Personen und Umstände auf, die zu meinem Erfolg beigetragen haben. Ein wichtiger Faktor war die einladend-offene parapsychologische Gemeinschaft; ich werde einige Details berichten, wie es dazu kam, mit dieser Gemeinschaft zu arbeiten. Der Beitrag enthält Vorschläge für spezifische Maßnahmen, die Einzelpersonen und Gemeinschaften ergreifen können, um mehr Frauen zu ermutigen, eine wissenschaftliche Laufbahn einzuschlagen, auch in der Parapsychologie.