Perception of Competence in Male and Female Pilots: Between Group Differences

Marianne Paulsen

Emory-Riddle Aeronautical University - Daytona Beach

Follow this and additional works at: http://commons.erau.edu/db-theses
Part of the Applied Behavior Analysis Commons, and the Aviation Commons

Scholarly Commons Citation
PERCEPTION OF COMPETENCE IN MALE AND FEMALE PILOTS:
BETWEEN GROUP DIFFERENCES

by

Marianne Paulsen

A Thesis Submitted to the
Department of Human Factors and Systems
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Human Factors & Systems

Embry Riddle Aeronautical University
Daytona Beach, Florida
Spring 2002
INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.
PERCEPTION OF COMPETENCE IN MALE AND FEMALE PILOTS.
BETWEEN GROUP DIFFERENCES

by

Marianne Paulsen

This thesis was prepared under the direction of the candidate's thesis committee chair, Christina Frederick-Recascino, PhD., Department of Human Factors and Systems, and has been approved by the members of the thesis committee. It was submitted to the Department of Human Factors & Systems and has been accepted in partial fulfillment of the requirements for the degree of Master of Science in Human Factors & Systems.

THESIS COMMITTEE:

Christina Frederick-Recascino
Christina Frederick-Recascino, PhD., Chair

Dennis Vincenzi, PhD., Member

Nancy Parker, PhD., Member

MS HFS Program Coordinator

Department Chair, Department of Human Factors & Systems
ACKNOWLEDGEMENTS

The author wishes to express appreciation to Dr. Dennis Vincenzi and Dr. Nancy Parker, thesis committee members, for their comments, suggestions, and assistance.

Appreciation is also due to Dr. Shawn Doherty who provided excellent editing comments for the first draft literature review and to the flight instructors who took time out of their days to assist in this research. A special debt of sincere gratitude is owed to Dr. Christina Frederick-Recascino whose constant encouragement, support, and availability greatly aided in the completion of this research.
This study investigated the relationship between gender and competence as perceived by pilots. Scenarios were utilized that depicted an airline captain successfully landing an airplane amidst adverse conditions. Scenarios varied only by the gender of the Captain: male, female, or unspecified by variance of pilot name. Perceived effectiveness, competence, avoidance, blame, and attribution as depicted by the Captain’s performance in the scenario were assessed by 30 male and 30 female certified flight instructors. Results showed that female flight instructors’ ratings of avoidance ability and attribution for success differed from male flight instructors. Attribution for blame differences between scenario conditions was also found. No significant gender or scenario differences occurred for ratings of effectiveness or competence.
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>1</td>
</tr>
<tr>
<td>Review of the Literature</td>
<td>1</td>
</tr>
<tr>
<td>Abilities Related to Aviation Competence</td>
<td>2</td>
</tr>
<tr>
<td>Gender Influences on Aviation Related Biological Functions and Abilities</td>
<td>2</td>
</tr>
<tr>
<td>Gender Influences on Aviation Related Cognitive Abilities</td>
<td>5</td>
</tr>
<tr>
<td>Gender Differences in Pilot&gt;Error Accident Rates</td>
<td>8</td>
</tr>
<tr>
<td>Gender in the Workplace</td>
<td>11</td>
</tr>
<tr>
<td>Relevant Theory</td>
<td>15</td>
</tr>
<tr>
<td>Social Role Theory</td>
<td>15</td>
</tr>
<tr>
<td>Perceptual Similarity Theory</td>
<td>18</td>
</tr>
<tr>
<td>Attribution Theory</td>
<td>20</td>
</tr>
<tr>
<td>Gender and Perception of Competence</td>
<td>22</td>
</tr>
<tr>
<td>Purpose of the Current Study</td>
<td>24</td>
</tr>
<tr>
<td>Statement of Hypotheses</td>
<td>25</td>
</tr>
<tr>
<td>METHOD</td>
<td>27</td>
</tr>
<tr>
<td>Participants</td>
<td>27</td>
</tr>
<tr>
<td>Materials</td>
<td>28</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>---------------</td>
<td>------</td>
</tr>
<tr>
<td>Design</td>
<td>29</td>
</tr>
<tr>
<td>Procedure</td>
<td>30</td>
</tr>
<tr>
<td>RESULTS</td>
<td>32</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>37</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>40</td>
</tr>
<tr>
<td>APPENDIX</td>
<td>43</td>
</tr>
<tr>
<td>A. Scenarios</td>
<td>43</td>
</tr>
<tr>
<td>B. Questionnaire</td>
<td>47</td>
</tr>
<tr>
<td>C. Consent Form</td>
<td>51</td>
</tr>
<tr>
<td>D. Debriefing Form</td>
<td>53</td>
</tr>
<tr>
<td>E. Instructions</td>
<td>55</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1: Scenario Means for Competence Variables
Table 2: Scenario by Gender Means for Competence Variables
Table 3: Means for Attribution of Blame for Encountering Incident
Table 4: Means for Attribution for a Successful Landing
Table 5: Means for Attribution of Captain’s Achievement of Success
INTRODUCTION

The modern world has seen an emergence of women in the workplace. Women have made enormous strides in successfully integrating themselves into nearly all occupations by breaking through the "glass ceiling" and dismantling "old boy's clubs". In recent history, women have begun not only to pave their way through the office, but also to soar their way into the skies. As women become an increasing segment of the aviation population, there are certain areas such as stereotypes and perceptions that need to be addressed which have been historically inherent to the advancement of any class of people. For example, no matter how intelligent, capable, or even superior a person may be, if their attributes are interpreted through a biased perception, true competence may be masked. Gender related stereotypes and biases might be causal factors of these tinted perceptions of competence. Within the aviation community there are age old, well established biases and stereotypes against women that could be causal in female aviators’ competence being perceived differently than that of male aviators. Examination of areas such as the differences between genders in biological and cognitive abilities related to aviation competence, pilot error accident rates, gender in the workplace, and relevant theories of how gender influences perception of competence may enable a better understanding of how female pilots are perceived and the challenges that they face when engaging in aviation as an occupation.
Abilities Related to Aviation Competence

Since 1993, women have been authorized to serve in combat aviation roles (Caldwell and LeDuc, 1998). The impact of this occurrence remains to be seen, but at present, little evidence exists that females are less capable of coping with military stressors in aviation. The fact that women generally have lower muscle strength than men has not proven to be a factor in the creation of in-flight problems with manipulating aircraft controls or tolerating sustained acceleration. While controversy remains over whether or not gender-related biological and cognitive abilities exist, any variations that do exist have little operational relevance in normal aviation operations (Caldwell and LeDuc, 1998).

Gender influences on aviation related biological functions and abilities. Although men and women should exhibit equally competent performance in normal aviation operations, gender might interact with stressors and produce gender differences in some situations. Maximal aerobic power is a commonly used, reproducible performance index that measures the combined respiratory and circulatory systems’ functional limit in delivering oxygen to active muscles and the ability of muscles to use oxygen. “Maximal aerobic power is affected by any factor that alters any process or processes involved in the chain of oxygen transport and use” (Cymerman, Fulco, and Rock, 1998, p.793). During an ascent to altitude, a person experiences a progressive decrease in atmospheric pressure, which severely modifies the oxygen gradient between lung and muscle (Cymerman et al., 1998). Therefore, exercise performance is impaired at altitude and the performance decrement will vary in proportion to the duration of the activity. Cymerman, Fulco, and Rock reviewed exercise performance data of altitude research studies over the
previous four decades. The contribution of gender, aerobic fitness level, pre-exposure resident elevation, and duration of altitude to the overall exercise performance variability at altitude was examined. Of these factors, fitness level differences were found to cause the most variability and gender differences the least. Data suggested that there is no difference between men and women in the percent of maximal aerobic power decrement with increasing altitude. Although no apparent differences were found due to the environmental condition of high altitude, genderal differences may exist in the ability to utilize aviation-related equipment such as night vision goggles.

Vision is another physical ability that has been theorized to vary by gender and affect performance. Night vision goggles have revolutionized night flying by enabling an expansion of night operations (Apsey, Ivan, Jackson, Mitchell, and Silberman, 1994). The U.S. Army, Air Force, and Navy have been utilizing night vision goggles to assist aviators during the endeavor of increasingly occurring night warfare. Previous studies of visual acuity with night vision goggles used small sample sizes and subjects who were non-aviators. Apsey et al. sought to add to the existing research base by utilizing a large subject base composed of all aircrew. Their research therefore possessed more generalizability to the aviation community. They investigated the range of visual acuity performance parameters of aircrew wearing two types of night vision goggles and looked at the effects of variables such as age, gender, night vision goggle experience, spectacle wear, and smoking. Gender, age, and night vision goggle experience were not found to be factors that affected night vision goggle visual performance. Participants who wore corrective lenses displayed statistically worse average visual acuity than non-wearers for one type of goggle. While conversely, smokers displayed statistically worse average
visual acuity than non-smokers when wearing the other type of goggles. No significant difference was found on visual acuity variances between the sexes. While this research found no significant differences between the sexes in visual acuity, other research has been done to examine the existence of differences in terms of biological manifestations that may occur in an aviation environment.

Motion sickness causes cold sweating, nausea, and vomiting and occurs when a person is exposed to certain kinds of real or apparent body movements (Hu and Park, 1999). Hu and Park (1999) investigated gender differences in motion sickness history and severity of symptoms in a real nauseagenic motion sickness-provoking condition. In phase one of the study, previous motion sickness incidence was assessed through questionnaire administration and was compared between genders. Results indicated that women reported greater incidence of feeling sickness and actually being sick on buses, trains, planes, in cars, in boats, on amusement rides, and on swings between the ages of 12 and 25 years (Hu and Park, 1999). These results concurred with previous research findings and were believed by the researchers to be resultant of social factors that make it more socially acceptable for women to report illness symptoms to others. Phase two investigated gender differences in the severity of induced motion sickness symptoms while subjects viewed an optokinetic-rotating drum. Subjective symptoms of motion sickness were not significantly different between men and women while viewing drum rotation. These results suggest, “retrospective reports of previous motion sickness incidence do not truly reflect the severity of symptoms of motion sickness in an actual nauseagenic environment” (Hu and Park, 1999,p.1080). Since symptoms of motion sickness can hinder job performance, susceptibility to motion sickness is critical in
personnel selection for occupations which occur in a motion sickness provoking
environment, such as aviation. The fact that women do not exhibit a higher incidence of
motion sickness susceptibility indicates that women are equally as capable as men to
work within motion environments such as aviation and therefore should have the same
opportunities in these fields. Research has also been conducted which examines the
differences in cognitive abilities between men and women.

Gender influences on aviation related cognitive abilities. Sleep loss-invoked
fatigue results in generalized decrements in human performance. The resultant condition
may cause slower reactions, cognitive ability decrement, vigilance reduction, and
changes in affect (Caldwell and LeDuc, 1998). Caldwell and LeDuc (1998) examined the
responses of men and women to the operational stressor of sleep deprivation in order to
see if these effects are more or less severe in women than in men. Studies with elderly
populations had revealed gender differences in terms of sleep-deprivation effects in males
and females, but whether or not sleep loss affects job performance and mood of young
men and women was previously not known. Caldwell and DeLuc examined the effects of
sleepiness and fatigue on simulator flight performance, mood, and recovery sleep in male
and female pilots whose mean age was 28.7 years. Pilots were tested on flight
performance and mood during 40-hour periods of sustained wakefulness. The flight
performance, mood, and sleep recovery data exhibited few significant differences
between males and females. There were no gender main effects and there were no
interactions between gender and sleep deprivation on any flight maneuvers. Men and
women both suffered performance decrements as a function of sleep deprivation and
were equally perceptive of their own alertness difficulties as the sleep deprivation period
progressed. Males did exhibit more tension and anxiety and females felt more vigorous than males during the sleep deprivation. The researchers indicated that although women felt more invigorated throughout testing, this did not translate into superior performance (Caldwell and LeDuc, 1998). This lack of gender specific effects supports the notion that even if important differences do exist between males and females, situations in which the formal roles assigned to each gender are the same result in a minimization of these differences. Hence, the effects on simulated flight performance and cognition are not enhanced or diminished as a function of gender. Although it appears that men and women are equally capable of cognitively enduring this major stressor in an aviation context, gender may have an impact on resistance to other types of operational strains in conditions requiring performance of cognitive tasks.

Gilliland, Schlegel, and Nesthus (1999) studied the effects of an antihistamine, age and gender on selected task performance. Participants were asked to perform a variety of tasks including: a dual task, tracking task, memory search task, manikin task, mathematical task, and a critical thinking task. The dual task was used to assess ability to allocate attentional resources among several tasks. The tracking task involved maintaining an unstable target in the center of a horizontal line on a monitor. In the memory search task, subjects were presented with a group of letters. Single letters were then put forth and the subject had to indicate whether the letter was present in the original letter set. The manikin task presented participants with a depiction of a stick figure, a manikin, facing either forward or backward and either upright or upside-down. The figure is standing on a box with either a rectangle or circle in it. The figure had a rectangle and a circle in its two hands. They were asked to identify which symbol was inside the box, and
which of the manikin's hands was holding the designated symbol. In the mathematical
task, participants were presented with three, single-digit numbers to be added or
subtracted. They were then asked to press one of two keys that corresponded to the
answer being greater than or less than five. The critical tracking task was identical to the
tracking task except that the level of difficulty increased until the point of participant
failure was reached. While results showed that gender had no main effects, there were
interaction effects along with age in the 50-55 year age group. Younger females (25-30
years) showed equal performance to younger males on all tasks, with age showing a
greater detrimental effect on women. Female participants showed a greater occurrence of
control losses and slower response times while under the effects of the antihistamine.
While the results of this study indicate that gender seems to moderate performance while
taking this type of drug, it is more likely that it only moderates in a significant way when
interacting with age (Gilliland et al., 1999). It was suggested that there might be a
biological explanation for this interaction, such that females could have a faster decline in
the neurological or cognitive processes that form the foundation for psychomotor skill
performance. Therefore, in an occupation with retirement age and drug usage limitations
already in place, women are equally as capable as men of task performance within these
ascribed limits. While the previously cited research indicates that women do not lack the
observed aviation related cognitive and biological capabilities related to aviation, a
review of statistical data sheds light on whether or not capable women aviators are more
prone to pilot-error accidents.
Gender Differences in Pilot-Error Accident Rates

There is an attitude within the aviation community that women do not belong in the cockpit. Is it more dangerous to have a woman in command of the flight controls? The traditional stereotypes of cautious female drivers and impetuous male drivers may have some truth at 10,000 feet. General aviation aircraft crashes claimed an average of 652 lives annually between 1995 and 1999, which accounted for 85% of all aviation deaths in the United States (Baker, Grabowski, Lamb, Li, and Rebok, 2001). There is a correspondence between gender differences in crash rates of general aviation and motor vehicle crash rates. Crash rates of females per thousand pilots or drivers are exceeded by male rates. A recent study shows that the cause of a private plane crash is usually closely related to the gender of its pilot (Baker et. al, 2001). The study looked at helicopter and light plane crashes, involving 144 women and 287 men, between 1983 and 1997 in the United States (Baker et. al, 2001). Because pilot age and inexperience are known contributors to aviation crashes, this study utilized pilots who were at least 40. Female subjects were matched 2:1 with male pilots by age within two years, pilot and medical certificate, year of crash, and region of crash (Baker et. al, 2001). Adjustment for flight time was achieved by regression analysis, and it was shown that differences between the genders was not due to the greater total flight time of the male pilots. A review of the study by Derbyshire (2001) found that the most common cause of crashes was loss of control during take-off or landing. These errors resulted in 59% of female accidents and 36% of male accidents. In terms of types of pilot error involved in the crashes, mishandling aircraft kinetics (e.g., incorrect use of rudder, inability to recover from a stall) was more common among female pilots and inattention and flawed decision-making were more common among male pilots (Baker et. al, 2001). Men’s crashes tended to be the result of running out of fuel, risk taking with weather and faulty aircraft, or forgetting to lower landing gear. Women
were more likely to stall or mishandle controls during take-off or landing. Twenty two percent of female pilot’s crashes resulted in death or severe injury compared with 32% of male pilot’s crashes. The researches noted that these differences may be influenced by the more common use of shoulder restraints by female pilots and the fact that a larger proportion of female crashes occurred when speeds and impact forces are not as great, during take-off and landing. For males, crashes related to pilot error decreased with age in that the decrease was seen in crashes involving flawed decisions.

Ekman and Vail (1986) analyzed general aviation data pertaining to pilot error accidents for the years from 1972 to 1981, for males and females. Data was taken from National Transportation Board (NTSB) records and the statistical handbook of the Federal Aviation Administration (FAA). According to NTSB data 42,597 males and 1,004 females had accidents during this time. Of that number, 37,862 males and 967 females had accidents due to pilot error. For student pilots, the male accident rate was 60% greater than for females over the ten years. Female student pilots had a lower accident rate than male student pilots for every one of the ten years. Private certified female pilots had a lower accident rate than males each year. The accident rate average for female ATP certified and commercial pilots was 31%, for males 50%, and for each year, the accident rate was lower for females than males (Ekman and Vail, 1986). For all certificates combined, the difference in accident rates between females and males was significant for all ten years; for females, the average yearly accident rate was 23% and for males, it was 52%. The fatality rate for males in pilot error accidents was found to be twice that for females and male pilots did serious injury to themselves with 9% greater frequency than females (Ekman and Vail, 1986). Male pilots walked away without injury
less than three-fifths of the time, whereas female pilots did so almost two-thirds of the time. Males had an overall higher rate of accidents at all age levels, which ranged from 15 to 70 years. For pilots with less than 100 hours of total flight time, the accident rates for men and women are nearly equal (Ekman and Vail, 1986). However, as flight time increases, the rate of male to female accidents also increases. In terms of phase of operation, the only phase in which female accident rates exceed male rates is in taxiing. Female accident rates are lower in all other phases of flight. This review has shown that not only are females significantly safer pilots in terms of the occurrence of pilot error accidents, but also that there is a significantly lower fatality rate when they do have these accidents. When considering these statistical findings, one must wonder why aviation remains such a male-dominated profession. In 1997, only 5.8% of all pilots were women (Baker et al., 2001).

While controversy remains over whether or not there are gender-related differences in biological and cognitive abilities, social behavior, and other characteristics, it appears that any variations that do in fact exist have little operational relevance in aviation (Caldwell, LeDuc, 1998). Research shows that females are equal to males in terms of attributes relevant to flight performance such as muscle performance at altitude, visual acuity, incidence of motion sickness, resistance to sleep fatigue, and task performance (Apsey, Ivan, Jackson, Mitchell, and Silberman, 1994; Caldwell and LeDuc, 1998; Cymerman, Fulco, and Rock, 1998; Gilliland et al., 1999; Hu and Park, 1999). Additionally, women have lower pilot-error accident rates (Ekman and Vail, 1986). In light of the reviewed studies, men and women should be equally competent to perform in normal aviation operations. These previous studies failed to provide biological and
cognitive evidence to support the need for occupational gender segregation based on the observed characteristics. Therefore, it is surprising that there are inequities concerning the presence, opportunities, pay, and advancement of women in the workplace.

**Gender in the Workplace**

Since the feminist movement, many fields have opened up to women that were traditionally considered male-dominated. Aviation is among those fields in which women are attempting to make their presence known, but are still clearly the minority. The number of female pilots went from 32,741 in 1972 up to 46,878 in 1981 and the number of flight certificates issued to women went from 4.4% of all issued certificates in 1972 to 6.3% in 1981 (Ekman and Vail, 1986). These advancements may be overly promising given that females only made up 1.4% of all commercial pilots by 1994 (Luedtke, 1994). According to the Federal Aviation Administration, of the nearly 700,000 active pilots in the United States in 2000, less than 6% are women (WIA, 2001). Additional statistics for percentages of women in 2000 include; 11.61% of student pilots, 5.79% of held private pilot licenses, 4.77% of commercial pilot licenses, and 3.12% of airline transport pilot licenses (WIA, 2001).

While the last few decades have seen advances in the occupational opportunities available to women, progress is not as evident in aviation related occupations (Luedtke, 1994). Davey and Davidson (2000) interviewed male and female commercial airline pilots about their work experiences to examine the difficulties experienced by female pilots. They found that although harassment, sexism, and isolation have declined over time, commercial aviation continues to be male-dominated in terms of values and
practices such as viewing women as inferior or incapable. The results suggest that in order to survive, women in aviation have had to adapt to the male culture by learning to take a joke even when sexist, and drinking and socializing with male crewmembers. Because they have much to lose by challenging the system, they are at a disadvantage when actively promoting equality within the aviation organizations.

Misbalance may also be found within the world of aviation academia. For example, the percent of faculty jobs in the aviation department of one higher education university, reflecting that within aviation occupations, was comprised of 94.8% men and only 5.2% women, as compared to the overall faculty that was comprised of 72% men and 28% women (Leudtke, 1994). In institutions of higher learning, women are less likely than men to be department chairs, academic deans, or become tenured; the higher the rank of a position the lower the percentage of females; and the more prestige schools have the lowest number of female faculty (Luedtke, 1994). Luedtke identifies lack of publications and low doctoral enrollment numbers as some possible barriers to the advancement of women in the academic administration arena.

Women who do achieve leadership roles often feel frustrated due to a feeling of limited power; having responsibility, but no authority; and feel less influential than their male counterparts (Luedtke, 1994). Gardiner (1999) postulated three consequences for women in an occupational minority. First, they are more visible, attracting a disproportionate amount of attention. This causes a sense of being under constant scrutiny and the pressure to perform better than male colleagues. Second, high levels of stress are resultant of being isolated from the main (male) group and therefore lacking formal and informal support. Last, women in the workplace, due to sex stereotyping, can
experience a wide variety of negative consequences. For example, if a woman in a male-
dominated environment utilizes a feminine leadership style, emphasizing people and
relationships, she risks being seen as less successful or less competent. This is because
successful managers are perceived to possess more masculine traits and less feminine
traits.

There is evidence of gender discrimination before women even enter into an
occupation. Air traffic control is a field in which women have long been under-
represented. Since 1981, entrance into the occupation has been determined by applicant
performance on a written aptitude test battery administered by the U.S. Office of
Personnel Management (Broach, Farmer, and Young, 1996). Definition, organization,
and manipulation of the perceptual field are assessed through verbal and numeric
reasoning. This test battery may have inadvertently served as a device for female
exclusion from this traditionally male dominated occupation. Broach, Farmer, and Young
examined the technical fairness of the written air traffic control specialist (ATCS)
aptitude test battery to assess if this battery may have served as an “engine of exclusion”
(1996, p. 1). Technical fairness was investigated within the structure of the Uniform
Guidelines on Employee Selection Procedures (29 CFR 1607) from two perspectives:
adverse impact and differential prediction. Overall, results indicated that the written
ATCS test battery did not fulfill requirements outlined by the Uniform Guidelines on
Employee Selection Procedures for technical fairness. Assessment of the adverse impact
of utilizing a composite score on the test battery showed gender differences in favor of
men. This suggests that there may be an expected adverse impact on women from use of
these test scores in selection. Selection rates by gender were analyzed and it was found
that men were identified as eligible for employment consideration based on composite
test scores at a higher rate (50.4%) than women (38.5%). Differential prediction of
performance in initial ATCS training was analyzed and differences were found in the
relationship for each gender between aptitude test scores and subsequent performance at
the academy.

Isaacs (1995) identified a general pattern of gender discrimination that women
experience once they have entered the US workplace. In the area of computer science,
women tend to start at lower positions, earn lower starting salaries than men, and over
time, these gaps between men’s and women’s salaries and promotions grow at an
increasing rate (Isaacs, 1995). The salary gap was even found in studies that equated
years of experience, level of education, and industry. In almost every reviewed industry,
women took up a very small proportion of the higher-level positions and consistently
made less money than men. Only three CEOs among the Fortune 1000 were women, and
only 1.7% of the chief operating officers, chief financial officers, and executive vice
presidents were women in 1988 (Isaacs, 1995). “Women working full time with two or
less years of experience make only 72% of what men with the same experience earn”
segregation of occupations, and high prestige and wages are associated with masculine
images. It was suggested that a possible route to raising women’s status in society is by
their movement into stereotypically masculine occupations. Earnings and prestige are
positively related to the belief that those occupations require more masculine personality
characteristics and superior cognitive characteristics and therefore, women in these
occupations would experience higher earnings and prestige by association (Cejka, 1999).
Cejka purports that women are discouraged to enter into such occupations because competence in these occupations might require that women view themselves as possessing a greater number of masculine qualities. Conversely, when large enough numbers of women do make their way into a previously male-dominated occupation, the wages might lower due to the wage penalty associated with feminized occupations. This has been evidenced in recent years in the pharmaceutical industry. As women have increased in number in the occupation of pharmacist, the salary has lowered. Why are women perceived so poorly that they are disadvantaged in the workplace and in aviation as an occupation?

**Relevant Theory**

Psychological literature offers many research-based examples of how gender influences perceptions of competence and ability. Why do these inequities persist? Some general beliefs are that people (men and women) think that men are generally more competent than women; when a woman shows expertise in an area considered to be masculine, it is attributed to luck, not skill; masculine traits include more positive characteristics than do feminine traits; and the areas of expertise for men are seen as more favorable than areas of expertise for women (Hasuike, 2000).

**Social Role Theory.** The Social Role Theory maintains that occupational inequalities are likely due to stereotypes in the social system (Cejka, 1999). Cejka examined “the role of gender stereotypes in justifying the social system by maintaining the division of labor between the sexes” (1999, p. 413). The study examined the extent to which people believe that success in occupations dominated by one sex requires personal
characteristics typical of that sex. This type of belief system would encourage employment segregation, just as the assignment of paid employment to men and domestic work to women is due to the belief that the domestic role requires feminine qualities and employment requires masculine qualities. Furthermore, if women’s subordination is justified by the existence of stereotypes, then income and prestige should be (and are) associated with occupations thought to require masculine characteristics. Despite the decline in occupational segregation in recent decades, 53% of women would have to change jobs in the United States in order to achieve occupational distribution equal to that of men. Many occupations are almost totally dominated by one sex: dental hygienists and secretaries are almost 98% women; automobile mechanics and carpenters are almost 98% men. Sex segregation is so embedded into occupations that there was a successful prediction of the sex of 90% of student research participants based on their occupational preferences. Social Role Theory also puts forth that occupations should be strongly related to gender stereotypic images of occupations and that ideas about gender are shaped by observations of men and women in the roles they commonly occupy in daily life. Women are believed to possess attributes suited for the roles they typically occupy, and similarly men are believed to possess role-appropriate attributes. Perceivers infer people’s characteristics from what they do in their daily lives and from these perceptions emerge stereotypes (Cejka, 1999).

There is evidence of a relationship between the sex ratio of an occupation and the rated masculinity versus femininity of an occupation, such that female dominated occupations are perceived to require a higher level of feminine personality traits (Cejka, 1999). Another assertion of Social Role Theory is that “people should tend to prefer
situations, including occupations, that favor qualities thought to typify their own gender, assuming that to some extent gender roles become internalized in self concepts” (Cejka, 1999, p.414). Therefore, both men and women should be attracted to gender-stereotypic occupations. Cejka’s study confirmed, mental images of occupations correspond to the sex segregation of the occupations and high prestige and wages are associated with masculine images. Participants therefore believed that success in a gender-dominated occupation requires qualities of personality and/or physical qualities associated with that gender. Feminine qualities of personality, the niceness-nurturance trait cluster that appears as stereotypic of women was the strongest predictor for assessing occupations’ sex ratios in virtually all studies of gender stereotypes. Success in female occupations was linked with attributes such as being gentle, nurturing, helpful to others, sociable, kind, cooperative, and supportive. Success in male occupations was linked with attributes such as being competitive, dominant, and aggressive. The findings indicate that gender-stereotypic images of occupations would promote sex segregation of employment by resulting in occupational gendered expectations for each sex and therefore influencing women’ and men’s tendencies to aspire to particular occupations (Cejka, 1999).

Previous research has shown that people in gender incongruent occupations tend to experience role conflict and personal difficulties, such as stress, discomfort, and a feeling of not belonging. It is concluded that gender congruence that is a product of the degree of fit that perceivers assume between the requirements of a job and the sex of jobholders promotes sex segregation. Furthermore, the relationships between gender stereotypes and occupational sex ratios were found to be bi-directional in causation (Cejka, 1999).
Perceptual Similarity Theory. The Perceptual Similarity Theory asserts that people evaluate others who are more similar to them more favorably (Luthar, 1996). In the context of this theory, Luthar found that male subjects tended to rate male managers higher and female subjects tended to rate female managers higher. Surmann (1996) examined the “interactive effects of race, weight, and gender on student’s ratings of writing competency” (p.173). Participants were given eight articles with photographs of the authors and were asked to rate the piece on style, clarity, logic, and overall writing competency. Authors varied by gender and by race. Noteworthy here is the fact that male participants selectively discriminated against female Caucasian authors in terms of competency evaluation. Male participants gave female Caucasian authors significantly lower ratings than male authors, while female participants gave consistent ratings regardless of gender of author. Male participants did not exhibit discrimination against male authors of either race or against female, African-American authors. The results sustain the findings of previous studies that American men devalue women, however the men in this study devalued only Caucasian female authors (Surmann, 1997). Significant differences were found for participant gender in ratings of style, logic, and overall writing competency, with male participants giving lower ratings than female participants in all three areas.

The researcher suggested that the more generous ratings given by female participants may be linked theoretically to “more empathetic responses and thus interpreted as evidence of a qualitative difference between the reasoning processes of the male and female participants in judging the stimulus material” (Surmann, 1997, p.175). Feminist theories have proposed that, when compared with that of men, the reasoning of
women may reflect a more caring and empathetic orientation that is resultant of specific differences in the socialization involved in the development of self-concept in women. In light of this perspective, a lower incidence of subjective denigration and occurrence of higher ratings could be the result of an empathetic orientation toward evaluation. The higher ratings by the women may also be the result of a caring ethic in a time when the behavior of American women is more influenced by an increased awareness of social inequity (Surmann, 1997).

Deal and Stevenson (1998) examined the effect of participant gender on perception of a target. The purpose of the study was to examine the differences between males and females in their perceptions of female managers, male managers, and prototypical (non-sex-specified) managers and to see if these perceptions had changed since the 1990s. Male and female subjects were both found to have similar perceptions of both male and prototypical managers, yet male subjects were more likely than female subjects to have negative views of female managers. These results indicate that the sex of the perceiver rather than the sex of the manager being evaluated has more bearing on the negative perceptions about female managers. Male and female subjects valued similar managerial characteristics as evidenced by the agreement between the sexes on both prototypical and male manager descriptions. The agreement between the sexes on descriptions of male managers is evidence that an increase of women in the workplace presents men with no apparent disadvantage.

There were strong differences between descriptions of female managers made by male and female participants (Deal and Stevenson, 1998). Women were more likely to use descriptors such as ambitious, competent, intelligent, firm, authoritative, and well
informed. Men were more likely to use descriptors such as bitter, deceitful, passive, nervous, reserved, uncertain, and having a strong need for social acceptance. The extremity of the differences in patterns and the fact that all participants were college students suggests that these ratings are a function of the young men responding and not of society in general. This research concludes that, even after twenty years, perceptions of female managers have experienced little change. Even these young men who were raised in a time of increasing equal opportunity hold persisting gender stereotypes that are detrimental to and negative about women in positions of power within organizations.

Attribution Theory. The Attribution Theory addresses the question of how people make judgments about the causes of behavior (Maisto and Morris, 1999). Making an attribution involves guessing about the true causes of a particular action and these guesses are often vulnerable to a number of biases. Fundamental attribution error occurs when people overemphasize personal causes for other people's behavior and underemphasize personal causes for their own behavior. This type of bias may result in the high performance of a female being attributed to external causes such as luck or increased ease of the task, whereas similar performance on the part of a male is attributed to internal factors such as skill and ability. Even when there was no significant difference between performance ratings of men and women, good performance on the part of men has been interpreted as more indicative of general intelligence. Luthar (1996) suggests attributes that result in a level of performance may be critical in employment related decisions, such as hiring, termination, and promotion. Based on attribution of skill or ability, which are perceived to be internal and relatively stable factors, predictions of future performance may be made. For women, attributions using luck or external forces
for similar performances over time may lead to a considerable divergence between men and women in wages, status, and the level of power and influence achieved in their careers.

The effects of differential attribution due to gender can be seen in many environments including the courtroom. Jurors perceive male and female lawyers differently. Women advocates achieve more success in trial preparation by analyzing case content, personal style, and the attitudes of the jurors whom she has to persuade. Hasuike (2000) stated that jurors have a tendency to attribute a woman's competence in an unexpected area to luck rather than skill. To overcome this perception, the female advocate needs to have someone with authority acknowledge her competent performance. For example, questions can be posed to expert witnesses in such a way that the lawyer can clearly display her own knowledge and therefore infer competence. In addition, the judge may be used as a source to signal approval and reveal unexpected competence.

Evidence of this attribution can be found in tasks other than those involved in litigation. People judging equally competent male and female performers in a masculine task (car repair), attributed the woman's performance to luck and the man's performance to skill (Hasuike, 2000). When they were engaged in a feminine task (cooking), the man was perceived as less skillful than the woman, but the difference was much smaller. This occurs because both men and women are more likely to attribute ability to a man, luck to a woman, and to rate a man's performance more favorably than a woman's even if their performance is identical. People are also perceived to have more competence when they exhibit competence in an unexpected area than someone who is expected to exhibit competence in the same area. In the context of this theory, if a female pilot is seen as
being more competent than expected, she will also be perceived as being more competent than she actually is because her perceived competence is outside the expected range (Hasuike, 2000). Conversely, if a female pilot is viewed as incompetent, she may be perceived as less competent that she really is.

### Gender and Perception of Competence: The Case of Female Pilots

Competence is a concept that is represented by attributes such as having expertise or being experienced, qualified, or informed (Hasuike, 2000). Perceptions of competence may be affected by characteristics such as gender and constructs such as stereotypes. Competence may be interpreted as requirements or imposed standards for a person’s performance (Foschi, 1996). Men and women both tend to rate a woman’s performance less favorably than a man’s when their performance is actually identical (Hasuike, 2000). In women’s areas of expertise such as child rearing, domestic tasks, and feeling-oriented, interpersonal tasks, women are seen as being more competent than men. Within a courtroom setting for example, a female advocate is perceived as being more competent when litigation involves family issues and a male advocate is perceived as possessing more competence when litigation is technical, complex, or abstract. Generally, men, whether progressive or conservative, assign higher ratings to competent women in traditional roles than competent women in nontraditional roles. Conversely, women who hold a conservative view toward sex roles prefer a woman advocate who displays competence in a traditional role, while progressive women prefer competent women in nontraditional roles (Hasuike, 2000). Hence, the assignments of competence are resultant of a comparison between actors in a given situation (Foschi, 1996).
The standards used to judge competence are norms specifying the type and level of outcome to infer ability, depending on the standard used (Foschi, 1996). For example, ability is evidenced with a grade point average of 2.5 when the standard is 2.0, but when the standard is 3.5, that GPA is unconvincing of ability. These standards may be viewed in terms of their level of strictness. More evidence of competence is required when a strict standard for ability is applied than with the application of a more lenient standard. Therefore, a female pilot may be held to a stricter standard for performance and hence need to display a higher level of performance to indicate equal competence. On the other hand, less evidence of incompetence is tolerated under a strict standard for lack of ability than under a more lenient standard. Hence, an error made by a female pilot may be less tolerated than the same error made by a male pilot if she is held under a stricter and therefore less tolerant standard of competence. When a status characteristic such as gender is present that differentiates people into two classes, the use of double standards in rating competence is activated.

Foschi (1996) found that when subjects had to set standards for a partner, gender was the only item of information used for differentiating level of standard. Subjects in opposite sex dyads report a stricter standard for a female than for a male partner, even when both partners perform at the same level (Dukes, Johnson, Newton, and Overstreet, 1991; Foschi, 1996). The status of a person being evaluated alters the evaluation (Dukes, Johnson, Newton, and Overstreet, 1991; Etaugh and Sanders, 1988; Foschi, 1996). For example, when evaluating a work of art, ratings were higher for work signed by a male artist (Etaugh and Sanders, 1988). However, when the work had won a prize in an art contest, there was no difference found for the ratings of female and male artists, the
additional status assigned by the award superceded the effects of gender (Etaugh and Sanders, 1988). Gender may also have effects on the perceived competence of aviators.

Competence is a key concept in aviation. Dukes, Johnson, Newton, and Overstreet (1991) examined whether characteristics of a pilot, such as gender, and gender stereotypes affect the opinions of people flying with that pilot. Their study sought to examine the effects of gender on estimates of pilot performance and level of confidence in continuing flight with him or her. Pilot and non-pilot participants were presented with scenarios in which pilot gender, experience, and performance were manipulated. Participants' perceptions of the pilot and apprehension level about continuing a flight with that pilot were then assessed. Gender-related results indicated that when a female pilot performed well her skill level was rated higher than the male pilot’s performance. When the landing was good, participants were less apprehensive about continuing the flight when the pilot was a female than when the pilot was a male. Additionally, when the female pilot performed poorly, her skill rating was lower than that of an equally performing male pilot. When the landing was poor, participants were more concerned with continuing on the flight when the pilot was a female than when the pilot was a male. These findings supported the theory that peers and/or passengers may perceive male and female pilots differently in the same situations.

**Purpose of Current Study**

The current study seeks to extend the work by Dukes, et al. (1991) that investigated stereotypes associated with male and female pilots by examining if males and females with flight experience will differ significantly in perceived competence of
male and female pilots. It is expected that the results will add to this area of investigation by providing support for the conclusion that male and female pilots may be perceived differently by their peers while in the same situation and displaying the identical level of skill and ability. It is also expected that results will support the findings of Surmann (1997) who claimed that there was an effect due to target gender, such that males selectively discriminate against females in ratings of competence. Additionally, findings are expected to be evidence for the continued presence of a double standard in rating the competence of men and women.

If it becomes recognized that members of a social category are commonly disadvantaged in settings, such as aviation, that involve evaluation with a stricter ability standard, the situation must be rectified. The application of an explicitly more lenient standard for the disadvantaged category in order to make up for past wrongdoings is not the answer. This would further perpetuate the inequality in that it would lead to an inference of lesser ability among members of that category. The implementation of such a reverse double standard would be nothing but detrimental to the cause. Instead, demonstrations of ability, which are rated for competence under the same standards for both genders, should be used to leave no doubt about competency level. Research in this area is needed in order to understand how male and female pilots are perceived, and to provide a basis for continued research in this area that will provide insight to the challenges faced by women aviators.

**Statement of Hypotheses**

In the context of the Social Role Theory, there are significantly more male pilots and as a result, certain (masculine) traits have been shown to be predictors of success in
aviation, a male-dominated profession (Cejka, 1999). Female attributes will be expected in female pilots and role incongruence, caused by the absence of these attributes, will result in a warped perception of competence for female pilots. Therefore, it is predicted that, due to the presence of a double standard, when a male and a female pilot perform equally, the female pilot will be assessed more strictly and therefore perceived competence will be lower. It is also expected that, in line with Perceptual Similarity Theory, both genders will rate competence higher in pilots of the same gender.

Additionally, situation specific attribution evaluations of success in scenarios depicting female pilots will result in attributions of external causality while scenarios depicting male pilots will result in attributions of internal causality. Finally, competence evaluations of scenarios depicting female pilots will result in the success of the female pilot being attributed to luck and scenarios depicting male pilots will result in the success of the male pilot being attributed to skill. The previous two anticipated findings would be in line with the Attribution Theory.
METHOD

Participants

The 30 male and 30 female participants were all certified flight instructors. Therefore, they were at least 18 years old, literate in the English language, held either a commercial pilot or airline transport pilot certificate, had comparable aeronautical experience, had adequate knowledge about the safe and efficient operation of an aircraft, and had at least 250 hours of logged flight time of which at least 15 hours were as pilot in command (Spanitz, 1999). Participants were flight instructors drawn from Embry Riddle Aeronautical University and several area flight schools. The ages of the male group ranged from 20 to 34 years with a mean age of 24.9 (SD= 3.1) years. Their total flight hours ranged from 250 to 7000 hours with a mean of 1099.8 (SD= 1240.5) hours. The ages of the female group ranged from 20 to 47 years with a mean age of 26.6 (SD= 7.30 years. Their total flight hours ranged from 250 to 4000 hours with a mean of 992.1 (SD= 847.9) hours. The participants were assumed to not be significantly different from the general commercial pilot population in terms of biases, perceptions, and stereotypes. Participants were not made aware of the exact focus of the study. Therefore, the researcher felt that the tendency of participants to provide only socially desirable responses to questions such as those presented in this study would not be enhanced by the gender context.
Materials

Three scenarios were constructed on a single sheet of paper (see appendix A). All of the scenarios depicted a situation in which a pilot who was flying a commercial airliner experienced adverse conditions, but still made a “successful” landing. The scenarios differed only in that the captain was male, female, or unspecified. This was achieved by variance of the Captain’s name within the three conditions. No participant received more than one of the three scenarios. This is an example of the way the version of the scenario with a female pilot appeared to a subject:

Captain Lisa Winfield has been a 767 Captain for a major commercial airline for 5 years. She has logged a combined total of 6,000 hours on this particular type of aircraft in the positions of Captain and First Officer. The First Officer has held this position for 4 years and has logged a total of 3,000 hours on this particular type of aircraft as a First Officer. As flight 1027 approached La Guardia International Airport, after a turbulent flight from Los Angeles, Captain Lisa Winfield made an announcement. She told passengers that the current conditions in New York were cold and rainy with winds out of the east at 20 knots, gusting at 35 knots. Additionally, she apologized for not being able to make up more than 30 minutes of the 2-hour delay of their flight. As the Boeing 767 was on final approach, the passengers could feel several abrupt power and heading adjustments. Subsequent to the unstable approach, there was a hard landing beyond the touchdown zone. As the aircraft continued down the runway, it began to hydroplane and consequently slid off the departure end of the runway into the approach lights. She brought the aircraft to an abrupt stop in the wet field while
successfully avoiding collision with other aircraft. There was significant structural
damage to the landing gear and fuselage. There were no fatalities or serious
injuries. Of the 334 passengers, 25 incurred minor injuries such as abrasions and
bruising.

A questionnaire (see appendix B) was developed to assess five dimensions related
to pilot behavior: competence, effectiveness, blame, avoidability, and attribution within
the context of the provided scenario. These dimension were defined within the
instructions for each section to ensure definitional compatibility among participants. The
questions made use of a non-specific gender name for both Captain and First Officer.
Responses for effectiveness, competence, and avoidance questions were recorded by
means of a Likert scale (see appendix B) in the form of low (1) to high (7) in order to
provide continuity and stability in question format. Responses for blame and attribution
questions were recorded by means of percentage assignment. These scales were used
instead of open-ended questions to enable a quantitative analysis of the responses.
Percentage assignment categories for blame consisted of Captain, weather, delay time,
First Officer, airport, and aircraft. Percentage assignment categories for attribution
consisted of effort, ability, luck, and task difficulty. The questionnaire also asked for
demographic information in the areas of participant age, sex, total flight hours, currently
held rating, and country of origin. Instructions, questionnaires, and scenarios were piloted
for this study to ensure reliability and validity.

Design

A one-way ANOVA was utilized to examine how the gender of the captain in the
scenario affected ratings on the variables of effectiveness, competence, and avoidance. A
A 3 X 2 between subjects, fully factorial ANOVA strategy was used to enable the examination of how participant gender and gender of the Captain in the scenario affected ratings on the variables of effectiveness, competence, avoidance, blame, and attribution. A between subjects design was chosen in order to prevent a familiarity or practice effect that may occur if all participants were to see all three scenarios. The independent variables were gender identified in scenario (male, female, unspecified) and participant gender. The control group was the participant group receiving the unspecified gender scenario. This group would serve to provide perceived pilot competence scores without an indication of gender against which the experimental groups scores could be compared. Male and female participants within each scenario treatment condition were matched as closely as possible by flight hours and age. The resultant matching occurred within plus or minus 300 flight hours and plus or minus 21 years of age. The researcher wishes to note that withstanding a few outliers, the majority of male and female participants were matched within plus or minus 4 years.

**Procedure**

Each participant was provided with a packet that contained a consent form, one of three scenarios, and a questionnaire. The participants were randomly assigned to one of the three scenario conditions. Participants were given standardized instructions (see appendix E). Packets were distributed to participants and they were asked to sign consent forms before beginning the experiment. Participants were asked not to communicate amongst themselves or to read each other’s information. Subjects were instructed to read the provided scenario and then answer the questions posed to them. Participants were assured that their answers to the questionnaire would be completely confidential. For the
questions utilizing the Likert scale, they were instructed to indicate only one answer per question along the continuum of the scale. For the questions requesting percentage responses, participants were told to assign percentages for each category in any multiple of 10 between 0 and 100, with the total of all categories equaling 100. Participants were then asked to provide the requested demographic information in the areas of age, sex, total flight hours, currently held certification, and country of origin. After reading and signing the debriefing form, participants were told to place all materials back into their packet, and were thanked for their time and participation.
RESULTS

Effectiveness, Competence, and Avoidance Differences Between Scenario Groups

Results of a one-way ANOVA failed to reveal significant differences between scenario groups in terms of ratings on the variables of effectiveness ($F(2,60)=.072$, $p<.93$, $\eta^2=.03$, power=.06), competence ($F(2,60)=.701$, $p<.50$, $\eta^2=.01$, power=.16), and avoidance ($F(2,60)=.747$, $p<.48$, $\eta^2=.01$, power=.12). Thus, no aspects of the Captain’s competence were related to the Captain’s gender. Mean levels for these variables are provided in Table 1 below.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Effectiveness</th>
<th>Competence</th>
<th>Avoidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>2.60 (1.2)</td>
<td>3.95 (1.5)</td>
<td>5.50 (1.5)</td>
</tr>
<tr>
<td>Male</td>
<td>2.75 (1.6)</td>
<td>4.15 (1.9)</td>
<td>5.75 (1.4)</td>
</tr>
<tr>
<td>Non-gendered</td>
<td>2.75 (2.8)</td>
<td>4.6 (1.9)</td>
<td>6.05 (1.3)</td>
</tr>
</tbody>
</table>

*standard deviations are provided in parentheses

Effectiveness, Competence, and Avoidance Differences Between Scenario by Gender Groups

Three 3X2 ANOVAs were used to examine gender and scenario based differences for the variables of effectiveness, competence, and avoidance. Results of these analyses showed one overall effect of perceived avoidance ability of the Captain ($F(5,60)=3.8$, 32
p<.00, ETA²=.19, power=.91). With this model, there was a main effect of gender such that female flight instructors perceived the Captain in the scenario to have a lower level of avoidance ability (F(1, 60)= 16.4, p<.00, ETA²=.23, power=.98) than that which was perceived by male flight instructors. Mean levels for these variables are provided in Table 2 below.

Table 2 Scenario by Gender Means for Competence Variables

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Instructor Gender</th>
<th>Effectiveness</th>
<th>Competence</th>
<th>Avoidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Female</td>
<td>2.7</td>
<td>4.0</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>2.5</td>
<td>3.9</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.6</td>
<td>4.0</td>
<td>5.5</td>
</tr>
<tr>
<td>Male</td>
<td>Female</td>
<td>2.8</td>
<td>4.7</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>2.7</td>
<td>3.6</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.8</td>
<td>4.2</td>
<td>5.8</td>
</tr>
<tr>
<td>Non-Gendered</td>
<td>Female</td>
<td>3.4</td>
<td>5.2</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>2.1</td>
<td>4.0</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.8</td>
<td>4.6</td>
<td>6.1</td>
</tr>
<tr>
<td>Total</td>
<td>Female</td>
<td>3.0</td>
<td>4.6</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>2.4</td>
<td>3.8</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.7</td>
<td>4.2</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Differences in Attribution of Blame for Encountering Incident Between Scenario by Gender Groups

Results of 3X2 ANOVAs failed to reveal significant differences in terms of assignment of blame for encountering the incident to Captain, weather, delay time, First Officer, airport, or aircraft. Mean levels for these variables are shown in Table 3.
Table 3 Average Percentages for Attribution of Blame for Encountering Incident

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Instructor Gender</th>
<th>Captain</th>
<th>Weather</th>
<th>Delay Time</th>
<th>First Officer</th>
<th>Airport</th>
<th>Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Female</td>
<td>48.0</td>
<td>18.0</td>
<td>11.0</td>
<td>17.0</td>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>51.0</td>
<td>21.0</td>
<td>7.0</td>
<td>13.5</td>
<td>3.2</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>49.5</td>
<td>19.5</td>
<td>9.0</td>
<td>15.3</td>
<td>3.6</td>
<td>3.7</td>
</tr>
<tr>
<td>Male</td>
<td>Female</td>
<td>34.5</td>
<td>27.5</td>
<td>7.0</td>
<td>24.0</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>43.5</td>
<td>27.0</td>
<td>8.4</td>
<td>18.5</td>
<td>1.8</td>
<td>.80</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>39.0</td>
<td>27.3</td>
<td>7.7</td>
<td>21.3</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Non-Gendered</td>
<td>Female</td>
<td>32.0</td>
<td>35.5</td>
<td>7.3</td>
<td>21.0</td>
<td>3.1</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>53.0</td>
<td>13.0</td>
<td>10.2</td>
<td>21.5</td>
<td>1.5</td>
<td>.80</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>42.5</td>
<td>24.3</td>
<td>8.75</td>
<td>21.3</td>
<td>2.3</td>
<td>.95</td>
</tr>
<tr>
<td>Total</td>
<td>Female</td>
<td>38.2</td>
<td>27.0</td>
<td>8.43</td>
<td>20.7</td>
<td>3.4</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>49.2</td>
<td>20.3</td>
<td>8.53</td>
<td>17.8</td>
<td>2.2</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>43.7</td>
<td>23.7</td>
<td>8.48</td>
<td>19.3</td>
<td>2.8</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Differences in Attribution for a Success Landing Between Scenario by Gender Groups

In terms of the successful landing of the flight being attributed to weather, the overall 2X3 ANOVA was significant ($F(5,60)=2.6$, $p<.04$, $ETA^2=.12$, $power=.75$). There was a main effect for scenario ($F(2,60)=3.4$, $p<.04$, $ETA^2=.11$, $power=.62$) such that the successful landing of the flight being attributed to weather was significantly higher for the female pilot scenario than for the unspecified gender scenario as revealed through post-hoc comparisons. Means for each group are provided in Table 4.
**Table 4 Average Percentages for Attribution for a Successful Landing**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Instructor Gender</th>
<th>Captain</th>
<th>Weather</th>
<th>Delay Time</th>
<th>First Officer</th>
<th>Airport</th>
<th>Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Female</td>
<td>53.0</td>
<td>7.0</td>
<td>4.0</td>
<td>22.0</td>
<td>3.0</td>
<td>11.0</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>40.0</td>
<td>19.0</td>
<td>3.0</td>
<td>24.0</td>
<td>8.0</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>46.5</td>
<td>13.0</td>
<td>3.5</td>
<td>23.0</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Male</td>
<td>Female</td>
<td>58.0</td>
<td>6.5</td>
<td>1.0</td>
<td>24.0</td>
<td>2.5</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>60.0</td>
<td>9.0</td>
<td>.80</td>
<td>21.5</td>
<td>3.1</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>59.0</td>
<td>7.8</td>
<td>.90</td>
<td>22.8</td>
<td>2.8</td>
<td>6.8</td>
</tr>
<tr>
<td>Non-Gendered</td>
<td>Female</td>
<td>59.3</td>
<td>5.5</td>
<td>1.5</td>
<td>23.5</td>
<td>3.1</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>50.0</td>
<td>.00</td>
<td>.00</td>
<td>22.5</td>
<td>8.5</td>
<td>19.5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>54.7</td>
<td>2.8</td>
<td>.75</td>
<td>23.0</td>
<td>5.8</td>
<td>13.3</td>
</tr>
<tr>
<td>Total</td>
<td>Female</td>
<td>56.8</td>
<td>6.3</td>
<td>2.2</td>
<td>23.2</td>
<td>2.9</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>50.0</td>
<td>9.3</td>
<td>1.3</td>
<td>23.7</td>
<td>6.5</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>53.4</td>
<td>7.8</td>
<td>1.7</td>
<td>22.9</td>
<td>4.7</td>
<td>9.5</td>
</tr>
</tbody>
</table>

**Differences in Attribution for Captain’s Achievement of Success Between Scenario by Gender Groups**

The overall model was significant for the Captains’ achievement of success in the scenario being attributed to luck ($\text{F}(5,60)=2.7$, $p<.03$, $\text{ETA}^2=.13$, $\text{power}=.77$). There was a main effect for gender such that female flight instructors attributed the Captains’ achievement of success in the scenario significantly less to luck ($\text{F}(1,60)=6.2$, $p<.02$, $\text{ETA}^2=.10$, $\text{power}=.69$) than did male flight instructors. Means for each group are provided in Table 5.
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Instructor Gender</th>
<th>Effort</th>
<th>Ability</th>
<th>Luck</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Female</td>
<td>22.0</td>
<td>47.0</td>
<td>17.0</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>18.5</td>
<td>30.0</td>
<td>37.5</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>20.3</td>
<td>38.5</td>
<td>27.3</td>
<td>14.0</td>
</tr>
<tr>
<td>Male</td>
<td>Female</td>
<td>32.0</td>
<td>46.0</td>
<td>10.1</td>
<td>11.9</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>30.5</td>
<td>49.0</td>
<td>13.0</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>31.3</td>
<td>47.5</td>
<td>11.6</td>
<td>9.7</td>
</tr>
<tr>
<td>Non-Gendered</td>
<td>Female</td>
<td>23.0</td>
<td>53.5</td>
<td>9.5</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>24.7</td>
<td>38.5</td>
<td>27.8</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>23.9</td>
<td>46.0</td>
<td>18.7</td>
<td>10.2</td>
</tr>
<tr>
<td>Total</td>
<td>Female</td>
<td>25.7</td>
<td>48.8</td>
<td>12.2</td>
<td>13.3</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>24.6</td>
<td>39.2</td>
<td>26.1</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>25.1</td>
<td>44.0</td>
<td>19.2</td>
<td>11.3</td>
</tr>
</tbody>
</table>
DISCUSSION

Results of the present study failed to support the premise of Social Role Theory (Cejka, 1999) that, due to a double standard, when male and female pilots perform equally, the female pilot will be assessed more strictly and therefore her perceived competence will be lower.

Perceptual Similarity Theory (Luthar, 1996) purports that both genders will rate competence higher in pilots of the same gender. Support for the theory was unable to be established by the results of this study, in that participant gender was not predictive of higher ratings of effectiveness, competence, and avoidance for scenario Captains of the same gender.

Attribution Theory (Maisto and Morris, 1999) was also examined in the present study. It was predicted that situation specific attribution evaluations of success in scenarios depicting female pilots would result in attributions of external causality while scenarios depicting male pilots will result in attributions of internal causality. While no differences were found for attribution of blame in encountering the adverse condition in the scenario, significant differences between groups were found in how attribution for the successful landing of the flight was rated. The attribution ratings for weather (an external causal element) were significantly higher for the female Captain scenario than for the non-gendered scenario condition. While there was a significant overall effect for the Captains’ achievement for success being attributed to luck, there was a lack of support
for the theory that female Captains’ achievement of success would be attributed to luck and male Captains’ achievement of success attributed to skill.

The lack of support for the proposed hypotheses may have been resultant of several causal factors. First, the existence of a pilot personality profile (Novello and Youssef, 1974) that suggests that female pilots have personality traits in common with male pilots may provide some insight. Novello and Youssef showed through a battery of psychological tests that the personality profile of female pilots has the least resemblance to U.S. adult females, followed by higher resemblance to U.S. adult males, and the greatest resemblance to the male pilot profile. This similarity of personality possibly extinguished the gender differences that may have been more apparent within other occupations that do not require, attract, and select out such a specific personality type.

Second, the effects of weakness in design of the present study must also be considered. Statistical analyses uncovered low effect sizes and low power. An increase in power would have required two times as many participants per cell. Due to the lack of presence of female flight instructors for participation, the researcher was only able to acquire ten female subjects per treatment condition.

While the results of the present study failed to support the proposed hypotheses, this is still an area that beckons examination. Perhaps future researchers could have access to a larger female participant base which would enable an increase of statistical effect size and power and possibly yield contradictory results. Support for this possibility can be derived from review of descriptive information. For example, male Captain scenarios were scored slightly higher than female Captain scenarios in effectiveness, competence, and avoidance. Although this finding was not significant, it was in the
hypothesized direction. As the number of females continues to increase within the aviation community it is important to continue research which examines the challenges, pitfalls, and tainted perceptions that may be a hindrance to the further integration and advancement of female pilots.
REFERENCES


APPENDIX A

Scenarios
Female Captain Scenario

Captain Lisa Winfield has been a 767 Captain for a major commercial airline for 5 years. She has logged a combined total of 6,000 hours on this particular type of aircraft in the positions of Captain and First Officer. The First Officer has held this position for 4 years and has logged a total of 3,000 hours on this particular type of aircraft as a First Officer. As flight 1027 approached La Guardia International Airport, after a turbulent flight from Los Angeles, Captain Lisa Winfield made an announcement. She told passengers that the current conditions in New York were cold and rainy with winds out of the east at 20 knots, gusting at 35 knots. Additionally, she apologized for not being able to make up more than 30 minutes of the 2-hour delay of their flight. As the Boeing 767 was on final approach, the passengers could feel several abrupt power and heading adjustments. Subsequent to the unstable approach, there was a hard landing beyond the touchdown zone. As the aircraft continued down the runway, it began to hydroplane and consequently slid off the departure end of the runway into the approach lights. She brought the aircraft to an abrupt stop in the wet field while successfully avoiding collision with other aircraft. There was significant structural damage to the landing gear and fuselage. There were no fatalities or serious injuries. Of the 334 passengers, 25 incurred minor injuries such as abrasions and bruising.
Male Captain Scenario

Captain Larry Winfield has been a 767 Captain for a major commercial airline for 5 years. He has logged a combined total of 6,000 hours on this particular type of aircraft in the positions of Captain and First Officer. The First Officer has held this position for 4 years and has logged a total of 3,000 hours on this particular type of aircraft as a First Officer. As flight 1027 approached La Guardia International Airport, after a turbulent flight from Los Angeles, Captain Lisa Winfield made an announcement. He told passengers that the current conditions in New York were cold and rainy with winds out of the east at 20 knots, gusting at 35 knots. Additionally, he apologized for not being able to make up more than 30 minutes of the 2-hour delay of their flight. As the Boeing 767 was on final approach, the passengers could feel several abrupt power and heading adjustments. Subsequent to the unstable approach, there was a hard landing beyond the touchdown zone. As the aircraft continued down the runway, it began to hydroplane and consequently slid off the departure end of the runway into the approach lights. He brought the aircraft to an abrupt stop in the wet field while successfully avoiding collision with other aircraft. There was significant structural damage to the landing gear and fuselage. There were no fatalities or serious injuries. Of the 334 passengers, 25 incurred minor injuries such as abrasions and bruising.
Unspecified Scenario

Captain Winfield has been a 767 Captain for a major commercial airline for 5 years and has logged a combined total of 6,000 hours on this particular type of aircraft in the positions of Captain and First Officer. The First Officer has held this position for 4 years and has logged a total of 3,000 hours on this particular type of aircraft as a First Officer. As flight 1027 approached La Guardia International Airport, after a turbulent flight from Los Angeles, the Captain made an announcement telling passengers that the current conditions in New York were cold and rainy with winds out of the east at 20 knots, gusting at 35 knots. Additionally, an apology was made for not being able to make up more than 30 minutes of the 2-hour delay of their flight. As the Boeing 767 was on final approach, the passengers could feel several abrupt power and heading adjustments. Subsequent to the unstable approach, there was a hard landing beyond the touchdown zone. As the aircraft continued down the runway, it began to hydroplane and consequently slid off the departure end of the runway into the approach lights. The Captain brought the aircraft to an abrupt stop in the wet field while successfully avoiding collision with other aircraft. There was significant structural damage to the landing gear and fuselage. There were no fatalities or serious injuries. Of the 334 passengers, 25 incurred minor injuries such as abrasions and bruising.
APPENDIX B

Questionnaire
Please answer the following questions by indicating only one answer on the scale for each question. Answer the questions within the context of the following definitions.

Competence is defined as possessing ability.
Effectiveness is defined as producing the desired outcome.
Avoidance is defined as evading or keeping clear of.
Blame is defined as being held responsible.

1. To what extent was the role of Captain effectively performed in the scenario?

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

2. To what extent was the role of Captain competently performed in the scenario?

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

3. To what extent was the role of First Officer effectively performed in the scenario?

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

4. To what extent was the role of First Officer competently performed in the scenario?

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

5. To what extent could the Captain have avoided the incident in the scenario?

<table>
<thead>
<tr>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

6. To what extent could the First Officer have avoided the incident in the scenario?
Please answer the remainder of the questions by assigning a percentage for each category. Percentages may be any multiple of 10 between 0 and 100. Total of all categories within each question must equal 100.

7. What percentages of blame for the incident encountered in the scenario should be assigned to the following categories?

   ____ Captain  ____ delay time  ____ airport
   ____ weather  ____ First Officer  ____ aircraft

8. How much of a role did the following play in the successful landing of the flight?

   ____ Captain  ____ delay time  ____ airport
   ____ weather  ____ First Officer  ____ aircraft

9. What percentages do you assign to the following categories in being contributory to the Captain achieving success in the scenario?

   ____ effort  ____ luck
   ____ ability  ____ task difficulty

10. What percentages do you assign to the following categories in being contributory to the Captain encountering the adverse conditions in the scenario?

    ____ effort  ____ luck
    ____ ability  ____ task difficulty

11. What percentages do you assign to the following categories in being contributory to the First Officer achieving success in the scenario?
12. What percentages do you assign to the following categories in being contributory to the First Officer encountering the adverse conditions in the scenario?

___ effort  ___ luck

___ ability  ___ task difficulty

Please provide the following information.

Age ___

Sex ___

Total flight hours ____________

Current ratings ________________________________

Country of origin ______________________________
APPENDIX C

Informed Consent
The experiment you are about to participate in is designed to investigate the relationship between personal characteristics and the perception of competence. The experiment consists of a single, 20-minute session. You will be asked to read a flight scenario and then answer a questionnaire pertaining to that scenario. You will also be asked to provide some general demographic information. Please do not communicate with other participants or read another participant's materials while the study is being conducted.

There are no known risks associated with this experiment. Please be assured that any information that you provide will be held in strict confidence by the researcher and at no time will your name be reported along with your responses. Please understand that your participation in this research is voluntary and you may withdraw at any time.

At your request, you will receive a report of the results upon completion of the study. Thank you for your participation. If you have any question, please ask during the experiment or feel free to call me at (386) 672-8327.

Statement of Consent

I acknowledge that I have been informed of the general purpose of this study. I acknowledge that my participation in this study is entirely voluntary and that I am free to withdraw at any time.

Signature of Participant: ___________________________ Date: _______________

I would like to receive a report of results from this experiment: yes ___ no ___
APPENDIX D

Debriefing Form
The study that you just participated in is concerned with the effects of gender on the perception of pilot competence. Three different scenarios that varied by the gender of the Captain in the scenario were utilized. Participants either received a scenario in which the Captain was identified (by name) as male, female, or unspecified. This was the only area of variance between the scenarios and all questionnaires were identical. The researcher is seeking evidence of the presence of a gender bias within the aviation community by observing gender differences in competency ratings when assessed through dimensions related to pilot behavior. Your responses will enable the researcher to evaluate your perceptions of the Captain in the scenario in the areas of competence, effectiveness, blame, avoidability, and attribution.

Findings are expected to be evidence for the continued presence of a double standard in rating the competence of men and women within the aviation community. If it becomes recognized that members of a social category are commonly disadvantaged, in settings such as aviation that involve evaluation with a stricter ability standard, the situation must be rectified. Research in this area is needed in order to understand how male and female pilots are perceived and to provide a basis for continued research in this area that will provide insight to the challenges faced by women aviators.

Signature of Participant: ________________________  Date: __________
APPENDIX E

Instructions
My name is Marianne Paulsen and I am a Human Factors graduate student conducting my thesis. Before we begin, I would like to thank you for your time and participation. I will be passing out packets to each of you to be opened upon completion of my instructions. Once you have received your packet, please do not verbally communicate with others or read each other's information for the duration of the experiment.

Please open your packets and read and sign the consent form before beginning. When that has been completed read the provided scenario and answer the questions posed to you including the requested demographic information. For the questions utilizing a scale, indicate only one answer per question along the continuum of the scale. For the questions requesting percentage responses, assign percentages for each category in any multiple of 10 between 0 and 100, with the total of all categories equaling 100 for each question. Your answers will be kept completely confidential.

When you have finished, please place all materials back into the packet and close it. I will then provide you with an additional form to be read and signed. If you have any questions during the experiment feel free to get my attention and I will attempt to provide clarification. Please begin.