Examining a Gendered Culture: Individual and Institutional Factors Impacting Women’s Desired Futures

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Short Title: Examining a Gendered Culture

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Abstract

This exploratory study examines the perceptions of women working in a male-biased environment and how individual and institutional forces impact their desired projected futures. Although participants projected three distinct career paths (i.e., research, teaching, industry), of significance is the shared ambition to contribute to the field of science based on traditional notions of success, regardless of path. Findings in this study offer insight into the individual’s career decision process involving sensemaking about how gender is experienced in a male-biased culture. Together, these two overarching areas provide information about the postdoctoral juncture for women that suggest an environment heavily laden with gender and family biases. This study surfaces how these disadvantages factor into participants’ choice of projected career path and how the culture of academic science contributes to the “leaky pipeline.” Responses from the participants intending to move into industry show anomalous findings that might warrant future research. Further, two unexpected findings emerged from this research: 1) participants in this study experience gender and family discrimination that is similar to what senior women in academia report and 2) the postdoctoral stage is a unique “transition zone” marked by a process of adaptation and selection.
"No one could anticipate this type of gender discrimination that accumulates over the lifetime of a career and has devastating consequences." – Nancy Hopkins, MIT, 1999

INTRODUCTION

Much is known about women working in organizations. Research continues to focus on the factors that hinder and help women throughout their career trajectories and reveals an ongoing and pervasive dissatisfaction about equity and opportunity along with the importance of professional development and institutional change. Prior investigation further indicates that women working in environments that favor males, or are male-biased (i.e., owners of power, privilege, or by sheer number) are subject to disparate treatment and gender-specific barriers that negatively impact their ability to reach their professional goals (e.g., the glass ceiling effect). What remains to be understood, however, is how the interplay of individual and institutional dynamics impact women’s career choices, job satisfaction, and retention in areas where women continue to leave in record numbers or where women continue to be underrepresented. One such example is the field of academic science.¹

Prior research in the sciences reveals a high attrition rate for women following the postdoctoral experience that is not explained, (i.e., the leaky pipeline)². This exploratory study focuses on women in the postdoctoral phase of their careers because it provides a unique vantage point to begin to understand the influence of identity, gender, and family and worklife integration on notions of success and fulfillment. The postdoctoral experience also offers insight into the sensemaking process of women during a time when they are focused on actively constructing their desired future.

¹ This study refers only to women in the biological bench sciences.
² This phenomenon is often called the “leaky pipeline” and signifies the increased departure of women from the sciences after each phase of their careers, especially during graduate school (Sindermann, 2001).
Women, Identity and Working in a Gender Zone

“Gender is one of the most basic constructs by which individuals define themselves” (Philpot, Brooks, Lusterman, & Nutt, 1997, p. 35). Gender provides a way for the individual to understand who they are in the world, who they hope to be, and what they can be expected to accomplish. “In the Holy Family model of ‘family’ that we have in the West, there is no type of relationship which men have with other women that is not based on gender. The model is one which stresses sexuality and gender as forming the basis of all relationships; sons and mothers, fathers and daughters, wives and husbands” (Hite, 2000, p. 198). Because gender attributes are socially constructed it provides as many limitations as it does opportunities. “In American society, women are expected to be nurturing, emotional, and cooperative, and serve in the capacity of wife and mother and provide a sense of family for children and spouses. Men, on the other hand, are trained to be aggressive, competitive, logical, and self-reliant and to serve in the role of protector and provider” (Philpot, et. al., 1997, pp. 41-42).

These gendered theories serve to create an awareness of the complex roles and responsibilities that make up a women’s life. It is equally important to understand that women themselves primarily base their identity on their relationships and connections to others (Belenky, Clinchy, Goldberger & Tarule, 1997; Chodorow, 1978; Miller, 1976). It is this fundamental link between self and other, and the accompanying expectations about tending to those relationships that prohibit women from segregating their lives into two distinct spheres, professional and personal. Because of the complexity of women’s identity and associated relational responsibilities and needs, women are continuously seeking ways to “function and find satisfaction in both work and personal life” and to achieve what is now being referred to as “work-life integration” (Rapoport, Bailyn, Fletcher, & Pruitt, 2002, p 17).
Juxtaposing a woman’s need to be in relationship with others, the socialized demands of her role as “caretaker” and her desire to develop a professional identity when the workplace culture may be “aligned with traditional images of masculinity such as autonomy, assertiveness, competition, and heroic action” (Rapoport, et al, 2002, p. 28) makes it possible to realize that women working in male-biased domains experience a daily battle as these competing desires collide. The impact of this environment on women’s lives can be most fully observed in “organizational cultures that glorify employees who work as if they had no personal-life needs or responsibilities, silence personal concerns and make it difficult to recognize or admit the costs of overwork” (Rapoport, et al, 2002, p. 31). What is the impact on women’s lives when they work in environments that are in direct opposition to how a woman sees herself? Further, how does a male-biased culture influence women who are in the process of creating a professional identity?

Women Working in Male-biased Organizations

Stereotypes, Sex Role, Sex-role Spillover, Sex Composition, and Tokenism

The most significant influence gender has in shaping our world is that it determines who has power and who does not (Philpot, et al., 1997). Research demonstrates that women working in male-biased cultures experience additional deterrents to success based solely on gender to include stereotypes, sex roles, sex-role spillover and tokenism. Stereotypical roles are acerbated when the proportion of one sex is dominant. The result of the skewed sex composition is that the dominant group’s ideology establishes the norm that ultimately supports a hegemonic system (Gutek & Cohen, 1987; Gutek & Morasch, 1982). Stereotypes serve to maintain socially defined roles and create an associate relationship between gender and “behaviors, occupations, and physical appearance (Unger & Crawford, 1992, p. 143) and promulgate sex-role spillover
defined as “the carryover of gender-based roles into the work setting.” The underlying function of sex stereotypes and role definition is to exert control based on social gender construction (Unger & Crawford, 1992, p. 143; Worell & Remer, 1992). “Sex roles are more stereotypical and more problematic” when there are “relatively low proportions of senior women” (Ely, 1995). Kanter’s (1977) research on tokenism further supports the impact of sex ratios on women that results in the individual being an outsider and is denied the true status afforded other members of the group. Tokens feel a need to work harder and make fewer mistakes compared to other members.

**Status and Power and Creation of Institutional Norms**

When a dominant group controls the primary roles of power they, as a collective, create status. Status groups are the founders of organizational culture and institutional norms and are “a major influence of life styles and beliefs” (Collins, 1998, p. 282). Members of status groups tend to associate with one another and exclude outsiders (i.e., anyone who does not fit the status profile). In essence, these groups control who may become a member. Although men report that they do not oppose hiring a woman if she has the qualifications (Galen & Palmer, 1994) the dilemma may be in how men perceive who is qualified and according to what standards. Research demonstrates that status characteristics (i.e., age, sex and race) determine the distribution of power, influence, and prestige among members of dominant groups (Berger, Cohen & Zelditch, 1972). This dynamic can create what is commonly referred to as the “old boys club,” an informal but powerful collective of like individuals who either explicitly or implicitly signal whether full membership in an organization is granted or denied.

Institutional theory offers further insight into how discrimination is perpetuated at the organizational level based on an interaction between the organization and its environment (or
society). Institutional theory demonstrates how organizations seeking legitimization reproduce themselves according to a dominant group or professional body. In order to secure legitimacy they apply a process of strict conformity to include shared meaning about behavior (Scott, 1987). Social norms are manifested and replicated when organizations, in seeking to become legitimatized continue to generate bodies of shared meaning that implicitly and explicitly represent the ideology of the dominant group. Gender-bias occurs in industries where power is maintained through the creation of closed systems that self-replicate dominant value, behaviors and ideologies (Perrow, 1986, pp. 157-177). In these environments equality is denied in order to maintain structures of power, privilege and opportunity (Kanter, 1977).

In order to change the status quo it is important to continue to understand how the salience of one’s gender identity results in disparate treatment against women working in predominantly male cultures. In this study we turn to the experience of these women in order to further understand the factors most important to their lived experience and that directly impact their ability to create their desired futures. The question central to the study is “What are the individual and institutional forces experienced by women working in a male-biased environment?” The second question is embedded in the first and asks, “How do these dynamics impact the projected desired futures of these women?”

METHODS

The research design is inductive and is intended as an exploratory study to understand the interplay of individual and institutional forces experienced by women in a male-biased environment and how this impacts their projected futures. The study is situated in the research sciences due to a high attrition rate for women and a predominance of men in higher level positions. The overall study is guided by feminist research methodology and thematic analysis.
The intent of this technique is to leverage the strengths of the method and the analysis in order to fully understand the experience of the participants (e.g., past and present) in the wholeness of their lives and to further understand how this information guides their future choices (Reinharz, 1992).

At its core feminist research aims "to create theories grounded in the actual experiences and language of women by investigating women’s lives and experience in their own terms" (Humm, 1989, p. 242). Following DeVault, the study is grounded in "women’s standpoint...[that] does not imply that all women share a single position or perspective" (1999, p. 60) but rather seeks to learn from the variation between the individual and the collective as well as from the similarities (Reinharz, 1992). A qualitative approach was used to support the exploratory nature of the study and because it will allow for the collection of descriptive data. Further, this method is appropriate because it “can be used to uncover and understand what lies behind any phenomenon about which little is yet known” (Strauss and Corbin, 1990, p. 19). Interviews were semi-structured and followed a feminist approach that allowed the participants to respond in a conversational manner, meaning that they could answer questions out of order, determine the length of response, and that digression was valued as a way to more fully understand both context and the sensemaking process (Reinharz, 1992). The interviewer was also free to probe for additional information or understanding in order to accurately capture the participants’ experience. At times the interviewer offered her own stories or insights and freely entered into the conversation as a way to create a sense of common ground that would hopefully foster a platform for shared learning. The interviews could be described as being collaborative in that both interviewer and participant were working together to create a thorough understanding.
of the participants experience as a women working in the bench sciences (Gersick, & Kram, 2002).

Sample Selection

The study utilized purposive sampling which is appropriate when a researcher wants to “select unique cases that are especially informative...[involve a] difficult-to-reach specialized population...[and] to identify particular types of cases for in-depth investigation” (Neuman, 1997, p. 206). Participants were chosen from the basic medical sciences for two primary reasons: 1) the importance of basic research as “the engine that drives medical advances” and the centrality of the field to human life (UniSci, 2000, p. 1); and 2) the fact that “four times as many men as women with doctorates...[in science and technology hold] full-time faculty positions” in U.S. research institutions (Trower & Chait, 2002, p. 35). The study employs Kanter’s theory of skewed groups to examine whether women in these fields experience additional challenges as a result of the disproportionate number of men. Kanter states that the “numerically dominant types” form the culture and establish the norms that others are expected to follow which can significantly impact the career path of minority members (1977, p. 208).

Utilizing purposeful sampling, potential participants were identified at a major Midwestern research university using the online directory and the search phrases “research associate” and “post doctoral fellowship.” The directory provided basic information on the 462 postdoctoral researchers on campus and included those individuals employed at an affiliate university hospital. Further, this information allowed for the compilation of a list of potential participants to contact based on the research criteria (i.e., gender, degree field, citizenship and physical location). In order to meet the specific criteria the names of men, foreign students and
women not doing research in basic sciences had to be eliminated. This resulted in a total of 46 women scientists within the population.

Women postdoctoral researchers are typically between 24-34 years of age, the period of early adulthood where many women begin to think about marriage and children (Newman and Newman, 1999). This is also the time when researchers are expected to focus on their work if they hope to become a successful scientist. The postdoctoral experience provides an opportunity to learn more about the salience of career, family and environment to women researchers. A recent report from the National Research Council’s Committee on Science, Engineering, and Public Policy confirms that “additional information is needed about postdocs who are members of underrepresented minorities; less is known about these groups than is known about foreign postdocs” (2000, p. 41). Controlling for this particular age group resulted in only a sample size of 10. Because of the limited number of women at the initial site, another major Midwestern hospital was contacted for access and three more participants were engaged. With only 13 women signed up for the study a “call for participants” was made via an online journal affiliated with a top tier journal in the sciences. Seventy-two women across the country responded to the request and 14 women who worked at major research institutions across the United States agreed to participate. The result of the intense scouting efforts resulted in a total of 24 participants in the final sample size which was sufficient for this research study.

Table 1 shows the demographical data of the participants used in this study. 14 of the 24 participants were married (58.3 %), and 7 (29.2%) had children. The age of the participants ranged from 28-35 and their tenure as postdocs ranged from 8-78 months. Participants were interviewed from 12 different research institutions across the United States within the bench sciences.
TABLE 1
Demographical Data of Sample

<table>
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<tr>
<th>Age</th>
<th>Martial Status</th>
<th>Children</th>
<th>Postdoc (mths)</th>
<th>Projected Career Path</th>
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<td>33</td>
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<td>No</td>
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<td>Industry</td>
</tr>
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Procedure

The participants were interviewed (11 face-to face and 13 by phone) and each interview lasted approximately 1½ to 2 hours. There were no differences between the in-person or phone interviews (i.e., quality, length of conversation). Participation was voluntary and all participants agreed to be involved in the study. All interviews were tape recorded and transcribed.

Thematic analysis was used to generate codes that could be uniformly applied to the data to maximize differentiation, meaning to determine if a difference exists between the subsamples (Boyatzis, 1998). Individual interviews were analyzed using the question as the unit of coding with probes considered to be a part of the question and not a separate query. Codes were only
accounted for once, in either the interview question or in a probe, as a way to avoid double coding. Since the study was designed to capture both differences and commonalities, the codes were also used to determine what themes were shared across groups. The codes were tested for reliability and then applied to the remaining interviews.

**Analysis Process**

Using the method outlined according to Thematic Analysis (Boyatzis, 1998), from the total sample size of 24, three groups were identified using choice of projected career paths (i.e. research, teaching, and industry). Three interviews were chosen at random from each of the three projected career groups which formed a subsample of nine that was used to develop the themes, clusters and codes. The data from these nine interviews were then reduced by highlighting only relevant information and then reduced again by reconfirming that all data kept true to the syntax and context as stated by the participants.

This reduced data was organized by interview questions and placed on a chart. The themes were then abstracted to clusters and a matrix was developed to identify the themes within each cluster. The themes within each cluster were verified again with the outlined data in the original nine interviews to ensure that the context of the participants’ responses was maintained. The themes were then compared across each interview within the three groups separately. Those themes that did not resurface from the comparison were removed while others that emerged were included. The process is outlined in Appendix 1. Reliability of the 12 codes was tested using an independent coder and an IRR of 89.9% was established which exceeded the requirement set at eighty percent. After establishing reliability, the codes were applied to the remaining interviews.
FINDINGS

Overview

The findings of this study are based on the interviews of 24 women in various stages of their postdoctoral experiences. At the time of the study all women were working in research institutions. Although the sample size is small, it permits a deeper analysis of the data as well as providing a vantage point from which to understand individual differences and shared experiences. Because this study is exploratory, the findings offer opportunities for further studies and for hypotheses to be tested. The intent of the study was to find out what women postdoctoral researchers experience at this stage of their careers and what factors might cause them to pursue other paths. It is hoped that this study will offer insight into how individual preferences and institutional dynamics contribute to the leaky pipeline. Due to the conversational nature of the interview process that permitted a free exchange of information, the data was analyzed by question, according to career path and in the aggregate to allow for the most complete understanding of the participants’ experience. Throughout our findings we explicitly state each of the three ways the data is presented so as to maintain its integrity. What follows is a detailed description of the emergent themes generated from the study representing both the individual and the collective.

Defining Success: Their Way and My Way

The participants in the study offered insight into some important differences that indicate why women may exit the research path immediately following their postdoctoral experience. Participants in the study helped to dispel the myth that everyone engaged in a postdoctoral experience is driven by the same type of achievement, or that everyone adheres to a shared definition of success. When asked, “What does it mean to be successful in science?” all 24
participants agreed that the overarching hallmark of success in research science is the ability to publish in top-tier journals. Other key factors include the ability to obtain funding, communicate your successes effectively and find “your niche.”

When asked, “What does it mean for you to be successful in science?” all of the women projecting a career in research or industry were coded for Contribution, defined as the interest or focus on publishing in reputable journals, the quantity of publications, doing thorough and accurate research and the need or desire to achieve a reputation as a respected scientist within their field. Women projecting a career in teaching also supported this notion of success with 5 out of 8 (63%) coded for Contribution. These responses reflect a concurrence and acceptance of a definition of success as held by the larger community of science.

Participants varied in their responses, however, as they included other concepts important to how they define success as a scientist and in how they hope to contribute to their field. All 8 women projecting a teaching career were coded for Developing Others defined as an interest and focus on mentoring and teaching in their field. This includes an interest in being a good role model and providing a nurturing and supportive environment for students. Their comments reflect the importance of Developing Others to their self-concept of what it means to be a success in science:

“I would rather go in a different direction where I really value teaching and conveying scientific concepts to people. . . . I would very much enjoy working with graduate students and I would make it a high priority to be mentoring people, and teaching them how to write papers, and how to write grants…”

“Success in science is making an impact on a young scientist’s life who can follow a more traditional path. So really being a support for graduate students. I love to teach graduate students. I love to help them give presentations and I think that is really rewarding for me.”
Developing Others was not exclusive to women focused on a teaching career. Participants projecting a career in research, 6 out of 11 women (54%), and industry, 3 out of 5 women (60%), were also coded for Developing Others. This finding suggests that women, irrespective of career choice, both value and enjoy mentoring, teaching and interacting with students. The bench sciences would then be found to be less fulfilling for those who place a primary importance on teaching or who want the relational interaction of working with students.

For those projecting a career in research, 5 out of 11 women (45%), also included Personal Satisfaction as a key factor contributing to their feeling successful in science. Personal Satisfaction is defined by the individual’s desire to achieve an overall sense of fulfillment in life and can include descriptions of those qualities or conditions that need to be present in order for them to feel happy or content. Participants spoke of paying attention to their feelings as a source of data for gauging their level of success rather than any marker of external validation:

“Feeling happy with what I’m doing and still enjoying things. Then personally, that’s more successful than if I’m just gritting my teeth and sucking it up and continuing on some path.”

“That I’m happy and excited about what I’m doing and what I feel. That I’m making a difference in what I’m doing and enjoy doing it.”

This study suggests that traditional notions of success hold true for women in science but that these participants present a more complex picture of achievement to include the need to develop others or to experience a genuine sense of happiness in one’s career.

**Considering Careers Beyond the Bench**

The women in our study also challenge the assumption that all individuals pursuing a postdoctoral experience plan to continue a career in academic research. We found that 13 out of 24 women (54%) participating in our study are already intending to leave a research path for a
variety of reasons and ambitions. At the time of our study 8 women projected a career in teaching and 5 planned to move into industry or other types of organizations (e.g., not-for-profit, government). Only 11 women (46%) planned to continue doing academic research. We found that the women in our study are either choosing to leave a research path after discovering what a career in academia entails or because they had always intended a different path, such as teaching. Two factors were found primarily to contribute to choosing a career beyond academic research: individual preferences and institutional realities.

When asked, “Where would you like to be in your career five years from now?” some women reported that they never intended to pursue a research career but rather hoped to teach. As one participant stated:

I would have finished post-doctoral training, and I would like to be teaching at least part-time if not full-time, at small four-year college. I might be doing some research, but research would not be one of the major requirements.

Another reflection of the array of individual preferences stated in this study is described as follows:

“I would [like] to stay as a senior post-doc. So goal number one is to have my own grant...With that I’ll have options to either stay a post-doc or to interview and try for a faculty job...I would still either try and stay in a good environment, as a postdoctoral fellow...there’s tons of advantages to that, mostly time flexibility and less paperwork...I don’t really see a problem with staying a post-doc for five or ten years.”

Others are making the decision to leave research after they begin to recognize the challenges and expectations of a career at the bench:

“I want to be teaching at a small liberal arts college. It’s very specific, that’s what I want to do. I’ve done a little bit of teaching here, I really liked it...I know what it takes to run a lab, and I feel like I could do that successfully, but I don’t have any desire to do that. I just don’t like the idea of writing grants all the time and having that pressure on me to obtain funding or to lose my lab...that’s just not my style, maybe it’s because I’m very low-keyed.”
“I’d like to be in a tenure-track position at a small college or university...that’s the whole thing with this field, needing to promote yourself and then success being based on your publications...my level of happiness will not be worth the sacrifice.”

Some women are hesitant to express their individual preferences due to a backlash within the environment and the realities of a culture that narrowly defines success:

“So there are things that I’ve been trying to explore, while doing my postdoc...but I’m afraid to bring it up with my boss or other senior scientists just because once you step off the yellow-brick road, you’re a pariah. Especially since things could change. I could get a great result tomorrow, and my choice of faculty jobs, in which case I probably would stay in academia. And so I don’t want to say I’m thinking of doing this, because then I would be labeled as someone who is not serious about science.”

In thinking about their career options women also consider the implications of leaving academia in the near future on their long-term plans:

“If I wanted to pursue that [a position in academia after working in industry] in today’s market, say I got my Ph.D. awhile ago and I’ve been in industry and I’m searching for an academic job now, I would not be considered. Because that, I think, would be viewed as selling out.”

The responses of the participants demonstrate the wide spectrum of options that women consider during the postdoctoral transition period. This finding may speak to differences at the individual level, reactions to institutional norms, indicators of success, or to the overall job market.

**Gender Bias: Subtle, Male-dominated, and the Impact on Women**

Beyond the differences expressed in choice of career, participants across all three paths (i.e., research, teaching and industry) expressed a collective awareness of the disadvantages that women experience due to working in a culture that favors males. Participants were asked to consider barriers to success for women in science that are imposed on them by others within the
culture of science. Three themes emerged: Subtle Discrimination; Male-dominant Culture; and Impact of Gender Bias on the Individual.

Subtle discrimination is defined as acts against women that are intentional and unintentional; visible but often unnoticed; communicated both verbally and behaviorally; and appear to be situational (Benokraitis, 1986). The participants clearly articulated the often difficult task of explaining subtle acts of discrimination with 14 out of 24 (58%) women being coded for this theme. This finding suggests that women in the early stages of their careers are as aware, or are developing an awareness, of the disparate treatment in science similar to that experienced by more senior women:

“Okay, there is a slight undertone. Not everybody perceives a woman at first impression...capable of making it to the top.”

“There probably is a little bit of a difference and it’s probably more just a perception of what men can do versus what women can do. Or what men know versus what women know, this whole idea that men are better at math and science than women...so there’s already this preconceived notion that this man is going to know more than this woman even if they both come in and they do the same work and they both have the same basic knowledge and the same scores on everything.”

“I think just from the starting point, a lot of women are offered, perhaps, lower salaries, or less in terms of square feet for their lab or their start-up package.”

Male Dominant Culture is defined as an environment where males are the primary owners of power and privilege or where men outnumber women. The behavior exhibited in the environment reflects preferential treatment toward males and toward those who behave in ways that favor the dominant culture (i.e., like a male, or anti-female) such as rationality, activity and aggressiveness (Gutek, 1987). All eleven women projecting a career in research describe their environment as one that reflects cultural norms and values that favor males. Male Dominant Culture was also reported by participants choosing teaching and industry with 6 out of 8 women
(75%) and 4 out of 5 women (80%) coded respectively. Variations on the impact of the “old boys network” was a continuous refrain throughout the interviews:

“I mean traditionally there are a lot of men and there is an old boys network and they help each other out. There’s a lot of politics involved in science too, and if you’re in the old boys network, or some network, of course you have an advantage of other people who aren’t.”

“And the guy sitting next to me who doesn’t really understand the applications of tools, and basically puts things together, he gets referred to as Dr. Such-and-Such, and I many times don’t even get introduced to people.”

“Like the type of discussion that goes on in lab group meetings, or journal clubs, or seminars, is pretty combative sometimes, or most of the time period. For a lot of scientists, especially male scientists, the idea of a great stimulating discussion is a very aggressive, heated argument.”

Impact of Gender Bias on the Individual is defined as the internal struggles/pressure(s) a woman scientist experiences as a result of the external gender bias. These descriptions include how she makes sense of the gender bias, how she experiences herself as a woman within the environment, and the different treatment/standards placed on her. Women were also coded for Impact of Gender Bias if they expressed an understanding or belief that the salience of their gender results in a type of “extreme expectations” for their performance on the job when compared to what is required of men in the same position:

“…confidence, determination, hard work…women might need more, I guess that, that’s the only distinction I would make.”

“I think that, unfortunately still in science, women I think need to work a little harder, need to portray confidence a little more. Not that they don’t work hard enough but I think…that they might need to do more work to get the same recognition.”

“The threshold for validity is maybe higher than for men. So you need to maybe publish fifteen papers instead of eight.”

Impact of Gender Bias was coded for 8 out of 11 women (73%) projecting a research path. For those focused on teaching 6 out of 8 women (75%) were coded for Impact of Gender
Bias and 4 out of 5 women (80%) choosing industry were coded for the same. These findings suggest that participants have both an awareness of the salience of gender bias as well as the impact of this disparate treatment on their daily work life. It is also important to consider what the spillover effect of “extreme expectations” on the job might have on the personal lives of these women.

**Family Bias: Managing, Struggling and Other Barriers**

Beyond Gender Bias, participants further reported Family Bias defined by how they experience the impact of children and family on their careers, and life in general, from the environment. Three major themes emerged from the data to include: Managing, Struggling, and Barriers. Managing refers to the need for additional support from the institution to deal with family responsibilities. Struggling highlights the difficulties they experience from the environment with regard to pregnancy, raising children and tending to family life. Finally, Barriers are descriptions used by the individual to discuss experiences within the work environment that suggest that family life will be an obstacle to achieving a successful career.

Not surprisingly, participants projecting a career in research, 6 out of 11 women (55%), were coded for Managing. These women expressed a need for additional resources to assist with childcare or family life. This finding may represent a continuum of their awareness about the “extreme expectations” placed upon them both as a mother and as a woman scientist:

“That just a lot of them [women] are the primary caregiver for their children … places that have some extra perks like child care might make a bigger difference to a woman than a man.”

“Women who have children use more support…with pay, with full pay… they cannot remove your position for one year…so this is actually exceptionally supportive to a woman.”
“Because it is very demanding, and certainly at the early stages, you’re not paid well enough to have other people do the things that you need to do. So you’re not paid well enough to have a full-time nanny or a full-time housekeeper, and all this kind of stuff. That people who work in other professions where they’re expected to work incredibly hard, at least they have the financial resources to pay other people to get the other stuff done in their life.”

To a much lesser degree, 3 out of 8 women (38%) focused on a career in teaching were coded for Managing and none of the participants heading toward industry reported a need for additional resources. These findings may support the notion that women staying the research course are aware of the demands that such a path will have on their lives and are considering how to manage both a career and a family once they achieve full-time employment. Conversely, participants moving toward industry may have an expectation that the environment will either provide them with benefits such as daycare, or compensate them with the financial means to purchase these services. Moreover, women planning to go into industry may also expect a more balanced work environment that would preclude needing additional resources to manage family life.

Participants across all three career paths were coded for Struggling reported as the challenges or difficulties they experience from the environment with regard to pregnancy, raising children and tending to family life. For those participants choosing research, 10 out of 11 women (91%) were coded for Struggling. All 8 women projecting a path in teaching were coded for Struggling and 4 out of 5 women (80%) hoping to go into industry also acknowledge difficulties presented by the environment of trying to have both a family and a career in science. It is worth noting the words these women used to describe these experiences as they are indicative of the deep stress this topic evokes:

“Because I feel so restricted in being able to balance out the other areas of my life, it makes me more resentful of work, just in general. Which makes it more
difficult for me to go to work on a daily basis and do what I need to do. Because I feel like it’s sucking every ounce of my life out of me.”

“Because I feel, when I look back now, I think that this is a terrible career choice for a family. On the other hand, I feel like if I hadn’t pursued this I wouldn’t be fulfilling my own personal goals. So I’m constantly wrestling with these two identities, one as a wife and mom, and one as a scientist as well.”

“I’ve heard of examples from people who say that when they’ve told their advisor that they’re pregnant, he’s threatened to cut off their health insurance. I don’t think that’s true for men. I think they [men] automatically sort of see this as a distraction from their [a women scientist’s] research.”

The third theme to emerge from the study with regard to Family Bias is Barriers.

Participants were coded for Barriers if they described experiences within the work environment that suggest that family life would be viewed as an obstacle to achieving a successful career in science:

“…and you did not get pregnant in his lab, he made it clear.”

“The barriers in terms of family – it becomes an excuse for why they [women] can’t really be successful. “Well we hired this female faculty, but now she wants to have a baby! We knew this wouldn’t work…”

“I do feel that it is not a field that makes it very easy for women. It is not very accommodating if they decide to have children or if they want to have a life outside of your work.”

Participants projecting a career in research were coded for Barriers with 7 out of 11 women (64%) stating that children or having a family would negatively impact their career. For those on a teaching path, 6 out of 8 women (75%) were coded for Barriers and only 2 out of 5 women (40%) seeking a career in industry felt that this was a salient theme.

Clearly women intending to stay in academia, whether in research or teaching, recognize that family life can be viewed as an obstacle to one’s career. This finding supports existing research about women fully employed in academia who also experience the challenges of family life. It is interesting to find that women projecting a career in industry do not perceive family
life as a significant obstacle to success for women in science. One explanation may be that they are more attuned to issues that expand to their projected work environment (e.g., struggling with family life). While this sample is too small to draw any conclusions, one possibility may be that the struggles related to family life are more prominent for women headed for industry since concerns about how to juggle family and work may be similar across contexts (i.e., issues of general worklife balance) and that barriers in academia are less significant to them since they do not project a career in this environment.

**Fullfillment and Worklife Balance**

We began the discussion of our findings by juxtaposing our participants’ notion of success against how success is defined in the larger community of science. What we found were variations that pointed to individual differences as well as themes shared by the participants that spoke to concepts of relationship and personal satisfaction, in essence, a more inclusive notion of success. Because we were interested in how these women place themselves within the wholeness of their lives, meaning other factors including but not limited to their career, we asked, “*How do you define success in your own terms?*”

One theme to emerge was Personal Satisfaction. For those moving toward teaching, 3 out of 8 women (38%) and 5 out of 11 women (45%) projecting a career in research were coded for Personal Satisfaction. Three out of five women (60%) seeking a career in industry stated this as also being important in their overall individual definition of success.

Interestingly, when asked about what they need to consider themselves a success in science, 5 out of 11 women (45%) projecting a career in research were also coded for Personal Satisfaction. This finding may indicate that one reason why these women might want to stay in research is that it offers them a sense of personal satisfaction as well. Just as for those women
who projected a career in teaching (6 out of 8, 75%) were coded for developing others as part of their definition of success in science which may be a contributing factor as to why they choose to leave academic research.

Participants also stated that Worklife Integration, defined as wanting a balance or integration in both work and life, was important to feeling like a success in science. This theme was shared by 18 out of 24 women (75%) across all three career paths. Examples of how this theme was expressed are:

“…a definition of success for me personally is a balance for me of various aspects of my life. And I think that some of the trick is finding how to achieve the right level of success in each area, so that you have enough of yourself to invest in the other areas.”

“I would like to be in a job that I find fulfilling and one that makes me personally happy, that’s stimulating and interesting. But that also allows me to have a life outside of just a career.”

“And just being able to have the right sort of balance, with work and being able to take time off from work and pursue other interests.”

The importance of Worklife Integration, however, became figural when asked, “Are there other things that you need to have a life that feels fulfilled?” All participants but one stated the importance of Worklife Integration as part of their envisioning a fulfilled life.

In essence, these findings may loosely be referred to as a series of snapshots that represent the sensemaking process of these women as they construct their future. However, just as a single snapshot does not tell a complete story, it can provide details that offer insight into a moment of importance or a portal into the everyday that only in hindsight becomes significant. Together these multiple snapshots present a compelling view of the hopes and challenges of 24 postdoctoral women researchers during a critical juncture in their lives.
DISCUSSION

The purpose of this study was to understand the individual and institutional forces that might contribute to the “leaky pipeline.” We asked a series of related questions about success, fulfillment, projected career path and how gender is experienced in science as a way to develop a more comprehensive picture of the participants lives during a critical transition point in their career. Further, we wanted to understand what is most important to them as scientists, as women, and in the totality of their lives. The overall design was intended to elicit concrete stories or examples that would be converted into a consistent way to interpret the interviews (i.e., a code). Since our intent was to learn how the participants make sense of what they experience in the environment and how that experience impacts their career choice, participants were free to draw and reflect upon past and present events.

Findings in this study offered insight into the individual’s career decision process involving sensemaking about how gender is experienced in a male-dominant culture. Together, these two overarching areas provide information about the postdoctoral juncture for women that suggest an environment heavily laden with gender and family biases. Two unexpected findings emerged from this study: 1) participants in this study experience similar gendered challenges as experienced by women in science who are further along in their academic careers and 2) the postdoctoral stage is a unique “transition zone” marked by a period of adaptation and selection.

The Path to Success and Fulfillment

In general, our findings have dispelled the myth that all postdoctoral researchers plan to continue a career in academic research. Some have decided to leave the academic sciences after experiencing this environment while others never intended to stay the research course. Despite their intent to remain in academia or to leave, all of the women agreed that a marker of success in
science is publishing in top-tier journals (i.e., coded as Contribution). Further, 21 out of 24 women (88%) were coded for Contribution in their own definition of success as a scientist. With this information, it would appear that their definition of being a success in science does align and represent the dominant group's ideology (Boyatzis & Kram, 1999). However, when asked to share their individual definition of success, two other notions surfaced that deviated from established masculine norms: Developing Others and Personal Satisfaction. This extension of the definition of success supports previous research about the tension individuals experience working in cultures defined by male notions of success (Rapoport, et al., 2002). The data from this study indicates that women may also “include more relationship-oriented definitions” of achievement in their overall concepts of success, and that they want to achieve in multiple arenas (Case & Thompson, 1995, p. 159). It is not unexpected then that 75% of the women mentioned Worklife Integration as an important criteria to being fulfilled. However, an interesting finding in this study may extend the notion of Worklife Integration – personal satisfaction. Forty-six percent of the participants mentioned personal satisfaction as an important aspect of being fulfilled in life.

This study was deliberately designed to study women during a transitional stage of their career. It is surprising to find that already more than half the women (54%) were preparing to leave the academic sciences. Even though 8 are projecting a career in teaching and 5 in industry, what we discovered is that their choices were based on a complex set of individual variables to include identity (e.g., as a teacher, mentor), definitions of success and fulfillment (e.g., personal satisfaction, worklife integration) and person-environment fit (e.g., industry). At the institutional level, the responses from the participants demonstrate that the environment poses additional challenges based on gender and family life.
Leaving Academia for Industry: A Noteworthy Anomaly

It is interesting to note that, overall, participants choosing industry were less communicative during the interviews and more frequently reported non-gender specific barriers for women in science. When directly asked about the obstacles or barriers to success our participants going into industry shared the belief that gender is not a factor and that the “playing field is level.” Yet, woven throughout their interviews were stories of experiences about a climate unfavorably biased toward women and 4 out of 5 participants (80%) choosing industry reported Impact of Gender Bias and disadvantages of working in a Male Dominant Culture. These responses suggest an awareness of challenges in the environment for women yet they do not perceive them as significant barriers to achieving success in science.

Our participants moving toward industry also expressed the belief that family life is not a primary barrier to success with only 2 out of 5 women (40%) stating that it would be an obstacle to their career. However, 4 out of 5 women (80%) were coded for Struggling which represents their particular awareness or concern about family related issues. While this sample is too small to draw any conclusions, one possibility may be that the struggles related to family life are more prominent for women headed for industry since concerns about how to juggle worklife may be similar across contexts (i.e., issues of general worklife balance) whereas barriers in academia are less relevant to them since they anticipate leaving. Another explanation may be that women going into industry believe that academic research’s narrow definition of success (i.e., Contribution) equally rewards those who produce and that learning how to manage the struggles of family life is therefore a critical competency needed to succeed. Although none of the women going into industry reported needing additional resources from the environment to aid in
managing family life. As previously stated this finding may indicate a belief that industry offers the feasibility and the resources to integrate worklife.

Another finding of this study is that women projecting a career in industry, 3 out of 5 (60%), noted Personal Satisfaction as an important part of their individual definition of success compared to teaching and research, 3 out of 8 women (38%) and 5 out of 11 women (45%) respectively. This finding may indicate that the academic environment lacks a component necessary to their sense of personal satisfaction and may suggest one reason for their intended departure. While no conclusions may be drawn from this sample, women headed toward industry presented compelling differences that warrant further study. Future research should be conducted to understand the factors that impact women leaving academia that will provide additional insight into that branch of the leaky pipeline.

**A Shared Experience: Gender and Family Biases**

This study sought to understand the experience of women working in a male biased environment and the impact of this context on the professional and personal spheres of their lives. These findings demonstrate the significant role that their gendered identity has on the daily lived experience of women in science. Because these themes were shared by women regardless of career path we also analyzed the data in the aggregate.

Although Gender Bias was coded as Subtle Discrimination, Male-Dominated Culture, and Impact of Gender Bias, 21 out of 24 women (88%) mentioned Male-Dominated Culture as a barrier in their work environment. Many women reported experiences where they were treated differently than male counterparts and live under a shroud of doubt about their ability to “do science” and “make it to the top as a woman.” Participants repeatedly stated the challenges they faced from working on the outside of the “old boys club” that results in an unfair burden of
“extreme expectations” and suggests dynamics akin to tokenism (Kanter, 1977). Tokens are expected to work harder, are scrutinized more severely, expected to behave as if they are not different from the majority, and their problems (which may differ from the majority) are seen as insignificant or a burden to the organization.

Perhaps the most salient point mentioned by almost all the women, 22 out of 24 (92%), are the challenges or difficulties they experience with regard to pregnancy, raising children and tending to family life (coded as Struggling). Even though only 14 women (58%) were married, of which 7 (29%) had children, almost all of the participants reported having experienced or anticipated having these difficulties or challenges. Fifteen women (63%) also mentioned that family life would be viewed as an obstacle (coded as Barriers) to achieving a successful career in science. As noted, although some women in this study were married and some also have children, the data was not analyzed for differences in groups because of the small sample size. Further studies should explore what women who are married and have children in the postdoctoral stage of their careers experience and how these factors impact their career choices.

The forms of discrimination that these women reported are often subtle, intentional or unintentional, but have real life implications. These findings support the fact that being a woman is still “a better predictor of inequality than such variables as age, religion, intelligence, achievements, or socioeconomic status” (Benokraitis, 1997, pp. 6-7.) Further research using a larger sample to conduct quantitative studies should be conducted to identify casual paths involving specific individual and/or institutional factors that lead to these women’s projected futures. In addition, since this study is based on a specific population (i.e. women in the biological bench sciences), the findings in this study should be tested further by carrying out studies involving women in other male-biased environments.
Yet, in spite of the challenges particular to women, the evidence from this study suggests that rather than opting out of the environment due to lack of ability or interest, our participants are committed to their chosen field of science but many are choosing other venues in which they can contribute (i.e., teaching, industry). This study offers insight into the “leaky pipeline” and suggests that, in part, it is an institutionally imposed construction based on a male version of success in science that focuses on “my way or no way.” This study proposes that women are not leaving the sciences but rather finding other arenas where their norms and expectations are more aligned with their personal identities and desired projected futures, or as one participant stated, “I’m going to leave and I’m going to be successful where I know I can be successful.”

In a male-biased environment one’s gendered identity is either an asset or a liability. Ibarra cites Gecas, (1982) in that “identity refers to the various meanings attached to a person by self and others (1999, pl. 766). “But the fact is that we do not have to give femaleness and maleness the meanings we presently give them” (Miller, 1976, p. 71). In order for women to participate as full members of the scientific community the gendered nature of the field must give way to an environment that fosters and supports both women’s and men’s ways of being.

**Transition Zones**

The data from this study supports earlier research that finds that women working in the male-biased culture of science experience challenges specifically related to their gender such as discrimination and issues related to family life (Etzkowitz, Kemelgor, Uzzi, 2000; Silverman, 2001; Zuckerman, 2001; Crittenden, 2001; Valian, 1999). Our study reveals that even at this early stage of their careers and before full membership has been obtained in an organization, these women are experiencing barriers similar to that of women further along in academia. This finding begs the question, “How are the experiences in such a transitional environment impacting
women postdoctoral researchers?” Evident in the findings is that the participants are engaged in a complex interaction of observation, word-of-mouth, lived experience or anticipation of biases within this unique learning environment that invariably influence their choices of career path.

While this deviates from the original intent of this research, of significance is the fact that these women are providing insight into their experience in a transitional environment. Less is known about women who are in transitional zones during their careers. This critical period ("transition zones") is defined in this paper as a period in time where formal membership in an organization is being considered and the individual is engaged in a process of exploration about the fit between self, environment and a desired future. The women in this study are in essence “free agents” and have not obtained or accepted full membership in the organization. Existing research involving career transitions focused primarily on accepted members within organizations that are changing careers (Ibarra, 2003); transitioning upward in their roles (Ibarra, 1999); managing dual roles (Boyatzis & Kram, 1999); or more specifically, leaving careers in order to create a life that is more meaningful or aligned with their identity (McKenna, 1997). Individuals in the postdoctoral juncture are not employed by an organization but are primarily funded through grants and are not afforded employment status including benefits.

This research therefore extends existing studies in two ways: 1) it involves participants in transition zones, and 2) individuals who are not accepted members of organizations. This study offers insight into the period prior to an individual obtaining full membership in an organization which is not just an adaptation process (Ibarra, 1999) but both adaptive and selective. This “adapting-selecting” process is unique to transition zones. Further research to study this adapting-selecting process involving individuals in transition zones would help contribute
significantly to the understanding and evolutionary nature of the experiences of women in science from graduate studies to established careers in this field.

**Implications**

Questions we asked that studying this particular transition zone may address. What is the impact on women’s lives when they work in environments that are in direct opposition to how a woman sees herself? Further, how does a male-biased culture influence women who are in the process of creating a professional identity?

This study focused on women in the postdoctoral stage of their career. We discovered that they project primarily three different paths: research, teaching and industry. What we don’t know is to what extent this experience influences their choice of path and does this experience carry over to influence them in their new environment. Further studies need to be conducted with women who have already established careers in each of these paths to determine if such experiences are still present or have evolved in anyway.

In order to understand the phenomena of the leaky pipeline it would be imperative to understand the individual and institutional forces at the postdoctoral stage and also which of these forces, or even new forces, might cause women to leave science from each of these paths. Perhaps the leaky pipeline is an interactive process which begins in the postdoctoral stage, or as research suggests, at an even earlier stage during their education as graduate students. It is more likely an interactive process of individual experience and sensemaking coupled with information or knowledge that they obtain either through observing the overall climate for women in science or by direct contact with individuals. The leaky pipeline may be impacted by the informal communication, or science “grapevine” whereby women are learning what is in store for them the longer they remain in science.
References


**FIGURE 2. DATA ANALYSIS PROCESS CHART**

START

TRANSCRIBED DATA (n = 24)

Selection of Subsamples

Subsample (Research) 3X

Outlining raw data (Highlighting)

Further reduction of data using syntax and words from the interviews

Develop Codebook (Label; Definition; Themes; Indicators; Examples)

Subsample (Teaching/Research) 3X

Transferred reduced data per interview to chart (organized by question)

Identified clusters based on reduced data on chart (IEF)*

Cluster verification and extraction of quotes

Created Matrix (using clusters)

Identify themes across each interview

Clusters verified?

Yes

No

Creation of emergent themes

*Note: IEF is an acronym representing the three clusters that emerged from the raw data: 1. Predominant Identity as a scientist; 2. Experience of the Environment; and 3. Projected Fulfillment