WORK AND LIFECOURSE OF WOMEN IN COMPUTER-RELATED PROFESSIONS IN THE UNITED STATES: A COLLECTIVE CASE STUDY OF TWO TIME PERIODS

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ABSTRACT

WORK AND LIFECOURSE OF WOMEN IN COMPUTER-RELATED PROFESSIONS IN THE UNITED STATES: A COLLECTIVE CASE STUDY OF TWO TIME PERIODS

by

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Women have been significant contributors in the computer field since computers were first built. They made up between 25% and 35% of the workforce in the computer-related occupations over the last 30 years. This represents a relatively high level of female participation when compared to other scientific/technical occupations. However, during the last 10 years there has been a drop in women entering Computer Science degree programs and an 8% drop in the participation of women in the computer-related occupations. This research study was an exploration of the participation and experiences women have had in the computer-related occupations. The study included not only the career decisions and experiences of individual women who have participated in these professions, but also set those career decisions and experiences in the context of the professions as a whole during the time periods studied. The interaction between overall occupational trends in a field and an individual's career decisions represents a complex set of dynamics. That interaction where the individual and the institution/culture interface is difficult to characterize effectively. Describing the phenomena can only be approximated. This study investigates the participation as well as career decisions and experiences of women in computer-related professional

occupations across 2 time periods. Because this approach takes a micro-perspective at the individual career level and a macro-perspective at the occupation level, 2 relevant theoretical areas, career development theory and labor economics, were used to create a framework for analysis. The methodology involved 2 case studies of women's participation and experiences in the computer-related professions set in 2 time periods. One case study was focused on women who entered the computer-related professions in the early-to-mid-1970s. The second case study was focused on women who entered those professions during the early-to-mid-1990s. The 1970s involved significant increases in the participation of women in computer-related occupations, and the 1990s involved a decrease in the participation of women in computer-related occupations. The inquiries included focus groups with women who entered these professions during those time periods. Other data for the 2 time periods included numerical data on occupations, occupational outlook and trends, occupation related articles, research, and reports. The results show that labor economics can explain to some extent the participation of women in computer-related occupations. Those labor economics theories are accompanied by career development theory that address career decisions made based upon perceived comparable attractiveness of an occupation. The data show that although there is a difference in the trends of female participation in these occupations over the 2 time periods, the women's career entry decisions were similar. For example, most of the women did not initially choose the computer field as a career.

Their work experiences have also been similar in that there are few other women in their work groups and they have few role models.

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CHAPTER 1 - INTRODUCTION

Purpose of Study

The first programmable computer was designed and built almost 60 years ago. This powerful new technology introduced fast growing occupational fields at a time when women were entering the labor market in larger numbers. From 1950 to 1999 the number of women in the U.S. workforce grew from 18.4 million to 61.1 million that represents an increase of 28.8% to 61.1% of women in the U.S. age 16 and over participating in the workforce. And the number of computer scientists/systems analysts and computer programmers grew from 254,000 in 1970 to 2,214,000 in 1999 (Bureau of Labor Statistics, 1999) - a phenomenal growth rate for this set of occupations.

The dramatic increase of women participating in the workforce reflects a time when women entered the workforce in greater numbers. Also, many of these women viewed their participation in the workforce as a lifelong commitment to their work careers. Today, there are many more women who have 30- to 25-year careers.

Female participation in the computer related occupations has varied up to a high of approximately 35% in the early 1990s. From 1990 to 1999 the number of people in the occupations has more than doubled and the female participation has dropped to approximately 27%. This decline in female participation has caused concern, not only

because of the low participation of women in the occupations, but also because there is a significant labor shortage in those occupations and the drop in participation of women further exacerbates that labor shortage.

Historically, there have been occupations that are predominantly male or predominantly female. This difference in the participation of a gender in an occupation impacts the ability of individuals participating in the workforce to chose and be successful in certain occupations. Gender-segregated occupations are those occupations populated primarily by one gender.

Bergmann (1986) analyzed the male/female participation in 335 occupations. After ranking the occupations by female participation, she found that the first 54 occupations employed almost 50% of the women. The 131 occupations at the end of the list employed almost 50% of the men. This study documents a distinct level of occupation segregation in the U.S. From this study, Bergmann (1986) described relatively well-integrated occupations as those with 30% to 50% women, and in 1986 those occupations employed about 17% of the workers of each sex. Scientific/technical occupations are generally recognized as being gender-segregated occupations. For example, in 1994 only 8.3% of the engineers were women (Bureau of Labor Statistics, 1995), making engineering a male dominated occupation. Computer-related occupations are classified as scientific/technical occupations; yet, for example, female participation in computer scientist/systems analyst occupations was 28% in 1999 (Bureau of Labor Statistics, 1999). Though not well integrated by Bergmann's

definition, still the computer related occupations are less segregated than many of the scientific/technical occupations.

The comparatively high female participation indicates these occupations approach gender neutrality. In this respect, computer-related occupations are unusual in relation to other scientific/technical occupations. Using Bergmann's definition of gender-segregated occupations, both computer analyst/scientist and computer programmer occupations are on the boundary between being male-dominated and well integrated.

Recently, there has been growing concern in the field because of a drop in the number of women entering Computer Science degree programs. In the 1993-94 academic year, 28.4% of the Computer Science bachelor's degrees were awarded to women. This is down from a high of 37.1% in the 1983-84 academic year (Camp, 1997, October). As Camp (1997, October) stated,

> Furthermore, while the percentage of bachelor's degrees awarded in CS to women decreased, corresponding percentages of other science and engineering disciplines increased. Since the number of women at the bachelor's level affects the number of women at levels higher in the pipeline and in the job market, these facts are of great concern.

This concern is indeed validated by the drop in the percentage of women participating in computer related occupations between 1990 and 1999.

The interaction between overall occupational trends in a field and an individual's career decisions represents a complex set of dynamics. That interaction where the individual and the institution/culture interface is difficult to characterize effectively.

Describing the phenomena can only be approximated. In this study, I have used the case study approach to describe individual career decisions through the experiences of two groups of women from time periods that are 20 years apart. This study investigates the participation as well as career decisions and experiences of women in computer-related professional occupations across those two time periods. Because this approach takes a micro-perspective at the individual career level and a macro-perspective at the occupation level, two relevant theoretical areas, career development theory and labor economics, were used to create a framework for analysis.

Importance of the Study

Women have entered the labor market in increasing numbers during the last few decades. The percentage of the workforce that is women in the U.S. has increased from 29.8% in 1950 to 46.6% in 1999 (Bureau of Labor Statistics, 1999). Women entering the labor market have also expanded their occupational and professional goals to fields traditionally non-female. One of those career fields is the computer field.

The field is relatively young and has been a high growth field at the same time large numbers of women entered the workforce. Labor studies show that high growth fields attract new workforce members (Donato, 1990). And so, it could be assumed that women would be drawn to this new and growing occupational field. For example, at SAS Institute, a software development company, 50% of the professional staff and 42 % of the managers are women (Culotta, 1993, April 16). In contrast, the field is in an occupational area (scientific/engineering) that has had and continues to have a disproportional low number of women. In addition, recently there has emerged a concern about the drop of young women entering Computer Science degree programs and a drop in the participation of women in these occupations. The alarming rate in the drop of women participating in the computer related occupations brings concern particularly since the occupations are hovering around the boundary Bergmann (1986) defined as a well-integrated occupation. The work dynamics of women working with fewer female colleagues impacts the individual's work experience. If these occupations

continue to decline in female participation, then the work environment of the women in computer related occupations would probably become less hospitable.

In addition, these occupations are experiencing a significant labor market shortage while at the same time not attracting female participants at the same rate as in earlier decades. If more women could be attracted to these occupations, some of the labor market shortage could be alleviated.

Relevant Theoretical Areas

The study encompassed career development theory and labor economics.

- The study of *career development* for women is inherently complex. As more women entered the labor market the focus shifted from "women oriented toward homemaking versus careers" to "traditional versus nontraditional careers and identifying career patterns for women." Career development theorists also believe women's careers remain different from men's. For example, Gutek and Larwood (1989) proposed the following reasons for the difference.
  - Differential expectations for men and women regarding the appropriateness of jobs.
  - Differential accommodation of husbands and wives to each other's careers.
  - Differential definition of parent role for men and women.
  - More constraints for women in the workplace.
- The field of *labor economics* studies the dynamics of the labor market using a set of mechanisms for a supply/demand market. Labor economics contributes theories on discrimination in the labor market and the resultant occupation segregation. It also contributes the theory that high growth occupations will attract new labor sources (Donato, 1990).

Research Objective

The research objective is to better understand why women entered the field and what their experiences have been; and to identify trends in women participating in computer-related professions, if there are any. Concern continues regarding women not entering and successfully participating in scientific/technical careers. Even in the computer-related professions fewer young women are entering computer science degree programs. The number of women obtaining computer-related undergraduate degrees has dropped by 50% since its peak in the 1980s (Camp, 1997, October), and the percentage of women obtaining doctorates has remained level at 13% annually (or approximately 90 women nationwide) since 1980 (Klawe & Leveson, 1995, January). In addition, from 1990 to 1999 the percentage of female participation in the computer scientist/analyst and computer programmer occupations have dropped from 34% to 28% and 36% to 26%, respectively (Bureau of Labor Statistics, 1999).

I am interested in the computer-related professions in relation to dynamics of women participating in those occupations. My research question is:

What are the experiences of women in two distinct periods in the development of computer-related professions – early-to-mid-1970s and early-to-mid-1990s?

This dissertation framed the research findings through two theoretical frameworks – career development theory and labor economics. The research approach was two case studies focused on the participation of women in computer-related occupations during

two time frames – the early-to-mid-1970s and the early-to-mid-1990s. These case studies were designed to investigate the career decisions and experiences individual women have had in those occupations, to identify and participation of women in computer-related professions, and to explore the intersection of individual women in computer-related professions and those professions.

CHAPTER 2 – REVIEW OF RELATED LITERATURE

Introduction

This chapter presents a literature review of the two theoretical areas that were used in the analysis of the research data. The theoretical areas include career development theory and labor economics. This review focuses on how those two theoretical areas describe and interpret women's participation in the workplace – in particular in relation to occupations with a low percentage of female participation. Next, the chapter addresses research that specifically applies to women in computer-related professions.

A summary of the literature review then follows. This summary highlights key points in the literature and identifies areas that need to be studied. Finally, the statement of the problem is presented in relation to the literature reviewed. The statement of the problem points out how the proposed research focused on aspects of the issues identified in previous sections of this chapter.

Career Development Theory

Osipow (1983) identified five broad approaches to career development theory. Those approaches are:

1. *Trait-factor theories* – assumes matching an individual's abilities and interests with vocational opportunities. Once the match is accomplished the vocational choice for that individual is complete.
2. *Sociology and career choice* – assumes the social environment significantly affects an individual's career choices. This approach tasks the individual to develop coping techniques to deal with the environment.
3. *Developmental/Self-concept theory* – holds that an individual develops a self-concept and a view of occupations. The person's ability to make appropriate career choices is impacted by the degree he/she accomplishes these developmental tasks and the views developed approach real life.
4. *Vocational choice and personality theories* – advocates that individuals choose a career to meet their personality needs.
5. *Behavioral approaches* – explores the interaction of individuals in their environment in a behavioral mode.

This discussion of career development theory focuses on the sociology and career choice approach. It explores women's career development and how it differs from

traditionally assumed career development, and it addresses career development in relation to occupational segregation – in particular in scientific/technical fields.

Women's Career Development

The study of career development for women is inherently complex. As more women entered the labor market, the focus shifted from "women oriented toward homemaking versus careers" to "traditional versus nontraditional careers and identifying career patterns for women." This shift reflects the changing career expectations of women in our society. Women have entered the labor market in larger numbers and are more likely to remain in the workforce for significant parts of their lives. This trend results in more women pursuing lifelong careers in their chosen occupations.

With growing numbers and the larger overall percentage of women in the workforce, women's career choices and career opportunities affect significantly not only their own careers, but also society as a whole. In the past, women of childbearing age (16- to 44-year-olds) did not participate as much in the workforce because of family responsibilities. However in 1992, 70% of the women in the workforce and over a third of the overall workforce was made up of women of childbearing age (Bureau of Labor Statistics, 1994, April).

As stated before, career development theorists believe women's careers remain different from men's for the following reasons – (a) differential expectations for men

and women regarding the appropriateness of jobs; (b) differential accommodation of husbands and wives to each other's careers; (c) differential definition of parent role for men and women; and (d) more constraints for women in the workplace (Gutek & Larwood, 1989).

The primary basis of different career development theories for men and women involves (a) inequality of career opportunities and (b) different expectations regarding family responsibilities. Two career development theories designed to account for women's careers include Astin's model (Diamond, 1989) and Larwood and Gutek's model (1989).

Astin's model reflects four major constructs: (a) motivation, (b) work expectations, (c) sex-role socialization, and (d) the structure of opportunity. This model is designed to explain occupational behavior (Diamond, 1989).

Larwood and Gutek (1989) proposed a model that incorporates five components in a decision matrix. The five components are (a) career preparation, (b) opportunities available, (c) influence of marriage, (d) pregnancy and children, and (e) timing and age.

These models differ from traditional career development theories based on career paths of men. Larwood and Gutek (1989) generalized traditional career development theories as identifying four career phases: (a) education and exploration, (b) identification and establishment, (c) maintenance and stagnation, and (d) disengagement and retirement. The traditional model presents a linear approach that maps a

progressive career development. Astin's model approaches career development through explaining occupational behavior based on internal and external factors. It does not present phases, but rather a model by which actions can be analyzed and understood. Larwood and Gutek, on the other hand, presented a model that explains or predicts career development using a set of decision points made at different times of one's life.

Larwood and Gutek (1989) suggested that given the changing lifestyles and the increased divergence in men's career paths their theory may be more generalized and relevant to both men and women than the previous male oriented theories.

Also, women face the "glass ceiling" throughout their careers. Ann Morrison, Randall White, and Ellen Van Velsor, and the Center for Creative Leadership (1992) conducted an extensive study of the lack of women achieving higher level management positions in organizations despite having the prerequisite job skills and experience. The glass ceiling is particularly insidious because of the cumulative effects of small differences in promotions and income increases across the span of a woman's career.

Women in Scientific/Technical Occupations

As stated before, career development research has more recently focused on "traditional versus nontraditional careers and identifying career patterns for women." Scientific/technical occupations are among the nontraditional careers for women.

Career development in technical fields usually consists of two tracks – technical and management. Both tracks start with junior level technical positions that lead to

technical specialties. The management track leads to technical project lead positions and finally general management positions. The technical track follows a technical series of positions. Career growth and development for the technical track is accomplished through working in varied specialties. Although some technical project leadership may be included, technical career growth is measured more in technical difficulty of projects and knowledge depth in multiple specialties. These two tracks are reflected in Schein's (1990) career anchor categories – technical/functional competence and general managerial competence.

Scientific/technical occupations have historically required significant work commitments in order to advance. Women scientists have often cited work expectations as being a factor in women's slow advancement in those fields. Because women generally have home and family responsibilities, they do not have the same time to commit to their work that has been traditionally expected. Although more women participate in scientific occupations, they remain divided into subgroups following the "traditional male path" or the "relational female path." The traditional male path requires a woman to dedicate herself to research and work often postponing marriage and family, and to ascribe to the belief that women have to be better than men in order to succeed. The relational female path is an alternative model that promotes a collegial and supportive research environment and strives to achieve balance between career and family. This division dissipates the ability women may have to influence the way work

is conducted and recognized in these occupations (Etzkowitz, Kemelgor, Neuschatz, Uzzi, & Alonzo, 1994, October).

The scientific/technical occupations also suffer from the era – 1940 through 1970 – when women were marginalized in those occupations (Rossiter, 1995). It was difficult for women to obtain employment in the scientific/technical occupations. Once employed, they were often relegated to research associate positions. Marriage and child care responsibilities hindered their ability to fully compete. Organizations, both private and nonprofit, perpetuated the systematic discrimination through hiring and employment practices that disadvantaged women. This legacy continues to affect the number of women who enter and remain in scientific/technical occupations.

There is also a recognized need to encourage more young women to enter these occupational fields. The American Association of University Women (1992) reported that even girls with high aptitude for math and science are less likely to pursue studies in science and technology than their male counterparts.

In general, career development of women in scientific/technical occupations begins with low numbers of young women choosing those occupations. Their career paths then branch depending upon commitments to career and family. In addition, for many of the women the glass ceiling plays an ever-present part in their ability to advance in these occupations.

When looking at a woman's career in the scientific/technical occupations using Larwood and Gutek's (1989) model, the five components can significantly impact her career in the following ways:

1. *Career preparation* – girls and young women historically do not enter scientific/technical degree programs in large numbers. Because of the low numbers of women faculty in many science and engineering programs, young women do not have women as role models. Women have higher dropout rate than men in graduate level scientific and engineering programs.

2. *Opportunities available* – women continue to have fewer opportunities than men in these occupations. For example, few women have tenure at universities. The job market for academic positions is becoming tighter, making it more difficult for women to get academic jobs.

3. *Influence of marriage* – marriage influences geographically where a woman is willing to work. More women apply for positions in large urban areas where both husband and wife can find employment.

4. *Pregnancy and children* – the scientific/technical occupations historically have required long workdays for people to achieve advancement. Women, generally, have primary responsibility for child care and are not able to work the expected long hours.

5. *Timing and age* – women who take extended leaves to care for young children are likely to experience significant setbacks in their careers. This is not only because of career paths, but also because of the fast moving technology. Skills in these occupations need to be constantly updated. If a woman leaves work, when she returns she will need to learn new skills.

Scientific/technical occupations are competitive and fast moving. The career paths in these occupations have been built on a traditional male model that requires long hours and commitment to the field of study. Institutions, both corporate and non-profit, continue to lag in hiring and promoting women in these occupations. The educational systems – K-12, undergraduate and graduate levels – have not supported girls and young women in aspiring to scientific/technical occupations.

Although slow change can be acknowledged, the overall system continues to promulgate a traditional male model for career aspiration, training, hiring, and advancement. Because of these factors, Osipow's (1983) third approach to career development theory – sociology and career choice – is most appropriate when studying scientific/technical careers. The approach assumes the social environment significantly affects an individual's career choices. This approach tasks the individual to develop coping techniques to deal with the environment. Women who enter and work in scientific/technical occupations reflect the need to deal with the environment as being a primary component to their career development (Etzkowitz et al., 1994, October).

Labor Economics

Labor economics is a subset discipline of economics. It studies the dynamics of labor through the definition of a labor market. The basic assumption that governs labor economics studies is that the labor market is a supply and demand market. The employers represent the demand side of the market, and the employees represent the supply side of the market.

Wages and other compensation paid the employees represent the price set for labor services obtained. Wages are determined in the supply/demand model by level of demand on the part of employers and availability of supply on the part of employees. Lower wages can be set if there is an overabundance of workers for a particular job category or if there is little demand for a particular skill. Higher wages, on the other hand, are set when there is a scarcity of workers or when there is a high demand for labor.

This simple model is then elaborated on by including other factors, for example,

- Definition of levels of labor service that account for skills brought to the job or education obtained by the employee – human capital.
- Compensation not included in wages like vacation, medical benefits, etc.
- Job attractiveness in relation to safe and clean work environments.

Many labor economists support the supposition that a free labor market, meaning a market not constrained by regulation or other artificial bounds, will seek the

supply/demand wage levels producing the highest market efficiency. This means that in an unbounded market wages will follow the levels of supply and demand to achieve the optimum. The optimum level is called the labor market equilibrium. For example, if a factory needed more workers to produce products, the employer would raise the wages to attract additional workers. This is tempered by the employer's drive to maximize profit. Thus there is a limit by which the employer can raise wages to add employees and still make a profit. As this limit is approached the marginal revenue of labor diminishes for each additional worker.

Not all jobs are the same and not all workers have the same skills. As a result the labor market is segmented. Different jobs are categorized, and workers are classified based on factors such as skill, education, experience, etc. The labor market can be categorized by industry (e.g., automotive, finance, or computer industries). Jobs can also be categorized by the work performed (e.g., accountants, computer programmers, or doctors). Some job categories can cut across multiple industries. For example, computer programmers can work in different industries, because they write software to support business functions in specific industries.

The study of labor economics involves a complex set of factors, and covers a wide range of research and theory. This research study focuses on women in the labor market and the labor market research and theories that address the special issues of women participating in the labor market. In particular, it focuses on labor economics theory involving discrimination and equal opportunity.

Women in the Labor Market and Discrimination

Historically, the labor market, as defined by wage paid labor, was made up primarily of men. Women have entered the labor market in increasing numbers during the last few decades. In 1999, women represented 46.6% of the U.S. workforce (Bureau of Labor Statistics, 1999) – almost 50%.

The increased participation of women in the labor market as wage earners has highlighted labor market inequities for these new workers. Women earn less than men – even after years of market participation and with almost equal education levels. In 1998, women's wages were 76.3% of men's (Bowler, 1999, December).

"Discrimination occurs whenever someone's opportunities are not based on his or her individual capabilities but are limited because of membership in a group" (Reynolds, Masters, & Moser, 1986). In a labor market free of discrimination, unequal pay would generally be the result of unequal productivity among workers. However, in labor markets today a level of discrimination plays a role in the pay differential between men and women and between Whites and minorities.

Reynolds et al., (1986) identified sources of discrimination in labor markets. These sources include: (a) personal preference or prejudice; (b) imperfect information; and (c) market power.

Personal preference or prejudice occurs when employers, workers, or customers do not want to associate with certain workers because of race or sex. *Imperfect*

information impacts job opportunities for some people. For example, an employer may be reluctant to offer a job that involves a high level of training to a woman because of the belief that she may leave her job to follow her husband to another location or to care for young children. These decisions are often made with imperfect information about the individual, but rather generalized statistical information on a group. *Market power* is a source of discrimination when a dominant group of workers excludes another group of workers therefore forming a monopoly. This form of discrimination can occur when a group regulates membership such as union membership or licensing of an occupation.

Differences in pay reflect a level of discrimination. However, discrimination may not account for all differences in pay (Ehrenberg & Smith, 1988). Some pre-market conditions include:

1. Market-work-life of a woman historically has been shorter than that of a man.
2. Because of traditional home responsibilities, women are less likely than men to work overtime or to choose occupations that offer jobs with high pay but long hours.
3. Historically, wives have tended to "follow" husbands when the husband decides on the geographic location of their jobs, and therefore the wives are not likely make the most beneficial decisions for their own careers.

Ehrenberg and Smith (1988) categorized theories of discrimination into two major categories: (a) power models that assume a noncompetitive environment; and (b) orthodox theories that have trouble explaining continuing discrimination.

In summary Ehrenberg and Smith stated:

> It would thus appear that all models of discrimination agree on one thing – any persistence of labor market discrimination would be the result of forces or motivations that are blatantly noncompetitive or very slow to adjust to competitive forces. While no one model can be demonstrated to be superior to the others in explaining the facts, the various theories and the facts they seek to explain suggest that government intervention could be useful in eliminating the noncompetitive (or sluggish) influences. (Ehrenberg & Smith, 1988, p. 560)

Occupational Segregation

Although women now make up a large portion of the market, the wage differential between men and women indicates that discrimination adversely affects women's success in the market. Occupational segregation is an outgrowth of labor market discrimination and is a mechanism by which discrimination is expressed in labor markets. Occupational segregation is the grouping of individuals in particular occupations based upon characteristics such as gender. It is a physical separation and therefore easier to identify and measure than discrimination as a whole.

Occupational segregation by gender is a recognized characteristic of labor markets. For example, women make up 90% of the secretaries in the U.S. and men make up 90% of the judges. In addition, women are predominantly grouped in only 16% of the occupations, and those occupations are traditionally low paying (Bergmann, 1986).

Bergmann (1986, p. 71) described relatively well-integrated occupations as those with 30-50% women. In her 1986 studies, she identified

- 16.1% of the occupations as being female-dominated (more that 76% female) and 49.87% of the women in the workforce in those occupations.
- 11% of the occupations as being well-integrated (between 30-50% female) and 17% of the women in the workforce in those occupations.
- 40% of the occupations as being male-dominated (more that 83% male) and 4.76% of the women in the workforce in those occupations.

Another labor market dynamic that occurs in relationship to occupational segregation is the revolving door phenomenon (Jacobs, 1992). Jacobs' research revealed that the actual number of women entering male-dominated occupations exceed the tabulated increases. His findings show that retention of women in those occupations is low. Therefore, although 10 women may enter a male-dominated occupation during a year, 9 women will probably leave, resulting in a net increase of only one. In order to accomplish better integration of men and women in the workplace, it is important to not only increase the number of women entering male-dominated occupations, but also to focus on retention of women already in those occupations.

Strober (1984) developed a general theory of occupational segregation that addressed how an occupation becomes segregated. Her theory assumed:

1. Social norms as well as profits influence employers' hiring decisions.
2. White males are given first choice for new occupations.
3. Choices made by these men are made to maximize their economic gain.

Strober's theory of occupational segregation is founded in the power category of theories of discrimination described by Ehrenberg and Smith (1988). This leads to the assumption that there is a noncompetitive environment and that normal functions of a free labor market will not remove this form of discrimination.

High Growth Occupations and New Labor Sources

Labor economics also supports the theory that high growth occupations will attract new labor sources (Donato, 1990). Labor economics tempers this assumption with constraints on matching: (a) education and skill requirements with education and skill levels of applicants, and (b) job status and wage levels with status and wage levels of the labor source. In other words, a high growth field with a high status and high wage level will not draw entrants from substantially lower level status and wage labor markets.

This theory supports the entry of women into certain occupations. For example, a high growth occupation that has historically been male-dominated will experience more

female entrants when there are not enough men in the labor market to meet the demand. This theory helps explain what happened in the decade between 1970 and 1980 in the systems analyst occupation. Positions in that occupation almost doubled between 1970 and 1980. Female participation in the labor market increased from 33.4% to 38.1% (Bureau of Labor Statistics, 1994, April). Female participation in the systems analyst occupation tripled from 14,658 in 1970 to 45,511 in 1980, a percentage increase from 13.6% to 22.5% for all systems analysts (Donato,1990). In other words, that occupation was a high growth occupation at a time when the participation of women in the labor market was increasing significantly. As a result, more women entered that occupation than would have been expected under normal conditions.

Women in the Workforce and Equal Opportunity

There has been a significant growth of women participating in the workforce over the last few decades. Much of the increase is the result of more women with children joining the labor market. Despite the growth of participation, there continues to be discrimination in pay and access to opportunities. Unequal opportunities begin with unequal educational opportunities, progress to unequal hiring opportunities, and continue with unequal promotion opportunities. Unequal educational opportunities are reflected in low numbers of women training for certain occupations.

Once in the labor market, women find their choices more limited. Positions are difficult to find because the positions are either not advertised at all or the organization's recruitment methods are not focused on recruiting women.

Finally, women face the glass ceiling throughout their careers (Morrison et al., 1992). In a U.S. Department of Labor report, Pipelines of Progress (1992, August), the following statement was made:

> This report is also a good news, bad news document. The good news is that the participation rates of minorities and women in corporate management has improved. The bad news is that surveys in the corporate world do not point to an optimistic future unless commitments to positive change are sustained and enhanced. This report abounds with anecdotal evidence showing the glass ceiling barriers can be removed. It also demonstrates that the Department's enforcement effort must continue to be a critical component of the strategy to remove such barriers. But the report also underscores the fact that the challenge to shatter the glass ceiling takes far more time and effort than even the strongest of commitments can produce in one year (1992, August, p. 4).

Legal Basis of Women's Employment Rights

Laws provide the regulatory basis on which agencies such as the Department of Labor can act. Laws also have the potential to support or deter social change. Laws can reflect the generally accepted norms of a society, or they can influence the creation of new norms. In addition, laws are interpreted – first, by a regulatory agency in how it determines to enact the code; and second, by the judicial system in how it rules on cases brought to court.

Laws provide the legal basis of women's employment rights. They enable agencies to develop programs to assist women, and they enable women to seek redress when they are discriminated against (U.S. Department of Labor, 1992). Table 1 presents chronologically the federal laws enacted that affect women in the workplace.

Table 1

Federal Laws Affecting Women in the Workplace in Chronological Order

Federal Law or Act	Purpose	Date
1960s		
Equal Pay Act of 1963	Amended the Fair Labor Standards Act to prohibit pay differential based on sex.	1963
Title VII of the Civil Rights Act of 1964	Provides structure to address discrimination based on sex, race, color, religion, and national origin in employment.	1964
1970s		
Executive Order 11246	Prohibits employment discrimination by Federal contractors and subcontractors.	1970
Employee Retirement Income Security Act (ERISA)	Ensure minimum standards for private retirement plans.	1974
Title VII of the Civil Rights Act of 1964 (amended in 1978)	Prohibits employment discrimination based on pregnancy.	1978
1980s		
Job Training Partnership Act	Provides job training and supplemental support of individuals living at or below the poverty level.	1982
Retirement Equity Act (REA)	Insure payment of retirement benefits.	1984
1990s		
Displaced Homemakers Self Sufficiency Assistance Act	Provides grants to supplement state programs for displaced homemaker job training.	1990
Civil Rights Act of 1991	Amends the Civil Rights Act of 1964 to add the right to a jury trail and monetary awards in cases of employment discrimination.	1991
Family and Medical Leave Act	Provides employees ability to take leave.	1993

Affirmative Action

"Affirmative action is planning and acting to end the absence of certain kinds of people – those who belong to groups that have been subordinated or left out – from certain jobs and schools" (Bergmann, 1996, p.7). Those who support affirmative action without numerical goals ("soft" affirmative action) advocate organizationally defined affirmative action programs. Those who support affirmative action with numerical goals ("hard" affirmative action) reference the slow change over the last few decades in regard to equal employment opportunity. They define equal employment opportunity to include the reduction of occupational segregation and unequal pay. Occupational segregation has decreased some in recent years as women enter more professions such as law and medicine. However, occupational segregation remains a major contributor in employment inequality. Women still occupy lower income occupations in large numbers. Their incomes reflect the disparity – women earn 76 cents for every dollar men earn (Bowler, 1999, December).

Data from different corporations show affirmative action programs in those organizations that have vigorously applied the program have been successful. However, there continues to be many organizations that have not addressed the issues, and those organizations continue to have segregated sectors in their workplaces (U.S. Department of Labor, 1992, August). Without more aggressive governmental programs, those organizations will probably continue as they have in the past.

Women in Computer-Related Professions

Many of the first computer programmers were women. It was believed that women were best suited for this kind of work because of the need for intense attention to detail and long hours of concentration. Also because programmable computers were first developed during World War II, there was a shortage of men to do this work. Some of these early women programmers became well known. Admiral Grace Hopper, U.S. Navy, has been recognized as a leader in software development and is best known for her leadership in the development of programming languages. She was named the first "Computer Sciences Man-of-the-Year" in 1969. Despite the early integration of women in computer-related occupations, women's participation in these occupations dropped during the years after World War II, increased until the 1990s, and then declined until recently.

Computer-related occupations include many different types of jobs – from data entry and computer operators to systems analysts and computer scientists. Because computers have become ubiquitous in the workplace, many occupations now require computer skills. For example, researchers in any field need to be able to use data analysis programs to analyze their data. I will use a specific definition of computer-related professions for this discussion. In this case computer-related professions are those professions that exist to enhance the design and usage of computerized systems. This includes the design of the hardware, the development of operating systems and subsystems, and the analysis and programming of application software. The first two

activities are generally confined to the computer industry or research organizations such as universities. The third activity can occur in almost any industry. This means systems analysts and programmers are employed in industries as diverse as health care, transportation, retail trade, banking, and insurance. In addition, state, local, and federal governments employ computer professionals.

Over the almost 60 years of the existence of computers, computer-related professions have been dynamic as the technology changes. At first, there were only computer designers and programmers. As the use of computers expanded, systems analysts were needed to interpret business functions into requirements and systems design so that computer programs could be written to perform those functions and be integrated into the existing business systems.

As noted in the National Research Council's (1993) report on computing professionals, it is difficult to identify specific job titles for computer professionals. Today, computing professional jobs include titles such as, software engineer, systems engineer, computer scientist, computer programmer, systems analyst, data modeler information engineer, software test engineer, etc. Each title denotes distinct job characteristics and requires specialized training. Because the census bureau recognizes only a few major categories of computer-related occupations, this study will focus on the bureau's computer scientist/systems analyst and computer programmer categories. Each of the above-mentioned titles fits within one of those two categories. Despite my limited definition for the computer-related professions, these professions are widespread

across multiple industries and remain fluid in response to the rapid changing technology.

Women have participated in the computer-related professions to varying degrees depending upon the industry and the job classification. Strober and Arnold (1987a) conducted a study of women in the computer field in 1985. The study included an analysis of women's participation in six major computer-related occupations and in high-tech industries; and an examination of earnings in three computer-related occupations. Their findings included:

1. Computer-related occupations are not gender-neutral.
2. Occupational segregation level was approximately the same in 1970 and 1980 (except for computer operators).
3. The higher the status and pay of the computer-related occupation, the higher percentage of White males were present.
4. Women fared worse within high-tech industries than in other industries.
5. Women earned less than men, and this generally did not change from 1970 to 1980.
6. This earning differential did not change when level of education, age, and high-tech versus non-high-tech industry was held constant.
7. Women were more likely to be found in the end-user industries than in the computer manufacturing industry.

Donato (1990) supported Strober and Arnold (1987a) in her research of systems analysts occupations. She found that the number and percentage of women systems analysts and scientists had significantly increased from 14,658 women (13.6%) in 1970 to 45,511 women (22.5%) in 1980. Donato attributed this increase to an increased demand for systems analysts that outstripped the male labor market, a decline in occupational rewards resulting in a decline of men seeking systems analysts positions, and an occupational change that focused on more people skills. Donato also found that although systems analysts positions provided women with higher rewards than traditional female jobs still women systems analysts tended to be in the lower paying industries and lower status positions within the occupational field. She summed her findings up by stating that her research suggests mixed progress for women computer specialists.

Camp (1997, October) noted a low level of participation of women faculty in Computer Science PhD-granting degree programs. She cited that the Computer Research Association's Taulbee Survey (Andrews, 1997, March) showed women represented only 15.6% of the assistant professors, 9.4% of the associate professors, and 5.7% of the full professors during the 1993-1994 academic year. This supports Donato's finding of women more likely being in lower status positions.

Recently, an additional dynamic has begun to impact the participation of women in computer-related professions. The number of women obtaining computer-related undergraduate degrees has dropped by 50% since its peak in the 1980s (Camp, 1997,

October), and the percentage of women obtaining doctorates has remained level at 13% annually (or approximately 90 women nationwide) since 1980 (Klawe & Leveson, 1995, January)

Fisher, Margolis, & Miller (1997) reported their research on the experiences of undergraduate women in Computer Science programs. One finding from their research showed that men cited an intrinsic interest in computers as the primary reason for entering the field. Women from the U.S. also cited interest as a primary reason, but also cited experience and promise of the future of the field for career growth. This finding indicates that these young women considered personal interests and occupation socioeconomic factors when making career decisions. The researcher's findings will also contribute to better understanding what women's experiences are in Computer Science degree programs with the intent to tailor those programs to encourage more female participation.

A National Research Council (1993) workshop on computing professionals reflected this concern in one of its conclusions that more effective efforts be made to attract more diverse people to computing professions. The workshop participants noted that participation in these professions by women, in particular, has been declining. And more recently, the President's Information Technology Advisory Committee noted in their February 1999 report that the information technology labor market is experiencing a market failure where there are not enough trained people to fill the positions. One of their recommendations was to "expand the participation of underrepresented minorities

and women in computer and information technology careers" (President's Information Technology Advisory Committee, 1999, February).

Like Donato, I find the data and the research reflect mixed progress. Where women in individual situations may progress, still there are pockets of significant pay differentials and job segregation. And like the National Research Council's workshop participants, I agree that additional research needs to be conducted on the participation in women in computing professions.

Summary of Review

There are different approaches to career development theory. This review explored the sociology and career development approach that proposes that career choices are influenced by the social context. The social context includes factors such as gender, race, and class. The social context also includes economic factors such as the job market and the current economy. As a result, career choices represent a combined consideration of personal interests and abilities, and socioeconomic factors.

The increased entry of women in the workforce has also changed career development theory. Women have different career structures than the traditional careers of men, as shown by Gutek and Larwood (1989). As a result, career development in general is being rethought. This is not only true for women, but also for men, since family and household responsibilities are more and more shared by both women and men. This shift represents an example of how society shapes individual career decisions and how individual career decisions (e.g., women entering the workforce) shapes society.

Labor economics describes a mechanism by which the labor market functions. The supply/demand market definition is the basic construct by which labor market theories are developed. This review focused on research conducted in labor economics addressing factors in the labor market that particularly affect women in the workplace.

These factors include discrimination in the labor market, occupational segregation, and equal opportunity.

There is a significant linkage between labor economics theory and the macro-level (or socioeconomic level) of career development theory. Labor economics' goal is to explain characteristics of the labor market and identify the contributing factors that affect it. The macro-level of career development theory intent is to describe how individuals make decisions given the socioeconomics of different careers. Each strives to describe the same phenomena, although each has different intents and a different level of focus. Labor economics strives for understanding in order to learn the mechanics and be able to better control the phenomena. Career development strives for understanding in order for individuals to make better decisions during their work lifecourse.

The macro level of career development theory takes into account job market and current economy; broad occupational characteristics; projected job skill requirements; and gender, race, and class. I will analyze each of these areas in respect to how labor economics contributes to them to show the linkages between the two fields.

1. Information related to *job market and current economy* is a product of labor economics. Data are collected, and then using labor economics models of analysis information are provided for individuals, organizations, and policy makers to use in decision-making. For example, an individual when making a career decision could

use this information to understand growth in different career fields and industry segments. If the job market is tight, a person would choose to stay in his/her current position rather than try to find a new job in a tight market.

2. Labor economics also provides much of the information used in defining the *broad occupational characteristics* of particular occupations. Labor economics provides information such as growth, salary trends, and gender and race makeup of the occupation. Other broad occupational characteristics include working conditions, unionization, basic education and skill requirements, and career growth opportunities.

3. Labor economics does not directly to contribute understanding *projected job skills requirements.*

4. Labor economics models regarding discrimination in the labor market facilitate the identification of *gender, race, and class* discrimination effects on different occupations. In particular, occupational segregation defines one outcome of discrimination in the labor market. This information is used in career development to inform individuals (particularly women) of occupations that are more favorable toward them.

I would characterize the general relationship of career development and labor economics as a use and information relationship. Career development uses labor economics findings to provide individuals with information regarding job

characteristics and opportunities. Career development focuses on individuals and how they can make better career-related decisions. Labor economics focuses on the general labor market and how that market functions. So another relationship is a systems relationship of individual actions (career decisions) and broad systems functioning (labor economics).

Career development theory translates the different expectations of individuals into operationally how they manage their careers. Career development is an area of study that takes the generalized experiences of a group and interprets those experiences to help individuals make sense of their own career decisions and experiences.

Labor economics describes labor market activities in the aggregate and is studied to better predict market trends and future markets. However, a side benefit is that these descriptions of how the labor market functions provide a better understanding of the social influences on individual career decisions. For example, past career development theory refers to a sociological influence on career decisions as being identification of sex roles. In today's society, this can be better described in labor economics terms as an individual's response to recognized occupational segregation by gender in the workplace.

When studying the participation of individuals in a particular occupation, career development theory provides a basic understanding of how individuals made their career choices. However, for certain populations in some occupations phenomena

described through labor economics provide additional understanding of career choices. For example, viewing career decisions through the perspective of labor economics' occupational segregation construct enhances understanding the dynamics of the participation of women in scientific/technical careers.

Career development theory and labor economics have significant interaction and overlap. If you look at the two areas of study from the viewpoint of the locus of research, you find that career development theory uses the output of labor economics to develop theories that help enable individual women to make informed and reasoned career decisions.

Labor economics uses aggregated data from the labor market to develop theories that help government and employment decision makers make decisions regarding policy and laws that affect the labor market. The part of labor economics that is focused on women in the workplace develops theories that are used by both labor economics in general and career development theory to improve the ability of women to participate equally in the labor market.

There are researchers in both fields whose primary research focus is on women and the specific concerns of women. The research reaches different levels of intent. Some research focuses on the individual and is intended to enable an individual to better interpret her environment. For example, discrimination is a recognized phenomenon in

the labor market. The research explores how discrimination is expressed and helps women recognize discriminatory actions in their everyday lives.

Other research focuses on society or institutions and is intended to inform social change. For example, discriminatory actions in the labor market affect the participation of women in certain occupations, causing occupational segregation. The research explores that manifestation of discrimination with the objective of informing policies such as affirmative action.

Career development theory seeks to enable people to make informed and reasoned choices, and labor economics aggregates those career choices to identify patterns. Table 2 summarizes the two theory fields by generalized objectives, inputs, and outputs.

Table 2

Summary of Two Theory Fields

Theory Field	Objectives	Inputs	Outputs
Career Development Theory	-Enable individuals to make informed and reasoned career decisions	-Individual experiences -Labor market data	-Identified career patterns to better understand effects of certain decisions. -Interpreted labor market information to use for career decisions
Labor Economics Theory	-Balance the labor market to optimize the economy and the workforce	-Participation data on the labor market	-Identified labor market characteristics, such as, participation, discrimination, occupational segregation, market shortages or surpluses

Discrimination is a construct defined in labor economics theory. Discrimination in the workplace as a systemic issue, and occupational segregation is a mechanism of discrimination. Career development theory, on the other hand, translates the different expectations of women into operationally how they manage their careers. Career development is an area of study that takes the generalized experiences of a group and interprets those experiences to help individuals make sense of their own career decisions and experiences. These areas of study provide a framework for research and analysis that addresses multiple levels.

Research on women in computer-related professions, such as Strober and Arnold (1987a) and Donato (1990), have primarily focused on a macro-level to identify dynamics in the occupations. Other research, such as Etzkowitz et al. (1994, October), explored the individual career experiences of women scientists. Each provides an important perspective, though none addresses nor explores the integration of the two levels, in particular, the participation of women in computer-related professions.

Statement of the Problem

The computer field is young. There are women still alive who were pioneers in the field. A study of women professionals in the computer field would provide a valuable case study of the experiences of women in a traditionally non-female occupational category that has relatively higher female participation than other scientific/technical professions. The Communications of the ACM's special issue on women in computing (Klawe & Leveson, 1995, January) reported that there has been no comprehensive study of women in industry or government computer-related occupations. In addition, efforts have been initiated to encourage more young women to enter scientific/technical occupations. This study provides educators, employers, and policy makers involved in those efforts with insights into the experiences of women computer professionals as the programs are designed and implemented to increase the participation of women in scientific/technical occupations.

The Research Question

As I look at what I studied in the literature, the following model is suggested. The model (Figure 1) depicts two factors "high growth occupations attract growing labor market sectors" and "computer-related field is nontraditional for women" contributing to the result, "women in computer-related occupations."

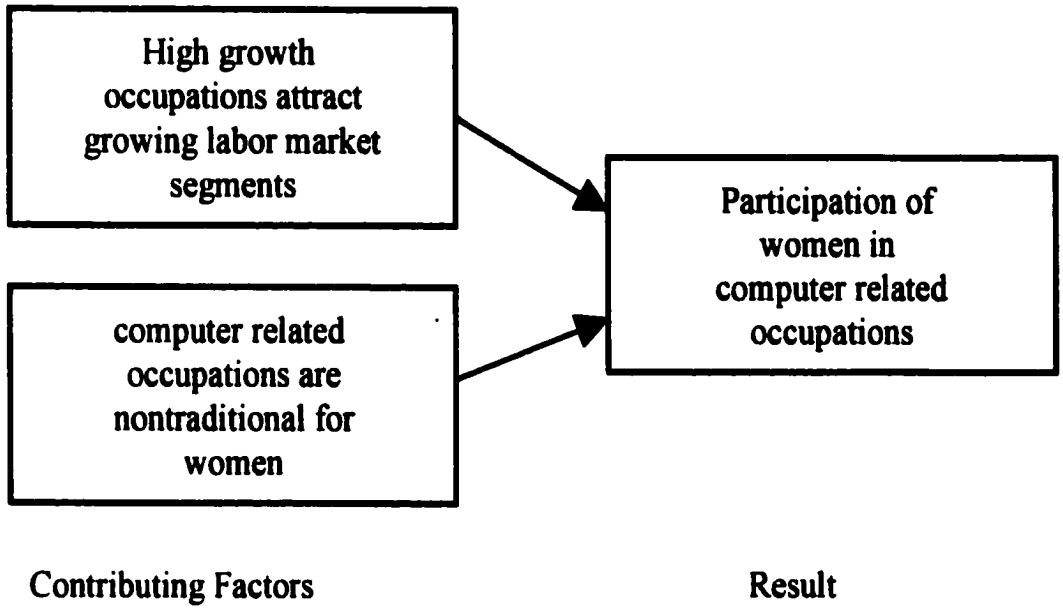

Figure 1. Women's participation in computer-related occupations.

This model shows conflicting forces that impact the makeup of the labor participation in computer-related occupations. The first contributing factor, "high growth occupations attract growing labor market segments," reflects labor market theory. The second contributing factor, "computer-related field is nontraditional for women," reflects labor market theory with strong influences from career development theory. The result, "women in computer-related occupations," shows the outcome of the influences of the two contributing factors on the participation of women in computer-related fields.

When studying the workforce, I believe that it is important to investigate the private sphere through the individual decisions women make regarding careers and work, and the public sphere through the institutional constructs that influence women in the labor market. Isolation of public and private leaves focus on only one. This, at best, addresses only part of the issues. Public and private are interconnected – both must be addressed.

Descriptive, exploratory data on female computer professionals' career decisions and career experiences will increase the understanding of the female participation in this group of traditionally non-female occupations. The research study is exploratory. I explored the career decisions and the experiences of women in computer-related professions in relation to the context of those occupations. The study is designed to investigate both the participation of women in those occupations and the experiences of women computer professionals to better understand the interaction of the two perspectives.

The research methodology involves two case studies of women's experiences and career decisions in this field. One case study is of women entering the field in the early-to-mid-1970s. The second case study focuses on women entering the computer-related professions during the early-to-mid-1990s.

I chose the early-to-mid-1970s time period because that was a period of significant change in the field. Computers were starting to become more prevalent; technology

advances were enabling computers to be used for new purposes; and colleges and universities were beginning to offer computer science degrees. Careers in the field were beginning to be better defined and recognized. Also, women were entering the labor market in larger numbers and expecting a longer engagement in the workforce.

The early-to-mid-1990s represents a time period that is 20 years later. This difference in time allowed for a comparison between the two time periods. Women represented a larger percentage of the labor market during this time period. The workforce practices had changed for them.

I am interested in the computer-related professions in relation to dynamics of women participating in those occupations. My research question is:

What are the experiences of women in two distinct periods in the development of computer-related professions – early-to-mid-1970s and early-to-mid-1990s?

Issues addressed involve the intersection of person, institution, and culture by focusing on women's career decisions in the context of two distinct periods in the computer-related professions.

Other Related Questions

Additional questions include:

1. What are the trends of female participation in these occupations over the years?
2. What have been the decision-making criteria used by women entering the field? Have those criteria changed over the two time periods?
3. What career decisions have women in the computer field made?
4. What have been the experiences of those women in the field in relation to professional opportunities and advancement?

CHAPTER 3 – PROCESS OF INQUIRY

Introduction

This inquiry was a collective case study of women in computer-related professions during two time periods. The collective case study included two separate case studies based in two time periods. The study investigated the participation, as well as career decisions and experiences of women in the computer-related occupations. I chose the use of case studies because the two inquiries are time bounded, and I wanted to set individual experiences in the context of the professions (Creswell, 1998; Stake, 1994). The inquiry focused on two time periods – the early-to-mid-1970s and the early-to-mid-1990s.

This chapter outlines the research design through describing: (a) purpose of the study; (b) design of the research; and (c) conduct of the research.

Purpose of the Study

Gender-segregated occupations are those occupations populated primarily by one gender. Bergmann (1986) described relatively well-integrated occupations as those with 30-50% women. Scientific/technical occupations are generally recognized as being gender-segregated occupations. For example, in 1994 only 8.3% of the engineers were women (Bureau of Labor Statistics, 1995) making engineering a male-dominated occupation.

The first programmable computer was designed and built a little over 50 years ago. This powerful new technology introduced fast growing occupational fields at a time when women were entering the labor market in larger numbers. Computer-related occupations are scientific/technical in nature, and it would be expected that they would be male-dominated occupations. In 1999, female participation in computer analyst/scientist occupations was 28% and in computer programming occupations, 26% (Bureau of Labor Statistics, 1999).

The comparatively high female participation indicates these occupations approach gender neutrality. In this respect, computer-related occupations are unusual in relation to other scientific/technical occupations. Both computer analyst/scientist and computer programmer occupations are on the boundary between being male-dominated and gender neutral occupations. This study investigated the participation, as well as career decisions and experiences of women in these computer-related occupations.

Design of the Research

Case Study

The research was exploratory. It sought to explore the experiences of the women who participate in the computer-related professions. The inquiry also described the labor market dynamics of those professions and the overall participation of women in the workforce in order to establish the broad labor market context for those time periods being studied. Although the inquiry involved two time periods, the study of each time period followed the same general design. The approach was similar to Mintzberg and McHugh's (1985) study of the Canadian Film Board where they divided the research into six case studies that represented six periods in the history of the organization. In this research study, two time periods were studied – the early-to-mid-1970s and the early-to-mid-1990s.

Women computer professionals in the workforce today are the source of a rich body of information that can provide important insights into the field. Therefore, the inquiry included focus group sessions with women computer professionals from multiple backgrounds who entered the occupations during the time periods being studied. The focus group approach allows participants the time to reflect and recall career experiences (Lofland & Lofland, 1984). A participant also builds on something mentioned by another participant, resulting in a rich interchange of ideas and experiences. The group setting also facilitates remembering decisions from the past through others recounting their experiences. This was an important aspect of group

interviews in this study because questions related to career decisions and experiences involved for some of the women remembering things that happened almost 30 years ago. In addition, agreement and disagreement on points were discussed in the group and highlighted in the group interview.

Each time period study also included a section that consists of analyzing Bureau of Census and Bureau of Labor Statistics data on computer-related occupations, specifically computer analysts/scientists and computer programmers. The analyses included a continuation of the analysis conducted by Strober and Arnold (1987a) on the 1970 and 1980 census data shown in Tables 1, 4, and 6 (pp. 145, 151, and 155) and 1981 Current Population Survey data shown in Table 9 (p. 161).

In addition, documentation on occupations and published personal accounts were used as data sources. These case studies provided a multifaceted picture of women's professional experiences in computer-related occupations and set those experiences in the context of the occupations during the two time periods.

Research Question

The framework was derived from two different points of reference. The first centered on the career decisions and experiences of the women participating in these occupations. Why did they initially chose and continue to remain in computer-related occupations?

The second point of reference involved the dynamics of an occupation on the boundary between being male-dominated and gender neutral. Will the occupation move into the gender neutral range? Will the occupation move toward being more male-dominated? Will certain subset occupations become male bastions? Also, it has been noted that some scientific/technical occupations seem to be hovering around 30% female participation. The number of women participating in these occupations could create a critical mass that would drive female participation higher. Instead there is a stagnation of female participation in these occupations. Is this happening in these occupations?

Each point of reference reflected the theoretical areas I use as a framework. The first point of reference related to career development; the second point of reference related to labor economics. I believe the research needed to reflect both in order to gain a better understanding of the occupational/career system women are participating in today.

Delimiters

Strober and Arnold (1987a) identified six major categories of computer-related occupations. The six categories included: engineers, computer specialists, engineering and science technicians, production workers, computer operators, and data-entry operators. This study focused specifically on the computer specialist category, which includes computer systems analysts/scientists and computer programmers. This category represents the largest concentration of women, other than computer operators,

identified by Strober and Arnold. The categories of computer operator and data entry operator are excluded because of the dramatic reduction of positions in these categories during the last 10 years as a result of moving from computer mainframe operations to personal computer (PC) and client-server environments.

Research Propositions

The following were the research propositions for this study:

1. Occupations on the boundary between male-dominated and neutral present a changing work environment. Women in that changing work environment need to learn how to function in the new environment.
2. These boundary occupations are not in a steady state unless held by opposing forces.
3. High growth in computer-related professional occupations and concurrent increased female participation in the workforce impacted female participation in these occupations.

Units of Analysis and Related Data

The design involved two time period studies with two units of analysis. The units of analysis are: (a) computer-related occupations; (b) individual female computer analysts/scientists and computer programmers.

The computer-related professional occupations unit of analysis represented the broad view and looked more toward a systemic understanding. The individual unit of analysis represented the focused view and looked more toward individual decisions and experiences that both reflect and influence the occupations.

I chose the embedded design (multiple units of analysis) over a holistic design (single unit of analysis) because I believed the individual perspective and the overall computer-related professions perspective was needed to understand the dynamics of gender participation in occupations. Table 3 shows the time periods and the units of analysis.

Table 3

Time Periods and Units of Analysis

		Time Periods (Early-to-mid-1970s and Early-to-mid-1990s)
Unit of Analysis	**Computer-related Occupations**	-What was the participation of women in the field during this time period? -What were the labor market dynamics?
	Individual Computer Analysts/Scientists and Computer Programmers	-What were the career decisions made by the women entering the field at this time? -What career experiences have these women had?

Linking the Units of Analysis to the Theoretical Framework

The theoretical framework involved the two areas – career development theory and labor economics – discussed in chapter 2. Table 4 shows how key factors in these areas are linked to the units of analysis.

Table 4

Linkage of Unit of Analysis and Key Factors in the Theoretical Framework

	Computer-related Occupations	**Individual Computer Analysts/Scientists and Computer Programmers**
Career Development Theory	-Career related information used in decision making. -Influence of professional organizations or other entities.	-Individual decision making regarding entry in the occupations. -Individual experiences regarding career paths. -Individual work expectations.
Labor Economics	-Female workforce participation. -Workplace acceptance of female participation. -Trends in female participation in these occupations -Occupation trends that impact female participation.	-Entry and retention of women in the occupations. -Individual experiences in regard to discrimination.

Data Management and Analysis

Data Management involved the processes used to collect, store, and retrieve data (Huberman & Miles, 1994). For a research project such as this one, data management included a systematic data collection approach, and a filing and indexing system that allowed the organized filing of data and easy retrieval. Data analysis included data reduction, data display, and conclusion drawing/verification (Huberman & Miles, 1994). Data analysis included categorizing and coding data based upon the theoretical framework and the identification of themes and patterns.

For data management, I maintained four sets of files – mundane, analytic, fieldwork, and chronological (Lofland & Lofland, 1984). The mundane files were organized by data type and source; the analytic files were organized by data categories and emergent themes; the fieldwork files included records on the research processes; and the chronological file were organized according to the date materials are collected. The data types used in the mundane files included (a) numerical data on occupations; (b) occupational outlook and trends; (c) occupation related articles, research, and reports; and (d) personal accounts of career decision and experiences (see Table 4 for a more detailed description of the data types).

Data were coded and categorized. The data were categorized by the 11 key factors identified in Table 3 that provided the linkage of the units of analysis and the theoretical framework. As additional categories emerged they were added.

Miller & Crabtree (1994) characterized a researcher's approach to qualitative analysis through the use of two continua. The first continuum defines the researcher's relationship to text as being from "structured and distant" to "open and intimate." The second continuum defines the perceptual filter used as being from "defined" to "open." The approach I used for my research initially was "defined" through the use of the categorization of data by the 11 key factors; though it was also iterative in that additional key factors (or categories) were added through the analysis. Because of the iterative nature of the approach my relationship with the text was toward the center of the first continuum, though on the side of the "open and intimate" end.

The multiple sources of data allowed for corroboration of fact. This research used statistics from census and published survey sources, documentation and written accounts, and data from focus groups. The multiple sources of data allowed the development of findings based on the convergence of the inquiry (Yin, 1994). Interpretation was accomplished through pattern matching. Also, time series analysis was done with statistical occupation participation data to augment data interpretation. Data were then analyzed using contextualizing strategies. Maxwell (1996, p. 79) described this analysis as "instead of fracturing the initial text into discrete elements and resorting it into categories, contextualizing analysis attempts to understand the data...in context, using various methods to identify the relationships among the different elements of the text."

Criteria for Interpreting the Findings

This collective case study research design involved two separate case studies and called for both a within case study analysis and cross-case analysis. Also, the embedded unit of analysis called for analysis of those units within each case. As Yin pointed out,

> the appropriate analysis of the embedded unit of analysis should first be conducted with each case. The results should be interpreted at the single-case level and may be treated as but one of several factors in a pattern-matching or explanation-building analysis at the sing-case level. The patterns or explanations for each single case may then be compared across cases, following the replication mode for multiple cases. Finally, the conclusions drawn for the multiple cases can become the conclusions for the overall study. (Yin, 1994, p. 120)

I conducted a cross-case analysis in addition to the within-case analysis. I used two cross-case analysis strategies outlined by Eisenhardt (1988). The strategies are:

1. Similarities and differences of pairs of cases – identify the similarities and differences across the two case studies.

2. Divide the data by unit of analysis – analyze like units of analysis across the case studies. For example, analyze the career entry decision-making criteria (individual females computer analyst/scientist and computer programmer unit of analysis) across the two case studies.

Conduct of Research

Sources of Data

A layout of data types and sources by unit of analysis is shown in Table 5.

Table 5

Unit of Analysis and Related Data

Unit of Analysis	Data Type	Data Sources
Computer-related Occupations	Numerical data on occupations	-Census and Bureau of Labor Statistics data -Data from non-governmental sources, such as, Catalyst
	Occupational Outlook and Trends	-Occupational Handbook -Occupational Reviews, such as, Working Woman's annual Best Jobs for women
	Occupation Related Articles, Research, and Reports	-Academic journal articles -Computer-related association publications and special reports, such as, ACM or IEEE association publications
Individual Computer Analysts/Scientists and Computer Programmers	Personal Accounts of Career Decisions and Experiences	-Focus groups conducted for this study -Published accounts, roundtable discussions, and interviews.

Procedure

I used the following approach to structure the inquiry for each case study. The first four steps explore the dynamics of female participation in the computer related professions and the overall labor market. Steps 4 through 6 collect data on career development and individual experiences. Finally, step 7 relates career development and individual data collected with the labor market trends identified in the first four steps.

Approach:

1. Identify the growth rate of computer-related careers during the two time periods in comparison to general occupational growth
2. Determine period of either high growth or stagnant growth in computer-related occupations and relate female participation during those times.
3. Determine periods of either high growth or stagnant growth of female participation in the workforce.
4. Research the public and published documents on career outlooks and career advice given to women.
5. Conduct focus groups with women in the computer field who entered the field during the time periods being studied.
6. Research individual accounts published during the two time periods be studied.

7. Compare and relate the labor market trends and career outlook findings to focus groups and published individual account outcomes.

Focus Groups

I conducted one focus group for each of the two case studies. The focus groups were designed to be in-depth conversations using open-ended questions and follow-up questions to guide the discussions. The intent of the focus group was for the researcher/moderator to explore with the participants thoroughly the participants' career experiences in the computer-related professions. The discussions went beyond the prepared set of questions. In addition, participants asked the researcher/moderator questions. The participants and the researcher/moderator explored and sought to understand career experiences and dynamics that played in the participants' career development. The scripted questions are included in Appendix A, and the informed consent form for the focus group participants is in Appendix B.

The conduct of a focus group inherently has advantages and disadvantages. Advantages identified by Fontana and Frey (1994) include:

- Inexpensive
- Data rich
- Flexible
- Stimulating to respondents
- Recall aiding

- Cumulative and elaborative

Disadvantages include:

- Emerging group culture interferes
- Domination by one person
- Group setting makes sensitive topics difficult to explore
- Possible "group think"
- Greater interviewer skills needed.

Merton, Friske, & Kendall (1956) suggested three skills needed by the group interviewer/moderator

1. Keep one person from dominating the group.
2. Encourage participation by all members of the group.
3. Obtain responses from each member of the group to ensure the topic is covered.

Protocol Questions

Part of the research conducted in these case studies was a set of focus groups with women who are computer analysts/scientists and computer programmers. The focus groups were semi-structured and lasted approximately 2 hours. There was a background information questionnaire associated with each participant. The questionnaire gathered some demographic information, such as age and education. It was short and only took a few minutes to complete. The focus group included open-ended questions asked by the researcher that were intended to guide a discussion of the

women's career decisions and experiences in computer-related professions. The focus groups were constructed to encourage the participants to tell their stories about their careers. The questions were used as a guide and to elicit information about particular aspects of career decision-making and experiences. Appendix A contains the questionnaire and a list of prepared open-ended questions used in the focus group sessions.

Confidentiality and Security of the Data

The public and published data are not confidential and were not secured. The focus group data were treated as confidential and, as such, were coded to retain anonymity. No real names were used. Identities were disguised, and fictitious names were used. Participants were advised not to use organizational or individual names in the focus groups. If they did, the names were substituted by descriptive identifiers, such as, a large computer manufacturer or a government agency. Participants were also asked to keep all information discussed during the focus groups confidential.

The tape recordings were listened to and transcribed by me and a professional transcribing service. The focus group notes, audiotapes, transcripts, and electronic media were secured in a locked cabinet in my home and will be destroyed after 5 years.

Potential Benefits and Harm to Participants

There were no direct benefits to the participants. The potential benefits to participants only involved possible career-related insight gained through reflection on career decisions made and work-related experiences. Each participant has since individually told me that she found the focus group beneficial.

Debriefing of Findings with Participants

I condensed the focus group information into a summary report and sent a report to each participant. I gained approval from each participant to use quotes through her e-mail responses.

CHAPTER 4 – RESULTS

Introduction

In 1946 the ENIAC computer was completed at the University of Pennsylvania. The machine was nothing like today's computers. It did not have an operating system like Windows 2000; it did not have a word processor like the one I am using to write this dissertation; it did not have software that performed calculations when given a simple command. This machine did not have software at all. Programming on the original computers consisted of setting dials on the front of the machine and in some cases rewiring the machine to perform certain functions. This was exacting and tedious work. And the first six computer programmers were women.

Computer-Related Occupations

Over the years, computers and software have penetrated every aspect of our lives. Activities that were once labor intensive and time consuming are now made easier to perform through their computerization. The development of computer software is an intensive people-oriented endeavor that requires high levels of knowledge, skills, and disciplined processes. The positions in computer-related occupations have dramatically increased year after year. One such increase was between 1970 and 1980 when the number of positions for computer scientists/systems analysts more than doubled, from

93,200 to 200,684 and computer programming nearly doubled, from 161,337 to 313,179 (Strober & Arnold, 1987a). Today the Bureau of Labor Statistics continues to report that computer-related occupations are among the fastest growing occupations in the U.S. In the 1998-1999 Occupational Outlook and Handbook (Bureau of Labor Statistics, 1998), they stated, "Computer scientist, computer engineers, and systems analysts are expected to be the three fastest growing occupations through the year 2006.

The Census Bureau and the Bureau of Labor Statistics currently recognizes a family of computer-related occupations. These occupations include computer scientists, computer engineers, systems analysts, computer programmers, database administrators, computer support specialists, and a number of specialty occupations such as, network administrators and computer security specialists (Bureau of Labor Statistics, 1998).

For this study, I focused on four of those occupations, which the Census Bureau categorized into two groups. These occupations are:

- Computer scientists
- Computer engineers
- Systems analysts
- Computer programmers.

Computer scientists are those professionals who design computers and the software that runs them. They develop information technologies and adapt the systems for new

uses. These professionals generally have advanced degrees, most with doctorates. Their work involves research and innovative application of new ideas.

Computer engineers design and develop the hardware and software of systems. These engineers may be computer hardware engineers who focus on computer hardware design or software engineers who focus on the development of software and software applications. These professionals have at least a bachelor's degree in computer engineering or electrical engineering, for computer hardware engineers; and a bachelor's degree in computer science or related degree field, for software engineers.

Systems analysts apply their knowledge to data processing problems to design solutions using computers. These professionals use their understanding of a specific area (such as financial systems, manufacturing systems, etc.) and computers to design systems made up of hardware and software to meet the needs of the specific area. These professionals generally have at least a bachelor's degree in computer science, management information systems, or information science.

Computer programmers write the software programs that run on the computers. The computer programmer occupation is categorized as a technical occupation by the Census Bureau because the work does not require the analytical component found in the previously described occupations. Most programmers have college degrees or some college.

The Census Bureau has classified the first three occupations – computer scientist, computer engineer, and systems analyst – into one group and reports data according to that classification. Computer programmers are classified as a separate occupation group. Though these classifications of occupations exist, computer-related occupations are difficult to categorize. Job titles vary in meaning, and some jobs actually span identified occupations (for example, programmer-analysts span computer programmer and systems analyst occupations). In addition, the field is changing rapidly with new technologies and new applications for computers that result in new job titles previously not included in any occupational classification scheme. However, despite this changing occupational environment, the occupations described above and used in this study are easily recognized and understood in the field and have been used for several decades.

Women in Computer-Related Occupations

Computer-related occupations have only been in existence since World War II. The initial development of computers resulted from research conducted during the war to enable the U.S. military to better calculate trajectories for artillery and to perform other calculations that required intense concentration and accuracy. Because the initial applications were mathematical, the first people to be employed to work with these new machines were trained mathematicians. Women were recruited for these jobs because (a) they were considered better suited to the need for intense concentration and accuracy requirements and (b) there was a shortage of men because of the war. For that period during World War II, women trained as mathematicians played an important part in the

development and use of computers (Frenkel, Schmidt & Friedman, 1995). After the war when men reentered the workforce they filled many of these jobs, like other jobs in the labor market. It is difficult to say how many people (or the ratio of women to men) were employed in these jobs because occupational data at that time did not represent the computer-related jobs as separate occupations.

There have been many remarkable women in the computing field that other women can look to as role models. One of the most well known is Admiral Grace Hopper. Admiral Hopper coined the term "computer bug" when she found an actual bug in one of the early computers. She also received the first Computer Sciences Man-of-the-Year award in 1969 (Rossiter, 1995). I remember attending one of her lectures when I was studying for my masters in Computer Science in the early 1970s. This small woman with her white hair and her impeccable naval uniform awed me as she spoke about the future of computing and how computing architectures would overcome the then perceived barrier of the speed of light. As a young woman just starting in the field, I also learned from her that I had a chance to be successful in computing. She provided a role model for many women in the computing field, and today there is a conference, the Grace Hopper Celebration for Women in Computing, held every 3 years.

As in any field, women have contributed significantly to advance computing. There are the pioneers in the field, such as Thelma Esprin, who built the first computer in Israel with her husband (Frenkel et al., 1995 and Gurer, 1995, January); Jean Batik, one of the original six programmers and contributor to the development of the internal

program (the first step toward the software programs we use today) (Petzinger, 1996, November 22); Betty Holberton, another of the original six programmers who led the committee to establish standards for COBOL so that computers of different makes and models could exchange information (Petzinger, 1996, November 22), and Jean Sammet who also participated in the development of COBOL and wrote *Programming Languages: History and Fundamentals*, a standard on programming languages (Gurer, 1995, January).

There have also been women in influential positions and who are successful entrepreneurs. Some of these women include Ann Winblad, co-founder of Open Systems (Zientara, 1987), Inc; Lorraine Mecca, founder of Micro D; Ester Dyson, industry analyst and publisher of RELease 1.0 newsletter (Zientara, 1987); and Carleton (Carly) Fiorina, the CEO of the Hewlett-Packard Corporation (the second largest U.S.-based computer/office equipment company with $42.2 billion net revenue in 1999 and 83,200 employees worldwide).

In the most recent Fortune list of the 50 most powerful women in the U.S., all of the top 5 listed are women who run computer based companies (Fortune, 2000, October 4). According to Carly Fiorina, who has been number one on the list three times, "power is the ability to change things." The list also includes women from well-known computer companies like IBM, Sun Microsystems, Cisco Systems, Oracle, and AOL. Interestingly, Judy Estrin, computer programming pioneer Thelma Estrin's daughter, is number 42 on the list. She is founder and CEO of Packet Design.

Trends of the Participation of Women in Computing Occupations

Women have participated in computer-related occupations since computers were first built. They initially participated more because of the wartime labor market; their participation has dropped during the last decade to less than 28% for both computer scientist/systems analyst and computer programmer occupations from a high of approximately 35% in 1990.

The lowest participation of women in computer-related occupations occurred between the end of World War II until the mid-1970s. In 1970, women represented 38% of the employed labor force and comprised 23% of the computer programmers and 15% of the computer scientists/systems analysts. In 1980, women represented 42% of the employed labor force and comprised 31% of the computer programmers and 22% of the computer scientist/systems analysts. The latest Bureau of Labor Statistics data show that in 1999 women represent 46.6% of the employed labor force and comprise 26% of the computer programmers and 28% of the computer scientist/systems analysts (Bureau of Labor Statistics, 1999).

Table 6 shows the number of people employed in the two occupation categories, and the number of women employed in those occupation categories from 1970 to 1999.

Table 6

Participation of Women in Computer-Related Occupations (in Thousands)

		1970	1980	1990	1999
Computer Scientist/ Systems Analyst	**Total**	93	200	609	1,549
	Women	14 (15%)	44 (22%)	210 (34%)	442 (28%)
Computer Programmers	**Total**	161	313	600	665
	Women	37 (23%)	97 (31%)	216 (36%)	175 (26%)

Note: Data from the Bureau of Labor Statistics Current Population Survey, 1999

The total number of people employed in the two occupation areas has grown steeply over the years. There has been a shift from primarily computer programmers to computer scientists/systems analysts as the computer scientist/system analyst occupation category has grown faster. That occupation category is one of the fastest growing occupation categories according to the Bureau of Labor Statistics (1999). Table 6 also shows that the participation of women in those occupations increased through 1990 and then decreased through 1999. Although that decrease in female participation has started to slow, there is concern in the industry. Many organizations (such as the National Science Foundation and the Association for Computing Machinery) are exploring downturn and trying to identify ways to encourage women to enter the field.

Women in the Labor Force

The workforce and work for pay is a construct of society that became common during the industrial revolution. People began earning their livelihood outside of their homes through work in businesses and factories. Women have always participated in the workforce to varying degrees. Initially, their participation was predominantly in domestic work and low-income labor. In the United States, women expanded their role in the workforce during World War II when a large number of men were called to military duty and the country faced a civilian labor shortage. After the war, many women returned to child care and homemaking when the men returning from the war re-entered the workforce.

Women did not return to the workforce in large numbers until the 1970s. The percentage of women participating in the workforce increased from 28.8% in 1950 to 32.7% in 1960; 37.5% in 1970; 42.1% in 1980; and 44.9% in 1990. In 1999, 61.1 million women were employed representing 46.6% of the U.S. labor force and a 61.1% participation of women in the labor force. Figure 2 is a graph showing the increase from 1970 to 1999 in the total number of people employed and the total number of women employed.

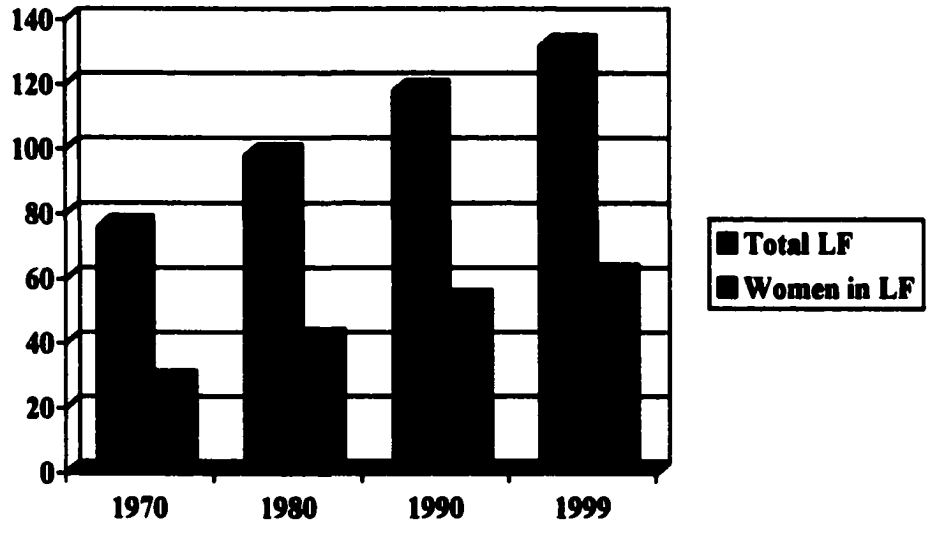

Figure 2. Women in the labor force (in millions).
Note: Data from the Bureau of Labor Statistics Current Population Survey, 1999

Historically, in the United States women have engaged in certain occupations that are characterized as female occupations, e.g., clerical, teaching, etc. These occupations are described as being gender-segregated and employing the majority of the women in the labor force. Unfortunately, these occupations are also limited (only about 10% of the defined occupations and generally lower paying occupations) (Bergmann, 1986). Women even in 1998 earned only 76% of what men earned. This earning differentiation can be attributed to be largely due to differences in occupational employment with additional factors such as, differences in years of work experiences and number of hours usually worked, and discrimination in labor market practices.

Two Case Studies

The sections that follow in this chapter describe two case studies of the participation of women in computer-related professions. One case study is on the career decisions and occupational experiences of women who entered the field in the early-to-mid-1970s, and the second is on the career decisions and occupational experiences of women who entered the field in the early-to-mid-1990s. The descriptions of the two case studies include (a) a summary context statement of the time period in relation to the computer-related occupations, (b) profiles of participants in the focus groups that were conducted, (c) a discussion of the participants' career related decisions, and (d) a discussion of their work experiences in the computer-related occupations. The case study descriptions are followed by a cross-case discussion of similarities and differences across the two time periods.

Focus groups were conducted with women who entered the professions during the time periods being studied. The intent of the focus groups was for the researcher/moderator to explore with the participants the participants' career decisions and experiences in the computer related occupations. The focus group sessions were designed to be an in-depth conversation using open-ended questions and follow-up questions to guide the discussions.

The Early-to-Mid-1970s Time Period

The early-to-mid-1970s time period represents a time that was still early in the development of computer-related occupations. These occupations were fast growing and open for people with different skills to enter. This was also a time when women were entering the workforce in larger numbers and who were more likely to pursue lifetime work careers. The women's movement was an active force in those years. Laws had been put in place to discourage discrimination. The women entering the workforce at that time were, in many cases, taking on roles and entering occupations that previous generations of women had not considered. In the two decades between 1960-1970 and 1970-1980, the percentage of women participating in the workforce increased almost 5% during each decade. Participation rose from 32.7% in 1960 to 42.1% in 1980. There was also an increase in women participating in the computer-related occupations from 1970 to 1980, an increase of 7% in computer scientist/systems analysts from 15% to 22% and an increase of 8% in computer programmers from 23% to 31%.

The computer related occupations were fast growing and the participation of women in these occupations was increasing. One of the focus groups that was held for this study was made up of women who entered the field in the early-to-mid-1970s. Six women participated in this focus group session. The six participants were volunteers who live and work in the Washington, DC metropolitan area. I made announcements at meetings of the National Capital Chapter of the Association for Women in Computing,

asking for volunteers. Each evening women volunteered. I also attended meetings of the DC Software Process Improvement Network and asked women if they would participate. In addition, I asked friends to identify potential participants.

The women in this group represent women who entered an occupational field that was relatively new. They also began careers at a time when women were starting to see work in relation to lifelong careers. Although some women had careers before the 1970s, it was not the norm. And although there are women pioneers in the computer related professions who started in the mid 1940s, the women in this focus group represent a wave of those who entered the workforce in larger numbers than in previous decades. Each of the women in the focus group have worked almost continuously since they started in the field, and their work is an accumulation of experiences that make up their work careers. A short summary of this focus group is in Appendix C.

Profiles of the Early-to-Mid-1970s Participants

Each participant has worked in computer-related professions for a number of years. One participant owns her own technical training company; one is a vice president for a large software integration corporation; one is a senior advisor on software development policy; and one is a senior level consultant. Two women were currently looking for work. They are consultants and were in the process of learning new technical skills to extend their consulting areas.

As a whole, the women are highly educated through both formal college course work and corporate development and technical training. The age range of the group was large (71 years old to 43 years old), because some of the women entered the field when they were young (while they were in college or right after college) and some of the women entered the field when they were older (after raising a family or as a second career). All of the women in the early-to-mid-1970s group are White women. None of the participants had been a part of a focus group before.

Alice

Alice is a 71-year-old widow. Her husband was in the foreign service, and the family lived in many places throughout the world. Alice earned a bachelor's degree in physics and math in 1950. When her two children were grown, she decided to start her career. She began taking classes, and after a year of study was offered a programming job. She has worked continuously until recently. At the time of the focus group session, she was looking for work.

She has worked primarily on government contracts and has worked as an independent for large contractor organizations. Alice had a cheery attitude and obvious enthusiasm for the field. She expressed a delight in learning new computer skills and is primarily self-taught.

Brenda

Brenda is a systems analyst who analyzes policies related to computer systems and software development. She earned her undergraduate degree in American studies in 1969, and she completed her PhD in information science and technology in 1992. She is a 52-year-old woman who is married and has one child. She describes her entry into the computer field as having "backed into it." When she was in undergraduate school she planned to enter law school. Then she decided that there were too many lawyers, and she worked in research for a couple years. Brenda then took a job as a junior programmer and learned on the job. She has worked in many aspects of software development, and she taught database and analysis at a university for about 4 years.

Brenda is thoughtful and analytical. During the focus group session, she provided insightful observations about what was being discussed and about her own experiences. She has worked in different environments, including industry, government contracting, and academia.

Frances

Frances is currently an independent management-level consultant. She is 45 years old, and is currently single with no children. Frances is the only participant with a bachelor's degree in computer science. She has a multiple degree in math, engineering, and computer science. She began her career in the computer field when she was in college through a cooperative education program. The university she attended had a program where she would work a semester and then go to school for a semester or two.

She made her career decision to enter the computer field during the cooperative education program and changed her degree program to include computer science.

She has worked continuously since then in the field. She has worked in programming, hardware development, systems integration, and program management. Frances expressed an infectious excitement for the field when she said, "And it seemed like an exciting place to be, and I wanted to be where fun problems were solved."

Elaine

Elaine has founded two companies, one of which she is currently running. She is 52 years old, married, and has two teen-age children. She grew up and was educated in the United Kingdom and immigrated to the United States after she had established her career. Elaine has a bachelor's degree in chemistry and metallurgy and a PhD in Information Science. She started working with computers through her work, designing drugs for a pharmaceutical company.

Elaine is a dynamic, energetic woman. She has a strong belief that women entering the computer field should get as much education in the field as possible. Even though she currently owns an IT training company, she says that the college education gives young women a jumpstart in their careers.

Denise

Denise actually started in the computer field in 1966. This is Denise's second career. She originally was a schoolteacher. Denise is 59 years old, married, and has two grown children. She has a bachelor's degree in education/music and a master's degree in information systems technology. She worked for a large organization for a long time and then became an independent contractor.

At the time of the focus group session, Denise was looking for work. Both she and Alice had worked on Y2K projects that ended in January, and both of them were looking for a new project to work on. She was in the process of determining what new technical skills she should develop and the direction she wants to pursue.

Charlotte

Charlotte is 43 years old, married and has 2 children at home. She has a business degree with an emphasis in data processing. Charlotte decided to enter the field when she was in college and has worked almost continuously in the computer field since then. She has worked for the federal government, helped found a software development company, and currently is a vice-president at a large software integration company.

Charlotte is direct and focused. She has recognized opportunities and barriers during her career and acted on them. Her career has evolved to managing technical programs. Through her involvement with a startup and her management experience, she has developed a business-oriented approach to her work.

Career Related Decisions

When the women talked about how they entered the field, they spoke of how their entry was not planned, rather they happened upon the work and found it interesting and exciting. They used statements such as, "I feel like I backed into it or stumbled into it;" and "But it just drew you in there. I mean, you were sucked in there, because it seemed exciting." They also talked about the field being exciting at that time. Frances said,

> But it seemed exciting. It seemed like it was going to happen – not to the extent that it did. But it seemed like it was going to be an exciting place to be and that's why I switched into computer science instead of switching from math to engineering. I switched from math to computer science. And it seemed like an exciting place to be and I wanted to be where fun problems were solved.

As Frances spoke you could feel the excitement generated from entering an occupational field that was new, fast moving, and would over the next 25 years make a significant impact on society as a whole.

The women also commented that they were attracted by the good salaries in the field. They wanted to earn good salaries, and they felt they could compete with men on a more equal basis. Charlotte commented,

> I was entirely drawn in for the money. That was all I cared about. I wanted to make the most money I could make, get out of school quickly so I could get married and so I graduated in 3 years and got married and went right to work as a programmer. That was my goal, to get a degree and get married and get working.

They talked about why they like the field. They like the problem solving aspect of the work. It provides them with opportunities to be innovative and creative. They spoke several times of the creative aspect of the work and that you needed to have a

certain amount of experience and knowledge to achieve the really creative level of developing solutions and systems.

I asked them to describe their most beneficial decisions and least beneficial decisions. Alice and Elaine noted that their most beneficial decision was to go back to school. Charlotte said that helping to form a woman-owned company was beneficial for her because she learned all aspects of the business through that experience.

Alice, Brenda, and Frances said the least beneficial decision was to stay with one company too long. Brenda talked about how she had become stagnant, and the new job that she took provided her with new challenges and helped her grow professionally. Osipow (1983) identified organizational constraints such as organization defined career paths and organizational expectations of the individual that can potentially hinder a person's career.

Elaine talked about getting into management too early. She missed enjoying the technical side of the work. And Denise questioned why she had not chosen the management career path. Of the participants, Elaine, Charlotte, and Frances represented the technical to management career path often used in technical careers. Alice and Denise represented the straight technical path. Finally, Brenda represented a slightly different career path that moved from technical to policy and standards analysis and development. Her career path differs in that it is not "management" and not strictly

"technical," yet the scope of her influence is broad because her work impacts a large part of the organization.

Work Experiences

Work experiences reflect the actual day-to-day work and how the activities and interactions with others in the workplace affect our feelings about our work. Since the computer-related occupations vary around the borderline between what Bergmann (1986) defined as male-dominated and neutral, I was interested in learning what issues the participants had faced as women in this field. The women generally talked about things that had been said to them in the past. Alice recounted being told that she should not be working because she was taking a job away from a man who had a family to support. Charlotte told of how she had been denied a promotion because she was too young and a woman. And Denise told about the difficulty she had when she was pregnant. She managed a group of 250 people and her management was concerned about what would happen to the project. She said, "it was extremely difficult for people to understand that as I got bigger and bigger that my brain wasn't shrinking." Denise then had trouble when she was pregnant the second time because people expected her to do everything like she did before.

The women reflected that they believe the work environment has changed since they started working. Given that these women entered the workforce in the early-to-mid-1970s, there have been several laws and regulations enacted since then. Title VII of the Civil Rights Act of 1964 addresses discrimination in employment and Executive

Order 11246 of 1970 prohibits employment discrimination by federal contractors and subcontractors. Since many of these women worked and still work for federal contractors, Executive Order 11246 has been particularly important for them. They have also benefited from the 1978 amendment to Title VII which prohibits employment discrimination based on pregnancy.

The group then discussed the subtle nature of working in a field dominated by men. Betty commented that a few years ago her husband pointed out to her that meetings she attended were almost all men. She had become so used to being the only woman, or one of a few women, that she no longer noticed the disparity. She noted that most meetings she currently attends are still mostly men. Charlotte then told the story of attending a meeting with about 50 men in the mid-1980s, and she was the only woman. She remembered that the men had on dark suits, and she was wearing a red suit. She said she felt very conspicuous, particularly since she was also presenting at the meeting. The dynamics of working in an environment where you are in a minority group impacts your interaction with the group (Kanter & Stein, 1993).

When asked what advice they would give a young woman entering the field today, they talked about the importance of a good education. They also talked about the difficultly getting the first job, and Charlotte suggested that internships (summer work) programs provided young students with work experience and the opportunity to get to know a company. Frances mentioned cooperative education programs like the one she participated in when she was in college, where she worked a semester and went to

school one or two semesters. When she graduated, she was courted by several companies and received excellent job offers.

Elaine and Charlotte also talked about trying to encourage their daughters to be more interested in working with computers. Ruth told of how she was pressured to enter a more traditional career, and she resisted her mother's pressure to be a kindergarten teacher. Ruth suggested that perhaps the daughters were also resisting their mothers in the same way she resisted her mother.

Alice commented that she encouraged her children to enter the computer field through showing them how much she enjoyed the work. She said,

> I'll tell you how I influenced my kids. Just like the Huckleberry Finn story with the fence. I was having so much fun! I'd get out my computer, and I'd just have a ball and my kids, saw here's their Mom, here was a woman, you know, and I was getting good money and I was having a great time, so my son switched from music to computer science so he ended up in the computer field. My daughter got a degree in psychology, but she couldn't get any work. She had to go on to a masters and she – she started in computer science too and she got a degree in computer science.

Elaine then reasoned,

> I recognize another route. Both my husband and I are in computing, and I think they see how hard we work. And I think they don't want to do it. It is hard work. Particularly if your in a development type environment, your Mom and Dad are working all hours of the day and night doing stuff, and I think that maybe we've given them the wrong message that – maybe I should do it like you and show them how much fun we're having from that perspective.

This discussion among the women showed that the women would like their daughters to enter the field. It also showed how people make career decisions based on

both what they want to do as well as what they do not want to do. In Alice's case, she encouraged her children through showing them how much she enjoyed the work. In Elaine's case, she encouraged her daughter to be more involved in computers and at the same time her daughter could see how hard Elaine worked in the field. Brenda talked about not wanting to follow the traditional path that her mother expected her to follow; and perhaps young women today were also demonstrating that desire by not wanting to enter the same field as their mothers.

There was some discussion about the changing expectations regarding education versus training. The women generally believed that education provided a long-term benefit to one's career. Though they also recognized that training and certification programs that are common today may be the way of the future and that the occupations are changing such that formal education is no longer the benefit it once was.

The Early-to-Mid-1990s Time Period

The early-to-mid-1990s time period represents a time when the percentage of women entering the computer-related professions was dropping. Although the actual number of jobs in the field increased 250% between 1990 and 1999, the percentage of women in these computer-related occupations dropped from all time highs of 34-36% in 1990 to 28-26% in 1999. This represents a significant change in the pattern for entry of women into the field.

As shown earlier in Figure 2, the change in participation of women in the labor force from 1970 to 1999 varies. The rate of increase of women participating has changed from a high during the decade between 1970 and 1980 of 5% to a fairly low increase during the decade between 1990 and 1999 of 1.3%. This shows that the rate of increase of women participating in the labor market has slowed as the total participation of women in the labor force moves toward equity with men. In 1999, women made up 46.2% of the total labor force in the U.S. (Bureau of Labor Statistics, 1999).

Over the years, women have also begun to participate more in a wider range of occupations. Women are more likely to be doctors, lawyers, and in business related positions. At the same time, computing has changed the character of many occupations. It is sometimes difficult to distinguish some occupations as being separate from computer-related occupations because of the level of computing that is done. For

example, filmmaking and animation are now made up of significant computer-supported activities. Yet, work in those fields is still very much filmmaking and animation, not computer professions.

These are some of the characteristics of the labor market that existed when the women in the second focus group entered the computer-related occupations. The second focus group in this study was made up of women who entered the field in the early-to-mid-1990s. The five participants were volunteers who live and work in the Washington, DC metropolitan area. I made announcements at meetings of the National Capital Chapter of the Association for Women in Computing, asking for volunteers. Each evening women volunteered. In addition, I asked friends to identify potential participants.

Profiles of the Early-to-Mid-1990s Participants

Each participant currently works in computer-related occupations. Two of the women work with network systems; one is a senior technical staff; one is a software quality manager; and one is a software developer.

The women are highly educated through both formal degree education and corporate development and technical training. The age range of the group was over a 20-year span because some of the women entered the field right after college and some of the women entered the field when they were older (after raising children or as a second career). A short summary of this focus group is included in Appendix C.

Amanda

Amanda is 43 years old, single, and has no children. As Amanda says, "my introduction to the computer field I feel is unique." She immigrated to the United States from South America where she grew up. During her first year in the United States, she was a nanny and housekeeper for a family. The wife of the family worked in the computer field and encouraged Amanda to enter the field. Amanda took some courses at a community college. She volunteered in the computer services group at the college and then she took at job as an acquisition specialist. After 4 years, she switched to the IT group and is now a technical lead at that company.

As Amanda says, "For me, I am proud because there are very few Latin American women who have done this...who have climbed to the position from being a housekeeper in this country to a technical lead without education and have done it. And I'm the only one in the corporation."

Beth

Beth is a senior network engineer. She is 29 years old, was single (she got married not long after the focus group session), and has no children. Beth has a bachelor's degree in government and a minor in economics. After graduation, she took a job insuring the accuracy of data in a database. She then was offered a job installing local area networks on U.S. Navy ships. That job gave her the opportunity to learn network systems. It also put her in a work environment where she often was the only woman. She decided to leave that job when the travel became more that she wanted. She then

moved to the corporate group to maintain the corporate wide-area network where she supports about 4,100 people at 12 sites. Her formal training in the computer field consists of mostly training related to certification. She is a Certified Network Engineer and a Microsoft Certified System Engineer.

Beth has an easy though confident manner. The kind of work she does is stressful and demanding. She remarked that her strength is in planning her work thoroughly so that she doesn't miss a step when doing something to the network like a rebuild.

Cathy

Cathy is a 38-year-old Black woman. She is married and has two children. She was the only participant in this group who is married or has children. Cathy decided to put her career on hold to raise her son. When he was older, she went back to school and finished a bachelor's degree in computer information and systems science. She is now a product assurance manager. Cathy was first introduced to computers in high school through a cooperative program with a local university. Although she didn't like programming itself, she liked working with computers and decided to enter the field.

Cathy is a quiet, thoughtful person. Her participation in the group was valuable because of her experience and the value she places on balancing work and family. She brought a perspective the other women did not have, and I think they learned from her experiences.

Donna

Donna has a bachelor's degree in electrical engineering. She is 27 years old, single, and has no children. She started in the computer field through working in the summers between semesters at school. After graduating, she worked for a very small company. She taught herself various computer skills. She then decided that the small company did not offer much opportunity for advancement, and the company did not have the technology to hold her interest. She has since worked for a couple of different companies. Donna most recently has been doing application programming, which she enjoys. She has also taken several training courses through the companies where she has worked.

Donna has the most technical degree of the group. Although she had not originally planned to be employed in the computer field, she has always been interested in technical fields.

Ellen

Ellen is a senior consultant/network administrator. She is 25 years old, single, and has no children. Ellen has a degree in international affairs. After she graduated from college, she took a job as a receptionist. After a while she took some classes to get into networking. She had to take a split position to get started in the networking group, and so she worked in administration and in the networking group. After getting certified in Novell systems administration, she moved to the networking group full time. Ellen

decided that there wasn't much more opportunity with that company so she took a job at a consulting firm.

Ellen has worked her way into technical positions through work and taking classes that led to several certifications in network systems and administration. She had to move to another company to leave the legacy of having been a receptionist, and to be fully recognized for the technical skills she had developed.

Career Related Decisions

None of the women in this focus group had a college degree in Computer Science. Cathy has a degree in Information and Systems Science, and Donna a degree in Electrical Engineering. Beth and Ellen have liberal arts degrees and Amanda has completed some college work. Cathy and Donna had some exposure to computers in high school.

The women entered the field through various routes. Their stories were very different. Amanda had immigrated to the U.S. and worked as a housekeeper and nanny in a household where the woman was in the computer field. Her employer encouraged her to go to school and enter the field. Cathy had left college to care for her young son and returned to school and the field when he was older. Beth and Ellen have liberal arts degrees and turned to the field because they could get jobs with good paying salaries. As Beth said,

> I think I took a more practical approach and realized that I'd be obtaining skills I could take anywhere I wanted to go. I can get a job in any state in the country, probably lots of countries around the world, too. But skills I could walk with anywhere at any time.

They also talked of how they enjoyed the problem solving aspect of the work – the logic and creativity needed to develop solutions. They were supported or encouraged by different people from high school teachers to employers to boyfriends who worked in the field.

When asked about the most beneficial decisions and the least beneficial decisions, this group had some difficulty. They tended to talk about their feelings about the work they do. They spoke of recent job changes and the first job taken. I then asked them what they looked for in a company when they were looking for a job. Cathy, who was the only married participant with children said:

> Something happened to me was learning how to balance family life and a career, because I did back out earlier when I had my son. I let all of the opportunities go for international travel and all of that because of family, and now, I have a daughter, and I said that I was still going to work this time. So, that was quite a challenge, because I felt like I was cheating my daughter. I didn't give her the same time I gave my son, but it's turned out to be OK. And I've been able to excel in my career and to be an OK mom, too! I'm glad that I took on the challenge.

Cathy's comments generated a discussion among the women about looking at company benefits and where women were in a company they were considering working for. Donna said,

> I've already looked at that myself, even though I'm not married yet and I don't have children yet. These are things that I definitely intend to do, and to me, family is the number one priority. I'm fine with doing whatever for the hours that I'm

> there, and maybe the hours will be a little bit more from time to time for various projects and things like that, you know, hey, there's responsibilities that come along with this business and there are places that I won't go because of the decisions I've made, but I'm OK with that. But I definitely look for flexibility, and I look for where the other women are in the company, and do I see them in other places. Are they listed as being high up? You know, are they doing technical things, or are they all kind of on the non-technical side? Are they the technical writer? Are they AAs? Where are they? What are they doing?

The women spoke very little about bad career decisions that they had made. Even though some of the women in this group had worked for up to 10 years, I think they did not have enough experience in making the important career decisions to effectively reflect on and analyze those decisions that have long-term effects on their careers.

These women entered the computer-related occupations at a time that was different from when the women from the first focus group entered. Women had a broader range of occupational choices, and the image of the computer-related occupations was not attractive to women. Instead, many believe that women who might have entered these occupations chose other more attractive occupations that either had potential higher monetary rewards or had a more positive image for women.

Work Experiences

When asked about issues they had faced as women in this field, the participants recounted situations that they faced in the workplace. They told of inappropriate remarks made to them, and of conversations that male co-workers had in their presence. One of the participants told of asking to be taken off a project because of the

inappropriate comments a co-worker continued to make. Beth at one point worked on ships installing network systems. She said,

> So not only was I trying to compensate for my lack of knowledge – and truly my lack of knowledge, I had no experience – but there was no way to fit in. The baggiest clothes, the dirtiest jeans, hard hats, steel toed boots, you're still a girl.

One other point brought up by Beth was that she believed that she worked differently than her male co-workers. She saw herself as working slower; she did more planning. She knew that the work involved precise steps and she created plans for her work to insure that she completed all the steps necessary. She observed that her male co-workers worked faster, but did not plan the way she did. She also told of a time when she had worked over a long weekend on an installation and a male co-worker came in and accidentally destroyed all her work. He cursed, and she cried. She explained to him that she simply expressed her emotions differently than he did. So that when upset and frustrated, she cried and he cursed.

Ellen talked about a work environment where she was the only woman in the work group. A second woman was brought into the group, and Ellen found that she was then excluded from certain activities because now there was another woman whom she could do things with. She had felt more included when she was the only woman.

The women also talked about having to prove themselves. Donna commented: "although nobody's saying anything, especially when you start something new, you

definitely have to be, you know, x many steps ahead of where the guys are." Beth and Ellen agree with her.

Donna made a final comment about the issues she recognized in her own work environment; however, through the focus group discussion she realized that she is not alone nor are the issues isolated to just the organizations where she has worked. She said,

> I don't think I heard anything today that I thought was a big surprise. From the same perspective, it was very comforting because you always sit there and wonder, 'this has got to be happening elsewhere, right? It's not just me.' And you can talk with other women in your company and you can get a perspective there, but you get it across the industry here.

I asked what advice they would give a young woman entering the field today. Many of their answers were related to day-to-day activities. They said they would advise a young woman to be assertive, to speak her mind, and not let anyone make you think you can't do the work. Ellen suggested, "So if you can just tell a person, 'I'll have to check on it and I'll get back to you,' and then go find out, you get pretty far, and you've learned something new, and they don't think any less of you for it." Cathy's advice was to go into an area that the young woman likes and then consider the money. She also recommended setting goals and evaluating them periodically.

At one point the group talked about Computer Science degrees. In general, they questioned the value of a Computer Science degree. Beth and Ellen received their training through certification programs. Most of the women said that if they were to get

another degree they would choose a different field to give them more breadth rather than the intense depth a Computer Science degree would give them.

Comparison of the Two Time Periods

The women in the two focus group sessions commented that they were struck by how they came from different backgrounds and yet there were so many similarities in their experiences. I found this was also true when comparing the participants' responses from the two focus group sessions. Yes, there are marked differences, but there are also strong similarities.

As a part of the analysis of the focus groups discussions, I coded the text into categories (see Appendix D for a complete list of coding categories). The analysis of both focus groups resulted in two major categories: career decisions and work experience. The 1970s group had more discussion around career decision criteria and the definition of computer careers. The 1990s group had more discussion around work experiences.

Similarities of the Groups

Both groups of women had bachelor's degrees in a wide variety of fields. Only one participant had a BS in Computer Science, and one a BS in Information Systems. Several participants in both groups said that they entered the field without planning to enter it. They talked about backing into it or finishing school and taking jobs in the field because their other alternatives were not as attractive.

Although the women who entered the field in the 1990s are relatively at the beginning of their careers, it looked like their entry and the kind of work they are currently doing is not incongruent with the career paths of the women who entered the field in the early-to-mid-1970s. The work they will be doing and their opportunities will be unique to the time period, but the general career paths look very much the same.

Both groups of women had experienced being the only woman in a work group or one of only a few women. They both also noted that there are not many women role-models in the computer field. Each group could list a couple of women, though each group also noted that the most visible role model in the computer field today is Bill Gates, the richest man in the U.S., who dropped out of Harvard University to start his business, Microsoft.

Differences between the Groups

There were marked differences in the two groups. The women from the 1970s believe formal education is important to career progression. The women from the 1990s question the value of education and favor training and certification in specific areas such as network administration.

The responses from the women from the 1990s to the question about advice to young women entering the field were much more tactical, for example, "be assertive," "speak your mind." I think the responses reflected issues they have recently struggled with and may still face periodically.

The women from the 1970s responded with more strategic advice, for example, get education. The women from the 1970s group are more experienced and probably do not worry much about being assertive or proving their competence. They talked about the need to be competitive in the field and that they had learned to be competitive over the years. This is a result of their accumulated work experiences, and they had a level of confidence that the women from the 1990s group will develop over the years as they also gain experience.

There were also differences in responses about what issues they have faced as women in the field. The women from the 1970s spoke with more detachment about things that had happened to them in the past and about observations they currently make but have become used to, such as being the only woman in a meeting.

The women from the 1990s spoke with intensity about situations they have recently faced in their work groups and the workplace. The women who have been in the workplace longer have developed defenses, perhaps unconsciously, to certain situations. They have also reached higher positions that preclude certain workplace issues. They would not refer to themselves as girls, as some of the women from the 1990s group did.

Summary of the Two Time Periods

The similarities between the two groups are reflected mostly in their decision-making processes. The ways they decided to enter the computer field are similar. Each has her individual story, but many are very much alike.

The ongoing career decisions for the 1990s group are just beginning. They have recognized some of the criteria that are important for them, such as: the need to move to another company to escape the label of a previous non-technical position held at that company; the desire to work with new and varied technologies; and the need to balance work and family. Their stories relayed the beginnings of these decision criteria that will provide them with guidance throughout their careers.

The 1970s group responses reflected a long-term view of career decisions that is gained only through retrospection over a multi-decade career. They talked about the impact of decisions made that lasted 10 to 15 years. They also talked about the value they now bring to the industry, since four of them were no longer "technical."

In general, the similarities between the two groups were strong. The differences were mostly because of the differences in their tenure in the workplace. The 1970s group reflected perspectives of women who had worked for a long time and had varied experiences. The 1990s group reflected perspectives of women in the early part of their careers.

CHAPTER 5 – DISCUSSION

Introduction

Women have been significant contributors in the computer field since computers were first built. Their participation in such occupations has increased steadily until the last decade. This study looked at two time periods. One involved significant increases in the participation of women in computer-related occupations (the 1970s), and the second involved a decrease in the participation of women in computer-related occupations (the 1990s).

Contributing Factors

Women have participated in computer-related occupations since computers were first developed. They played a significant part in the advances made in software function and design. Today women participate in these computer-related occupations at a higher rate than many other scientific/engineering occupations. Yet, there also are indicators that raise concerns.

Each year the magazine, Working Woman, has a special issue on "hot" careers for women. In their July 1995 issue, the magazine listed computer software engineer third in the top 25, and ranked the field as male-dominated because only 17% of computer-engineering college graduates were female (Jones, 1995, July). For years there has been a drop in women entering computer science and computer engineering degree programs. Only recently (1998-1999 academic year), has the number of women receiving both undergraduate and graduate degrees remained constant (Morris & Morris, 1999, March).

The increased representation of women in the computer scientist/systems analyst occupations in the 1970s was attributed to two contributing factors originally cited by Strober and Arnold (1987a) and further elaborated on by Donato (1990). These two factors are that women have significantly increased their participation in the labor force at the same time the computer scientist/systems analyst occupations have grown. For example, from 1970 to 1980 the occupations grew from 93,200 to 200,684; women

employed in the labor force grew from 29,090,368 (38%) to 41,984,355 (43%)(Strober & Arnold, 1987a). This means that the occupations more than doubled in size, at the same time the number of women in the labor force increased by 128,939,987 (30%).

In contrast, in 1999 the computer scientist/systems analyst occupations employed 1,549,000 people with 442,000 (28%) being women (Bureau of Labor Statistics, 1999). This represents a drop of 6 percentage points from 1990 in a occupation field that increased by 2.5 times during the same time period. In addition, the 1998-1999 Occupational Outlook Handbook (Bureau of Labor Statistics, 1998) projected these occupations to be one of the top three growth occupations through 2006.

The question arises, "Why are the computer-related occupations less attractive to women?" or from a market place perspective, "Why are women not entering the computer-related occupations?" One theory that can be used is Strober's (Strober,1984; Catanzarite & Strober, 1993; and Strober&Arnold, 1987b) general theory on occupational segregation. Her theory assumes:

1. Social norms as well as profits influence employers' hiring decision.
2. White males are given first choice for new occupations.
3. Choices made by these men are made to maximize their economic gain.

Strober's theory of occupational segregation was founded in the "power" category of theories of discrimination (Ehrenberg & Smith, 1988) and leads to the assumption

that there is a noncompetitive environment. This means that normal labor market functions will not correct the occupational segregation.

The women in both focus groups cited their career entry decisions as being based primarily on ease of entry into the field, prospect of good salaries, and liking the work (the problem-solving aspect of the work). This was also not the first career choice for most of the women in the focus groups. They have degrees in various fields and chose to enter the computer field because it offered them an interesting job with good salaries and multiple job opportunities. The criteria have not changed much over the two time periods.

The women have made different types of career decisions over the years. The women in the 1970s group commented that they felt they stayed in one organization too long, while the women in the 1990s group talked about changing jobs because they wanted access to different technologies, or because they needed to get away from the carryover of a previous non-technical position. The women in the 1990s group were more likely to change jobs and organizations. Part of that willingness could be attributed to the high availability of IT jobs during the 1990s.

The women in both focus groups said they would encourage young women to enter the field. They believe that there are opportunities for advancement as well as multiple job opportunities. Although they recognize that there are issues working in a field that

is predominantly male, they also recognize that there are opportunities because of the tight labor market and that women can take advantage of those opportunities.

Women's employment opportunities have also changed over the years. Women are more likely to enter professions such as medicine, law, and business, than they were in 1970. Women are represented to some degree in the higher jobs in the computer field. Generally, those women have degrees in business and have experience in the business side of the industry. These women, such as Carly Fione of Hewlett Packard, are highly skilled in business and not necessarily technically trained. In many cases they hold MBA degrees.

At a recent conference on women in computing, there was a great deal of discussion around the current image of computing. The women at the conference expressed concern that the computer field has an image that is not attractive to young women.

Indicators for the Future

The President's Information Technology Advisory Committee noted in their February 1999 report that the information technology labor market is experiencing "appropriability." This is a "market failure" where there are not enough trained people to fill the positions. There is added concern because there are not enough young people in the "pipeline." The number of students in undergraduate computer engineering and computer science programs is below the market demand, and the number of students in those graduate programs is even more crucial. One of their resulting recommendations is to "expand the participation of underrepresented minorities and women in computer and information technology careers" (President's Information Technology Advisory Committee, 1999, February).

Professional societies such as the Association for Computing Machinery have special committees for women in computing. The Computer Research Association, a research oriented association, has a special program to study women in computing research. The National Science Foundation also has a program to study underrepresented minorities and women in Information Technology. All of these programs are in place because the information technology industry is a growing segment, and it has become critical in the overall well being of the country – economically and in support of the country's infrastructure.

At the same time, the labor market has not been able to meet the demand for trained people, and young women have not been entering computer-related degree programs at the same rate as they were in the 1980s. The indicators for the future show a deepening "market failure" as pointed out by the President's Information Technology Advisory Committee. For women, the high demand for computer professionals continues to be an opportunity to gain entry. However, for those women to fully advance in their careers they need to start early and optimally have a degree in the field. This is not just an individual decision. It also requires that women find these degree fields attractive and not discriminating. Today that is not the case, and it is up to organizations such as the National Science Foundation, colleges and universities, and professional societies to change the image of the field to be more attractive to young women as they choose their careers.

In the 1999 study of the supply of Information Technology workers, Freeman and Aspray (1999) commented:

> A number of groups are underrepresented in the IT workforce and in the educational programs that prepare people for careers as IT workers. These include women, Hispanics, African-Americans, and Native Americans. If these groups were represented in the IT workforce in proportion to their representation in the U.S. population, this country would have more than an adequate supply of workers to fill even the most dire estimates of a shortage.

Limitations of the Research

The research had two major limitations. The first was that only one focus group was held for each of the two time periods studied and second that the study involved only two time periods. The data collected would have been richer if there had been more than one focus group for each time period. There would have been less risk of bias in the data because of group interaction in the individual focus groups. The study of more than two time periods would have provided a fuller view of the occupations and how they have evolved over the years. As it is, we see the differences between only two periods in a very fast changing set of occupations.

Suggestions for Further Research

In the two focus group sessions that I held there were marked differences in the responses to some of my questions. The women who started in the computer field in the 1970s could easily answer questions like, "What were the most beneficial career decisions that you have made, and conversely what were the least beneficial career decisions you have made?" The women who started in the computer field in the early-to-mid-1990s had difficultly with that question, and some said they could not answer it. Based on that, and some other comparisons between the two groups, I think there are developmental stages for people in relation to their careers and their ability to analyze their career-related decisions. The accumulated experiences enabled the women who have worked longer to reflect on questions such as this. However, given that some of the women in the 1990s group have been working for up to 10 years it seems as though this moves into the "lifecourse" realm, and stages that could be best marked in decades rather than years. In my readings on career development I have not found anything that relates to this. The only stages I have seen in career development related more to career progression or to development from childhood to young adulthood in establishing appropriate career expectations, rather than the ability to reflect and analyze career decisions later in life.

I was not expecting to find this. I expected the two groups to have different experiences based upon when they started work, but not that they would have such

marked differences in ability to answer some of the questions. I think this warrants additional research in the area of career development theory.

Conclusion

As I look at the results, one thing strikes me as important. The computer field was not the first choice for most of the women who participated in the focus groups. This was also true for me. Of particular note is that this was true for both focus groups and apparently has not changed over the years.

I see that for the computer field there are two points of entry – first, through initially studying computer science or a related degree, such as information science, in college; the second through entering the job market and changing careers to the computer field. Since many of the women enter the field as a second career, employers, colleges, and professional associations would benefit by putting programs in place that would help these women enter the field more easily and enable them to develop a good career foundation that would enhance their ability to advance in the field. I know some organizations have put in place programs to train people in specific computer skills to meet current needs. These programs could be expanded to provide those people who are changing careers a more in-depth understanding of the computer field and therefore a better chance to advance in the field.

Colleges and universities could also develop and promote transition paths for people who already have degrees to get a degree in computer science. Computer Science degrees are often viewed as difficult and very structured. People who may want to return to school are often discouraged by the structure of the Computer Science

programs and the degree requirements. I suggest that schools look at how they can help potential students who already have degrees to enter their programs and successfully complete them.

Professional societies recognize the need to encourage women to enter the field. They are currently focused on young women entering college. They also need to identify other sources of women entering the field and develop programs to both encourage them and help them transition into the computer field.

This study was intriguing to me. I did not anticipate when designing the study different career development stages. These different career development stages became evident in the participant responses to certain questions. At some point I would like to hold additional focus groups with women who entered the field at different times to see if my observations are upheld with additional data.

The study has also helped me develop a better understanding of the dynamics of the profession I have participated in for over 25 years. The recent changes in female participation in the field is alarming. As a professional woman in the field, I am also concerned and want to help young women made informed and reasoned decisions regarding their career choices and help the image of the computer field to better reflect the general experience rather than a caricature representation.

EPILOGUE

This epilogue explores and analyzes my career decisions and experiences. As a method of exploring my career, I will answer a set of questions that were initially developed for use with focus groups to explore the participant's career decisions and work experiences in computer related occupations. Each question is first presented and followed by potential probe questions. My response to the question is then given. I grouped the six questions the following way.

- A brief introduction
- Career decisions made
    - Why did you enter the field?
    - Most beneficial and least beneficial decisions
- Work experiences in a predominantly male career field
- Meta questions
    - What advice would you give a young woman entering the field today?
    - Why are women today not entering the field?

Before I answer those questions I have provided some background information about myself. I have said that careers are influenced by personal and social factors, and I believe this information will add valuable data that can be used in analyzing my career.

I am a 52-year-old White woman. I have been married twice and am currently single. I do not have any children. I have worked continuously in the computer field since 1973 except for an 18-month period. During that time I studied and was the guardian for a 17-year-old girl from Lithuania.

I have a Bachelor of Science degree in Family Resources, a Master of Science in Computer Science, and a Master of Arts in Organizational Development. I have completed numerous corporate sponsored professional development courses in business and management as well as personal interaction skills. In the past, I also took corporate sponsored courses to strengthen my technical skills.

The field has changed, and computers have become an integral part of our everyday lives. My work in the field has also changed, partly because of the changes in the field and partly because of my increased breadth of experiences. I am currently a visiting scientist at a research and development center that is administered by a university. My work now focuses on how software development organizations can improve the way they develop software. This involves both developing better software engineering practices and advising about organizational change to help organizations implement new practices.

A Brief Story

Question 1:

Briefly describe your professional journey in the computer related occupations.

Probe:

What is your current position and responsibilities?

What other positions have you held? For how long?

I have worked in the computer field over 25 years and have found it both rewarding and frustrating. The computer field was not my first career choice. I originally went to college with the intent of becoming a clinical psychologist. After one semester, I changed my major to Family Resources. This major prepared me to teach home economics (which I never did), and enabled me to start a master's degree in Family Relations (which I never finished).

I wanted to work while studying and could not find a job in the small university town where I lived. I finally took a job at the university computer center as a data clerk. While working at the center, I took a computer programming class and found I enjoyed programming. I remember meeting with my major professor in Family Relations and asking him what kind of jobs would be available to me after finishing that degree if I did not relocate. His reply was that I could probably get a part-time teaching position at a university branch campus about 45 miles away. The next day I met with the chair of the Computer Science and Statistics Department and asked what I needed to enter the Computer Science masters program. He said that I would need 12 hours of calculus and

another 3 hours of statistics. I then asked if I could take those courses concurrently with the computer science courses, and he agreed with that request. And so, with the encouragement of family, friends, and computer center colleagues, I entered the Computer Science masters program at the university.

The Computer Science degree program I entered in the early 1970s was new at the university. The department was looking for students, and my entrance was relatively simple. The field was new and open. Students were encouraged to enter and successfully complete the program. If a potential student exhibited academic capabilities, previous non-technical related degrees did not stop acceptance. This lack of pre-enrollment requirements enabled me to enter the field and complete a graduate level degree. The master's degree in Computer Science provided multiple job opportunities for me and was one of my major career decisions.

My work in the field includes several years as a programmer and systems analyst, almost a decade as a systems engineer, several opportunities as a technical manager, and now I work in a research organization that researches and advises organizations on improving software development processes.

Why Did You Enter the Field?

Question 2:

As you look back, when you first entered the profession, can you think of two or three factors that you considered when you were making the decision to enter the field?

Probe:

Has a particular person encouraged you or helped you during your career?

When you were deciding what field to enter?

Later in your career?

My decision criteria included both economic and personal interest reasons. The economic reasons were very high at that time and have continued to be high through out my career. The field has enabled me to earn a comfortable living and has provided me with many employment opportunities.

I also entered the field because I thoroughly enjoy computer programming. The development of algorithms to solve programming problems is like a number game for me. I was a programmer/systems analyst during the first 7 years of my career. That experience and another 6 years as a systems engineer enabled me to build on the computer science degree and develop a thorough understanding of computer systems.

I was encouraged by friends and family to enter the field. My first husband was a systems analyst with the university. He introduced me to computing and encouraged me to get the degree. Once in the Computer Science degree program, fellow students

encouraged each other. The graduate students got together in the evenings a couple times a month to talk about the curriculum and our studies. As a result of those evening sessions, we submitted suggestions to the department on the curriculum. I still keep in contact with friends made at that time and consider them some of my closest friends.

Later, I received encouragement and mentoring from a senior level systems engineer. When I first joined a company, he was assigned to mentor me and help me learn about the company as well as answer any technical questions I might have. Like my graduate school colleagues, we have maintained contact through the years – even after my leaving that company and his retirement.

Most Beneficial and Least Beneficial Decisions

Question 3:

What career related decisions have you made that were most beneficial? Least beneficial?

Probe:

Have you made decisions that have guided you through several jobs or positions?

Have there been any specific decisions that have affected you career significantly?

I have always believed that completing the master's degree in Computer Science early in my career was one of the best career decisions I ever made. Having that degree on my resume has separated me from other job applicants because there are few people in the field with graduate level Computer Science degrees. It has enabled me to compete more effectively for jobs. Though, I must add that once hired your work is what distinguishes you, and your work is a result of what you have learned throughout your career. The combination of education and experience is what you bring to the work you are currently doing.

Another good career decision was to take a job with a computer company that is considered a leader in the industry. I increased my technical understanding tremendously through their educational program, and I developed business and professional skills that I believe I would not have learned anyplace else.

There are two least beneficial career related decisions that I have identified. The first is related to the company I mentioned before. I let the culture of the company influence my career too much and tried to follow their career path rather than my own. As a result, I became frustrated and unhappy. Although it was an important experience for me and I can credit the company with many positive attributes, I needed to leave to achieve a fuller expression of myself and my career.

The second least beneficial career related decision was that I let myself drift from the more technical skills. Some of that is inevitable in a technical career field as one moves through different kinds of jobs; however, I enjoyed the technical side and feel a loss of the highly honed skills needed to keep that sharp technical edge.

I also have some long-standing career related decisions that have guided me through several career situations. Early in my career I started a list of "warning signals" that tell me when it's time to leave a job. These warning signals actually reflect basic indicators that relate to job satisfaction and career advancement. The list is not long – there are only three items. I state them the following way,

"Its time to change jobs when,

you feel you need to drink a martini at the end of each work day,

you (or your manager) believe you are indispensable,

you see the organization as your career."

I identified the first two signals when leaving the first job I had after graduate school. The first signal is an indicator that the job had become too stressful and had

started to detrimentally affect my emotional and physical well-being. The second signal means that neither you, nor your manager, see potential career advancement opportunities in the position. I was locked into a position in that organization. The only way for me to advance was to leave.

The third signal is related to my experience with the computer company mentioned before. That company is very large, and a person can spend a career being adept at understanding and moving through the organization. After a few years, I found that I had lost my career identification with the computer industry and instead identified more closely with the company. That was one of the major reasons I left. I needed to start "writing my own career script" rather than following a company's script.

In 1980, I made what I call a meta-career decision. That career decision has since been a primary guide for my employment decisions. I decided that as long as I worked in the computer field, I would work only for computer-related companies. In other words, I decided not to work in a support function such as payroll or accounting for a manufacturing company. I decided that it was too easy to end up in a dead-end job, and I needed to work in an organization that provided multiple opportunities for career moves. If my career was to be in a computer-related profession, then I wanted to work for a company in the computer industry. Since then I have worked for four organizations – three of the organizations were in the computer industry, and the organization I currently work for is a software engineering research center at a university.

Work Experiences in a Male-Dominated Occupation

Question 4:

Computer related professions are around 30% women and are grouped in nontraditional types of occupations for women – scientific/technical. Have you faced issues as a woman in a computer related occupation, and if you have, do you have an example of an issue you faced that you think would be unique to these occupations?

Probe:

For example, has there been an assignment or job that you wanted, but didn't get?

It's often difficult to distinguish between career disappointments based on expectations that were not realized and experiencing discrimination. Discrimination can be so subtle that even the person who is discriminating against another may not fully realize the impact of his/her actions. There were obvious discriminatory practices that happened to me when I was a young woman. These types of practices occurred often in the early 1970s. One experience was during a job interview. The prospective employer asked me when I planned to have children and if I could assure him that I would work in that job for at least 10 years. My response was that I felt I could provide his organization with a level of expertise not many people could bring to the job. I believed that I could help them improve the computing efficiency and effectiveness of the office. However, I did not see myself being happy in that one job for 10 years, and I

could not give him the assurance that I would stay for that length of time. Needless to say, I did not get the job.

Employment practices like that are no longer acceptable, although subtle discrimination still occurs, both in employment practices and workplace practices. For example, I have seen my ideas not recognized and then revisited when male colleagues suggested them.

Once I had a pay adjustment of several thousand dollars made to my salary because of recognized pay inequalities. This indicated to me that over a period of years my salary increases had not been comparable with my male colleagues.

In a technical field, women often have to prove their technical expertise. Many times I have felt that I needed to prove my expertise and abilities. This was particularly true when I worked in more technical positions. I also found that once that expertise was recognized, it was much easier for me to stay in that organization rather than move to another and go through reproving my expertise.

Advice to Women Entering the Field

Question 5:

Today, if you were advising a young woman making a career decision to enter a computer related profession, what advice would you give her?

Probe:

Would you advise a young woman to enter the computer field?

Is there something specific that she can do early in her career that would benefit her in the long-term?

I definitely would advise a young woman to enter the field. The field has changed dramatically over the years. There continue to be forms of discrimination; however in general, the field provides women with the opportunity to do exciting work as well as make a good living. First, I would advise her to get as much education as possible, preferably a degree in Computer Science or a related field. She can then focus on expanding her learning through technical training and professional development. The field requires people to constantly learn new skills. She needs to recognize that, and work hard to develop and maintain technical and business skills.

Next, I would advise her to look closely at the different organizations involved in the work that she wants to do, and choose the best of those organizations to work for. She should look for the organizations that have the best reputations for both their

products and their personnel practices. She should also look for organizations that have women managers, preferably in higher positions.

Why are Women Not Entering the Field?

Question 6:

During the last several years there has been a significant drop in the number of women entering computer science undergraduate programs. What do you think has caused this change in women pursuing computer science careers?

I think there are several reasons women have not been entering the Computer Science degree programs. When I entered in the early 1970s, there were not many career opportunities for women. There were few women in professions such as medicine and law. Even the military academics were closed to women students. Computer Science was a new field that offered career opportunities for people regardless of their gender. Since then, other professions have expanded to include more women. In addition, the computer field has developed a public image that is not attractive to young women. The expectation is that you need to have an extensive background in computing before entering a degree program to be successful, and that the program is extremely difficult.

The computer field has and continues to provide women significant opportunities. At the same time, there have been difficulties involving acceptance in many subfields; and there is evidence of a glass ceiling.

Analysis of a Career

I have used the interaction of career development theory and labor economics theory as a framework to analyze my career. This includes an exploration of the impact socieoeconomic factors may have had on my career. I have divided the analysis into four sections: (a) career entry choices; (b) ongoing career decisions; (c) work experiences; (d) reflections.

Career Entry Choices

Like many people making a career entry choice, I did not conduct an extensive study of the field nor did I explore other potential fields. Rather, my entry was the result of false starts in other fields and learning the hard lesson that employment opportunities and wages are very important when choosing a career.

In retrospect, however, I believe my career entry into the computer related occupations was influenced in some way by labor market trends at that time. There was a significant increase in the number of computer scientist/systems analyst and computer programmer positions in the 1970s. Those occupations grew from 254,000 to 513,000 from 1970 to 1980 (Bureau of Labor Statistics, 1999). At the same time, the participation of women in those occupations increased from 20% to 27%, an increase of 7%. In addition, the participation of women in the workforce increased from 37.5% in 1970 to 42.1% in 1980. Donato (1990) attributed this increase of the participation of women in computer related occupations to the labor economics theory that high growth occupations will attract new labor sources. I entered the computer related occupations in 1973. Therefore, I am one of those many women who entered the labor force at the same time demand in those occupations increased.

How those broad labor market activities can influence an individual's decision to enter a particular career field is hard to describe. Yet, I know that at the time I recognized that for me the field was relatively easy to enter, and that it would enable me to earn a good salary. I recognized multiple opportunities for employment even in the

small university town where I lived. I also knew that salaries were competitive with salaries in other professions.

Ongoing Career Decisions

Ongoing career decisions include those decisions that help a person guide future decisions. My primary ongoing career decisions were guided by my "warning signals." These warning signals helped me recognize when it was time to leave a job or organization. The first warning signal – "a martini at the end of each work day" – reflects a high level of stress. This is very much a personal sign that I need to change jobs. The second warning signal – "you (or your manager) believe you are indispensable" – reflects a job situation where even if there were opportunities to advance it would be difficult. This warning signal may be an indicator for many career related problems that all lead to the same outcome – slow career advancement.

The third warning signal – "you see the organization as your career" – reflects the situation where you have lost contact with your career field and instead identify more with the organization where you work. Osipow (1983) discussed this potential situation in relation to industrial organization. This sociological approach to career development considers the impact of organizational constraints. The organizational constraints such as organization defined career paths help explain my third warning signal.

The meta-career decision that I made in 1980 – to work only for computer-related companies – indicates my desire to work in organizations that would provide me with multiple opportunities. Astin's model (Diamond, 1989) addressed work expectations and structure of opportunity as major constructs of women's careers. My

meta-decision takes into account these constructs in that I recognized I probably did not have the same number of opportunities available as my male colleagues, and so I needed to structure my career moves to allow for the availability of the most opportunities. I knew that working in a support function for an organization would limit my opportunities and determined that the most opportunities would be in companies whose primary business was computer related.

Larwood and Gutek (1989) developed a model that incorporates five components in a decision matrix. The components are (a) career preparation, (b) opportunities available, (c) influence of marriage, (d) pregnancy and children, and (e) timing and age. My career in the computer-related occupations can be analyzed to an extent using the model.

Career preparation – My career preparation involved the master's degree in Computer Science. In addition, in computer-related occupations ongoing training and education is necessary.

Opportunities available – As I mentioned before, I structured my career to increase the number of opportunities. I have also found that living in large metropolitan areas increases opportunities.

Influence of marriage – My first husband introduced me to computing and was influential in that way. I have found that, in general, my marriages have been positive influences on my career.

Pregnancy and children – I do not have children and therefore pregnancy and children have not played a critical role in my career decision. However, family responsibilities toward my mother did play a significant role in my decision to return to the Washington, DC area.

Timing and age – It seems as though age is playing more of a role now. I find that I do not want positions that require significant travel. I am also looking toward retirement and am starting to think about how I can best be ready for those years ahead of me.

Work Experiences

Work experiences reflect workplace environment and can indicate discriminatory practices. My experiences as a young woman are indicators of the times. Over the last 25 years workforce practices have changed dramatically, and practices that were once common are no longer accepted. These changes have come about with the help of workplace laws and regulations, such as, Title VII on the Civil Rights Act of 1964 and its amendment in 1978, as well as the Civil Rights Act of 1991.

I think the most dramatic indicator of discrimination in my career experiences is the pay adjustment I received a few years ago. This pay adjustment was significant in both the amount of the adjustment and the recognition by the organization that it was needed. As Morrison et al. (1992), pointed out, the glass ceiling is particularly insidious because of the cumulative effects of small differences in promotions and income increases across the span of a woman's career. As I think about the pay adjustment I received, I think of the years that led up to the adjustment when I was not receiving the pay increases I should have, and the lost income over those years that will never be recovered. I have wondered what my salary would be and what kinds of job opportunities I would have had if I were a man. Although I will never know, I do know that over the years it would have made a difference.

Reflections

After spending over 25 years in a career field, there are lessons learned. Some of those lessons were hard earned and need not be lost. My career warning signals and my meta-decision have been important to me over the years. The advice I would give to young women entering the field reflects my years of experience.

Over the years, the computer field has changed tremendously. The technologies have changed, and computers have become common household items rather than monstrously large machines cloistered in highly regulated rooms that only the specially trained personnel could access. The field has expanded in definition, career opportunities have multiplied, and degree programs have divided from strictly computer science to include degrees such as information technology and information systems management.

It remains one of the most exciting and challenging career fields. I have learned much over the years and have much more to learn. I have also given to the field and look forward to giving more in the future. The work that I do now in research and development allows me the opportunity to give to the field.

Analysis Summary

Labor economics explains aspects of my participation in the computer-related occupations. First, labor economics points out that I am a woman who has chosen to participate in an occupation field that is nontraditional for women and is between what Barbara Bergmann (1986) described as male-dominated and well-integrated. Only approximately 27% of the workforce in the computer-related occupations are female. Next, labor economics explains that I entered the field when women were entering the workforce in greater numbers and the computer-related occupations were increasing dramatically in demand. And so, I entered at a time that made entry easier for women.

Career development theory is more helpful in explaining my ongoing career decisions that include decisions to increase the availability of opportunities and my decision to focus on my career field versus a corporate career ladder.
The women's movement at the beginning of my work-life influenced my career. Feminist social action has also enhanced my work environment through its advocacy of civil rights and elimination of gender discrimination. Enacted laws have made the workplace less hostile to women and provided mechanisms for improving equal opportunity. For example, at the beginning of my career there would have been little chance for a salary adjustment like the one I received later in my career.

In conclusion, each theory base contributes to understanding my career and career decisions. As a result of using the different theory bases I confirm my belief that

each interacts with the other and contributes to not only each other, but also to the whole understanding of the dynamics of women's careers.

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APPENDIX A – Focus Group Script and Questionnaire

Focus Group Script

Thank you for agreeing to participate in this focus group. I am hoping to gain a better understanding of how women have participated in the computer related occupations that are in traditionally male-dominated occupations. I am interested in learning about you career decisions and experiences while working in the computer field. There are no right or wrong answers but rather differing points of view. Please feel free to share your feelings and opinions even if they differ from what others have said. We will not refer to specific organization or individuals during the focus group. If any names are mentioned, they will be substituted with a descriptive identifier.

I don't expect any one woman's experiences will fully describe the participation women have had in these occupations. Rather I expect to derive patterns and common themes from their experiences.

As I mentioned to you when we set up this focus group, I expect the session to last about 2 hours. This session will be audio taped. If you do not want to participate because of the taping, I understand.

I have a few questions to ask you, but essentially I hope you will feel free to share your career decisions and experiences with the group. What you tell the group will not be reported to anyone, and I ask the group members to treat what is said during the focus group session as confidential information. Because this is a group setting, I can not guarantee confidentiality though I, as the researcher, will treat the data as confidential.

This study is for my doctoral dissertation. I will use the information from this session to identify themes. I will send you a copy of the summary report from this session, and I will ask permission from you to include any quotes in the dissertation. I will use fictitious names for participants or companies mentioned to insure anonymity.

Before I start I need you to read this Informed Consent Form and to sign it if it seems right for you to go ahead in this focus group. One copy is for you to keep. You can telephone me later at the number on the top of the form if you would like to add, change, or discuss anything. I also appreciate you filling out this short background questionnaire.

START

Before we begin, let me share some group rules. Please speak up, with only one person talking at a time. I'm tape recording the session because I don't want to miss what you have to say. If several people are talking at the same time, the tape will get garbled and I'll miss your comments. We will be on a first name basis today. This is a discussion. You don't need to be called on to speak. Also, keep the focus on yourself and relate your first hand experiences.

Focus Group Guide

The following questions are designed to guide a conversation between the researcher/moderator and the participants. They are open-ended and developed to allow the researcher and the group to gain a better understanding of the career decisions made by the participants and their work experiences in the computer related professions.

1. Briefly tell the group about your professional journey in the computer related occupations. Use this as an introduction so the group has an idea of what your background is.

Probe:

- What is your current position and responsibilities?
- What other positions have you held? For how long?

2. What career related support/encouragement have you received from your colleagues, friends, family, organizations, or associations?

As you look back, when you first entered the profession, can you think of two or three factors that you considered when you were making the decision to enter the field.

Probe:

- Has a particular person encouraged you or helped you during your career?
    1. When you were deciding what field to enter?
    2. Later in your career?

3. What issues have you faced during you career?

I mentioned earlier that computer related professions are around 30% women and are grouped in nontraditional types of occupations for women – scientific/technical. Have you faced issues as a woman in a computer related occupation, and if you have, do you have an example of an issue you faced that you think would be unique to these occupations.

Probe:

- For example, has there been an assignment or job that you wanted, but didn't get?

4. What career related decision have you made that were most beneficial? Least beneficial?

Probe:

- Have you made decisions that have guided you through several jobs or positions?
- Have there been any specific decisions that have affected you career significantly?

5. Today, if you were advising a young woman making a career decision to enter a computer related profession, what advice would you give her?

Probe:

- Would you advise a young woman to enter the computer field?
- Is there something specific that she can do early in her career that would benefit her in the long-term?

6. During the last several years there has been a significant drop in the number of women entering computer science undergraduate programs. What do you think has caused this change in women pursuing computer science careers?

7. As you think back about what we have talked about over the last couple hours, is there a particular point that you think is striking or of particular importance?

Background Information Questionnaire

Code Number:_____ Date:_____

Please indicate you age. _____years

Are you married _____ or single _____?

How many children do you have? _____

What year did you first take a job in the computer field? _____

How long have you worked in the computer related occupations (include full-time and part-time work)? _____years

What is your current position? _____

What is your educational background?

Degree, Certificate, Diploma	Name of School	Date
High School		
Undergraduate Studies		
Graduate Studies		
Specialized Training and Professional Certifications		

How do you describe yourself in terms of racial/ethnic identity? _____

APPENDIX B – Informed Consent

Barbara A. Tyson
8213 Stone Trail Drive
Bethesda, MD 20817
(301) 365-4614

INFORMED CONSENT FORM

You have been asked to participate in a research study conducted by Barbara A. Tyson, a doctoral student in the HOD Program at the Fielding Institute, Santa Barbara, CA. This research involves the study of women's participation and experiences in computer related professions and is part of Ms Tyson's dissertation. The study is for academic research. You have been selected for this study because you have been employed as a computer analyst/scientist or computer programmer.

The study involves a small group discussion that is expected to last approximately 2 ½ hours. Upon completion of the focus group, the Researcher will send you a summary report. If the Researcher needs to clarify a point after the focus group, she may call you. This phone conversation is expected to last 15 minutes. Hence, the total time involved in participation will be no more that 2 hours, 45 minutes.

The Research Ethics Committee of The Fielding Institute retains access to all materials pertinent to the evaluation of research ethics. The information you provide will be kept strictly confidential. You, as a participant, agree to keep the information disclosed in the focus group confidential. In addition, the observer will keep the information confidential. The tape recordings will be listened to only by the Researcher or a professional transcribing service, and you will be asked to provide a different name for any quotes that might be included in the final report. You will also have the opportunity to remove any quotations when the Researcher contacts you. In addition, the tapes and all related research materials will be kept in a secure file cabinet and destroyed five years after the completion of the study. The results from these focus groups will be incorporated into Ms Tyson's doctoral dissertation and a follow-up report to the focus group sponsoring organization.

There are no direct personal benefits to you for participating in this research. The potential benefits to participants only involves possible gained career related insight through reflection on career decisions made and work-related experiences. The risks to you are considered minimal; there is only a small chance that you may experience some emotional discomfort during or after the focus group. Should you experience such discomfort, please contact the Researcher at the phone number listed above to discuss your reactions. In addition, you may withdraw from this study at any time (either during or after the focus group) without negative consequences. Should you withdraw, your data will be eliminated from the study.

There is no financial remuneration for participating in this study.

In addition to receiving a summary report from the Researcher, you also may request a copy of the summary of the final results by indicating you interest. Please indicate if you would like a copy? _____yes _____no

Do you have any questions about any aspect of this study or you involvement?

Two copies of this informed consent form have been provided. Please sign both, indicating you have read, understood, and agreed to participate in this research. Return one to the Researcher and keep the other for you files.

_____

NAME OF PARTICIPANT (please print)

_____

SIGNATURE OF PARTICIPANT

_____

DATE

FACULTY ADVISOR'S NAME, ADDRESS, AND TELEPHONE NUMBER

Argentine Saunders Craig, Ph.D.
309 E. Cold Spring Lane
Baltimore, MD 21212
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APPENDIX C – Summaries of Focus Groups

Focus Group Summary Report
March 2, 2000 Focus Group

Barbara Tyson, Researcher/Moderator

The intent of the focus group was for the researcher/moderator to explore with the participants the participants' career decisions and experiences in the computer related occupations. The focus group session was designed to be an in-depth conversation using open-ended questions and follow-up questions to guide the discussions. The focus group is a part of my dissertation research. The research is designed to learn about the career decisions and experiences of women who have participated in the computer-related professions and consists of two case studies. One case study is on the career decisions and occupational experiences of women who entered the field in the early to mid 1970s, and the second is on the career decisions and occupational experiences of women who entered the field in the early to mid 1990s.

The participants of this focus group were women who entered the computer systems analysts, computer scientists, or computer programming occupations in approximately the early to mid 1970s. I convened and moderated the focus group session. The session was held at the National Science Foundation building in Arlington, VA from 6:00 p.m. to 8:30 p.m. on Thursday, March 2, 2000.

About the Participants

The six participants were volunteers who live and work in the Washington, DC metropolitan area. I made announcements at meetings of the National Capital Chapter of the Association for Women in Computing, asking for volunteers. Each evening women volunteered. I also attended meetings of the DC Software Process Improvement Network and asked women if they would participate. In addition, I asked friends to identify potential participants.

Each participant has worked in computer-related professions for a number of years. One participant owns her own technical training company; one is a vice president for a large software integration corporation; one is a senior advisor on software development policy; and one is a senior level consultant. Two women were currently looking for work. They are consultants and were in the process of learning new technical skills to extend their consulting areas.

As a whole, the women are highly educated through both formal degree education and corporate development and technical training. The age range of the group was large, because some of the women entered the field when they were young (while they were in college and right after college) and some of the women entered the field when they were older (after raising a family or as a second career). None of the participants had been a part of a focus group before.

Conduct of the Focus Group

I began the focus group with a prepared opening script that included the intent of the focus group and a brief description of the design of my dissertation research. I asked the participants to sign one of the Informed Consent Forms and give it back to me, and to complete the background questionnaire.

The questions I had prepared focused on learning about the career decisions and experiences the women had in the computer related occupations. I first asked each woman to introduce herself and to briefly tell the group a little about her work background. The participants responded to different degrees. Some were short, and others were longer. I found that those who responded to the introduction question with briefer answers filled in more information when they answered follow-on questions.

The remaining questions focused on career decisions and experiences in the field. They were open-ended questions that elicited a wide range of responses. At first the participants often looked at me as they answered questions. After a while they started to respond to the other participants and many times keyed off of each other's comments.

I waited until they had stopped talking to ask another question. The discussion got rather lively at times. Occasionally, the discussion diverged from the asked questions; however, I found that the topics brought up were relevant and contributed valuable information. The women were bringing up ideas and concerns of their own. As the moderator, I had difficulty not participating in their discussions. I wanted to contribute my own experiences, mostly because my experiences were often similar to theirs.

I turned off the recorders at about 8:25 p.m. All the prepared questions had been covered, and the participants had made some final comments. As can happen, the discussion continued as the group broke up. That was when two of the women commented that they were the first in their families to gain the level of education they have. The group broke up at 8:35 p.m.

Researcher's Final Thoughts

I found the focus group session exciting. The participants engaged in an intense discussion for approximately 2 hours. They talked about career decisions they have made and experiences they have had. The women in this group represent women who entered an occupational field that was relatively new. They also began careers at a time when women were starting to see work in relation to careers. Although some women had careers before the 1970s, it was not the norm. And although there are women pioneers in the computer related professions who started in the mid 1940's, these women represent a wave of women who entered the workforce in larger numbers than in previous decades. Each of the women in the focus group have worked almost continuously since they started in the field, and their work is an accumulation of experiences that make up their work careers.

I learned a great deal from the participants, both from the differences in their experiences and from the similarities in their experiences. I hope that they gained insights as well from this opportunity to reflect on their careers with other women who have chosen to work in the same occupational field.

Focus Group Summary Report
March 6, 2000 Focus Group

Barbara Tyson, Researcher/Moderator

The intent of the focus group was for the researcher/moderator to explore with the participants the participants' career decisions and experiences in the computer related occupations. The focus group session was designed to be an in-depth conversation using open-ended questions and follow-up questions to guide the discussions. The focus group is a part of my dissertation research. The research is designed to learn about the career decisions and experiences of women who have participated in the computer-related professions and consists of two case studies. One case study is on the career decisions and occupational experiences of women who entered the field in the early to mid 1970s, and the second is on the career decisions and occupational experiences of women who entered the field in the early to mid 1990s.

The participants of this focus group were women who entered the computer systems analysts, computer scientists, or computer programming occupations in approximately the early to mid 1990s. I convened and moderated the focus group session. The session was held at the National Science Foundation building in Arlington, VA from 6:00 p.m. to 8:30 p.m. on Tuesday, March 6, 2000.

About the Participants

The five participants were volunteers who live and work in the Washington, DC metropolitan area. I made announcements at meetings of the National Capital Chapter of the Association for Women in Computing, asking for volunteers. Each evening women volunteered. In addition, I asked friends to identify potential participants.

Each participant works in computer-related occupations. Two of the women work with network systems; one is a senior technical staff; one is a software quality manager; and one is a software developer.

The women are highly educated through both formal degree education and corporate development and technical training. The age range of the group was large, because some of the women entered the field right after college and some of the women entered the field when they were older (after raising children or as a second career). None of the participants had participated in a focus group before.

Conduct of the Focus Group

I began the focus group with a prepared opening script that included the intent of the focus group and a brief description of the design of my dissertation research. I asked the participants to sign one of the Informed Consent Forms and give it back to me, and to complete the background questionnaire.

The questions I had prepared focused on learning about the career decisions and experiences the women had in the computer related occupations. I first asked each woman to introduce herself and to briefly tell the group a little about her work background. The participants responded to different degrees. Some were short, and others were longer. I found that those who responded to the introduction question with briefer answers filled in more information when they answered follow-on questions.

The remaining questions focused on career decisions and experiences in the field. They were open-ended questions that elicited a wide range of responses. At first the participants often looked at me as they answered questions. After a while they started to respond to the other participants and many times keyed off of each other's comments.

I waited until they had stopped talking to ask another question. The discussion got rather lively at times. Occasionally, the discussion diverged from the asked questions; however, I found that the topics brought up were relevant and contributed valuable information. The women were bringing up ideas and concerns of their own. As the moderator, I had difficulty not participating in their discussions. I wanted to contribute my own experiences, mostly because my experiences were often similar to theirs.

I turned off the recorders at about 8:25 p.m. All the prepared questions had been covered, and the participants had made some final comments.

Researcher's Comments

I found the focus group session exciting. The participants engaged in an intense discussion for approximately 2 hours. They talked about career decisions they have made and experiences they have had. The women in this group represent women who entered an occupational field that is undergoing significant growth and change. They are at the beginning of their careers in this field. Over the span of their work careers they will see great change in both the occupational field and in the work environment.

I learned a great deal from the participants, both from the differences in their experiences and from the similarities in their experiences. I hope that they gained insights as well from this opportunity to reflect on their careers with other women who have chosen to work in the same occupational field.

APPENDIX D – Coding Categories

Hierarchy of Coding Categories for Analysis of Early-to-Mid-1970s Focus Group Text

- **Computer Career Decision and Experiences**
  - **career decisions**
    - education
      - computer training
        - computer training
        - computer certification
      - college education
        - BS degree
        - College work
        - MS degree
        - CS degree program
      - importance
        - computer education
        - CS jobs without education
      - self-taught
      - on-the-job training
    - decision process
      - CS career characteristics
        - perceived work
          - peaceful, solitary, logical, exciting, problem solving, fun
        - career and life
        - exciting career
        - changing environment
      - employment
        - professional groups
        - ease of getting a job
        - quitting job
      - decision criteria
        - initial

- mothers and daughters, decision process, ease getting job, fit personality, good salaries
- ongoing
  - job enjoyment, good salaries, not planned, career satisfaction
- analysis of decision
  - bad decisions
  - good decisions
  - advice to young women
  - women not going into CS
- CS career definition

work experiences

- motivators
  - exciting
  - fun
  - creative
  - powerful
  - equality
  - flexible work
- workforce characteristics
  - competitiveness
  - few women colleagues
  - pockets of women
- discrimination
  - employment resentment
  - restricted job advancement
  - pregnancy
  - reflection of the times
  - women and careers

Hierarchy of Coding Categories for Analysis of Early-to-Mid-1990s Focus Group Text

- **Computer Career Decision and Experiences**
  - **career decisions**
    - education
      - computer training
        - CS training
        - CS certification
      - college education
        - BS degree
        - degrees are for management
        - CS degrees
          - Other ways into field, question value of CS degree, choose other degrees, CS degrees are intimidating, inability to change degrees
      - self-taught
    - decision process
      - CS career characteristics
        - perceived work
          - not like programming, problem solving, logic, creative, helping people
        - career and life
        - get a job anywhere
        - competitive field
      - employment
        - entry into field
        - ease of getting a job
        - availability of jobs
      - decision criteria
        - initial
          - mentor, availability of jobs, restricted job advancement in old job
        - ongoing
          - career and family
    - analysis of decision
      - good decisions
      - advice to young women
  - **work experiences**
    - motivators
      - desire to do quality work
    - workforce characteristics

- no role models
- workforce environment
  - inappropriate comments
  - exclusion from group
  - only female
  - express feelings differently
  - competitiveness
  - different way of work
  - workload