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렌즈모델을 이용한 의사결정자의 Admission Policy 분석 - 과학과 공학분야에서의 성차이의 영향을 중심으로

성연호[1] · Sherry L. Springs · Deanna Tinnin · & Meisha Watkins

Capturing Admission Judgment Policy from the Lens Model Perspective to Understand the Gender Difference in Science and Engineering

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ABSTRACT

Despite the government promoting women's participation in the engineering field, some statistics show that it has yet to be achieved. Potential reasons for this phenomenon include lower level of applications by women, or inherent gender gap in the professional field. Therefore, this study attempted to find impact of gender on college admission from the Lens Model perspective and Signal Detection Theory. This study consisted of three phases: identifying the necessary cues used in the admission process, analyzing existing data, and conducting two experiments to identify the effect of gender on admission decisions. Although the college application consisted of many cues, only five cues, school ranking, GPA, SAT score, resident status, and gender, were used to capture the officers' judgment policies for engineering admissions. Two experiments were conducted to investigate the impact of the gender factor in college admission. The enrollment officers first were presented with the existing data without the gender and asked to make dichotomous judgments. Secondly, the officers were asked to perform the judgment task with the gender cue present. Results showed that the gender did not play an important role in the judgments as expected. However, ideographical analyses on judgment strategies revealed that there were significant differences between the admission officers. Possible training implications are discussed.

Keyword: Lens model, Judgment and decision making policy, Admission policy

1. Introduction

Previous national statistics have shown that the level of women's participation in Science, Technology, Engineering, and Mathematics(STEM) demonstrated steady increase(Dietz, Anderson, & Katzenmeyer, 2002). Furthermore, according to Campbell, Jolly, Hoey, & Perlman (2002), it was shown that women(53%) are more apt to attend colleges and universities than men(47%), which indicates a subtle gender disparity. Astonishingly however, the disparity becomes extremely opposite for the engineering enrollment only, showing that more men (82%) attend engineering college than women(18%).

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In the United States, the National Science Foundation (NSF) monitors women and minorities in science and engineering biennially. In 1984, less than 5% of professional engineers were women; and the percentage of women engineering faculty was only 5.5%(Smith, 2001). Since 2002, these numbers have increased to 14,102 women versus 54,546 men, which is approximately 20% of professional engineers; and approximately 24% of full-time professors who hold doctorate degrees(this number includes full, associate, and assistant professors) are women(NSF, 2006). For example, the fact book published by one state university showed that 51% of the students enrolled in the university are female while 38% of them are in the engineering fields.

Increasing women's participation in STEM areas must be a consistent effort starting from providing more education for high school students through more careful consideration of women in the admission process and retention in school. Over the years, researchers have documented persistent gaps in the performance of different groups on the SAT and other standardized tests. For example, the College Board(2005) reported that the average score for women bound for college fall semester 2005 is 43 points below the average score for men. This is the typical phenomenon called, "stereotype threat" showing social context can prime particular aspects of one's self-identity, which, in turn, may hinder or facilitate intellectual performance(Lewis, 2005). Further, it was also shown that the average score for Asian Americans, Asians and Pacific Islanders on the SAT I math was higher than that for whites. Therefore, it is obvious that the women's test scores being lower than the male affect the judgments(accept/reject individual).

However understandably, capturing judgment policy in admission has received little attention considering the impact on society. However, Campbell, *et al.*,(2002) stated the importance of using research-based decision making to increase diversity in the quantitative disciplines. Thus, this study proposes to identify the relationships or correlations between the objective measures that are part of the application form and the judgments made by the enrollment officers. The results could provide a partial roadmap how women's performance in the objective measures is related with the enrollment officers' judgments.

2. Background in Gender Gap in Science and Engineering, and Purpose

During the past decades, researchers have attempted to reduce the gender gap and identified many factors including classroom climate, experience prior to college, and self-fulfilling prophecy(Bix, 2000; Hodgkinson, 2000; Seymour, 1999). For example, the classroom climate can also have an impact on how students feel about themselves, their abilities, and the material they are learning. The experiences prior to college also can greatly determine whether a student pursues a particular field of study or not.

Additionally, Smith(2001) adds to this point by discussing several "micro inequities" that faculty members may do without even realizing that it may have a negative impact on female students. Asking female students primarily factual(yes/no or right/wrong) questions while asking males thought-provoking questions can show that the male students are considered to be the real thinkers, while the women are just the doers. It also gives an impression that the professor has lower expectations of female students(Smith, 2001). As it relates to class participation, it is important to recognize when women want to contribute to the discussion by acknowledging them if they raise their hands. An interesting research study performed at Harvard University showed that women are interrupted more when making comments; and when interrupted, are not likely to contribute again in the discussion. Their research also found that the way men and women de-stress is seen as related to their ability to handle the academic environment. For example, a female may cry or get depressed, while a male might get aggressive(Smith, 2001). Therefore, the female may be advised to consider going into less stressful disciplines.

When professors refer to professionals such as the doctor, engineer, or lawyer using male terminology such as "he" and referring to teachers, nurses, the patient or victim as "she," they are stereotyping the professions that men and women are likely to enter. Hodgkinson (2000) agrees that the masculine image of these occupations further reinforce the ways in which science and

technology are presented in the classroom and represented in educational curricula, which exclude girls' experiences and worldviews. According to Sasser, Lineberry, & Scheff(2004), two problematic categories were postulated as the reasons for the significant gender incongruity in engineering; recruitment, retention and advancement. Sasser, *et al.*(2004) agrees that the ineffective recruitment of women into engineering is a direct result of misconceptions regarding the image of engineers and the field of engineering which dissuades women from entering this profession.

According to the results of a survey given to Enrollment Services Officers in the Office of Admissions at North Carolina A&T State University, approximately 27% of applications received by their office are for admission into the College of Engineering. Within that 27%, 78% of applicants are male and 22% are female. In as much, 58% of applicants are actually accepted into the college; with 78% of male applicants and 22% female being among the accepted individuals into the College of Engineering. So it can be said that more males are applying and accepted into the college of engineering than females.

The main purpose of this study was to increase understanding of judgment policies that the Enrollment Service Officers(ESOs) have to make and determine whether or not the gender factor plays an important role in college admission in the STEM areas. Although there are multiple possible ways to accomplish this objective, this study attempted to understand the women's participation in the STEM area by investigating college admission policies and provide cognitive strategies that each individual maintain when each decides the other's future.

In order to focus on the decision to formally accept the students, the Social Judgment Theory(SJT: Hammond, Stewart, Brehmer, & Steinman, 1975), and the Signal Detection Theory(SDT: Swets & Pickett, 1982) provide the methods to approach this problem. These two approaches are valuable for a number of reasons. SJT provides a theoretical and a practical analysis framework for the complex and ambiguous environment. On the other hand, SDT has been widely used in applied decision making and proved useful in this study because it separates the sensitivity with which a person can discriminate between the decisions(accept/reject) from the bias that the person has towards one decision or the other. Dalgleish(1988) also used both approaches on his study of decision making in child separation decision.

3. Lens Model, Signal Detection Theory and Cue Identification of Enrollment Service Officers

3.1 Background

Requirements for models and theoretical frameworks to answer the role of gender factor in the admission process are: 1) the theoretical framework needs to produce each individual's judgment policy on how each individual should or should not be admitted. Specifically, the model must be capable of identifying how each individual considers or "puts weight on" different types of information to understand the judgment policy on college admission. In this regard, Brunswik's Lens Model (LM)(Brunswik, 1952) would be used, which provides fundamental theoretical and methodological framework to capture one's judgment policy and performance. This modeling framework provides theoretical underpinnings in that it identifies the "contribution" made by each cue. Also, the model allows investigations on how consistently the human(enrollment officers) implement their cognitive judgment policies in this setting(shown as cognitive control in Figure 1).

Brunswik's(1952) idea is such that accuracy is dissected by estimating both models of the judgment and models of the criterion in understanding and improving human judgment and decision-making(Brunswik, 1952; Cooksey, 1996). Within the LM are associated parameters which are used to evaluate the judgment. These lens model parameters(LMPs) represent different aspects which provide information about the judgment policy and the task ecology. The parameters include Achievement (r_a), Cognitive Control(R_s), Ecological Predictability(R_e), Linear Knowledge(G), and Unmodeled Knowledge(C) (See Cooksey(1996) for detailed description of these parameters). Briefly, achievement represents the degree of judgment performance calculated by correlating the actual ecological criterion values and the participant's

actual judgments. Cognitive control refers to the degree of control over one's judgment policy on a specific judgment task. Ecological predictability indicates the degree of predictability of the ecological criterion given the cues, and equivalent to the degree of difficulty of the judgment task. Linear knowledge can be interpreted as the extent to which the human judge demonstrates one's knowledge in the task at hand. Finally, unmodeled knowledge refers to the extent to which the judgments are systematically different from the ecological criterion. The LM with its extension has been applied to many different settings including military identification task(Seong, & Bisantz, 2000) and child abuse(Dalgleish, 1988). A typical Lens model is shown in Figure 1.

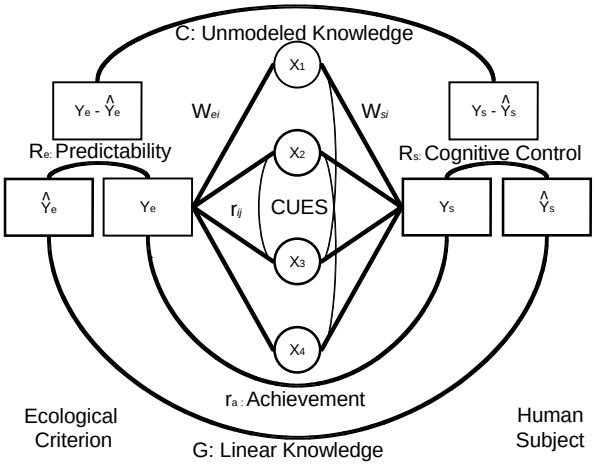

Figure 1. Lens model with its parameters superimposed.

3.2 Lens Model Cue Identification for ESOs

To capture the judgment policies of ESOs within the framework of this study, first the environmental cues must be identified in order to understand and construct the lens model of ESOs. Therefore, several interviews with ESOs were undertaken to extract important cues considered in making admission judgments, which resulted in five cues; resident status, schooling ranking, GPA, SAT score, and state requirement. For the purpose of this study, gender cue was added, creating a total of six cues. Among these, the state requirement was later excluded because applicants who do not meet this requirement are automatically rejected, which resulted in 5 cues shown in Figure 2 within the lens model framework.

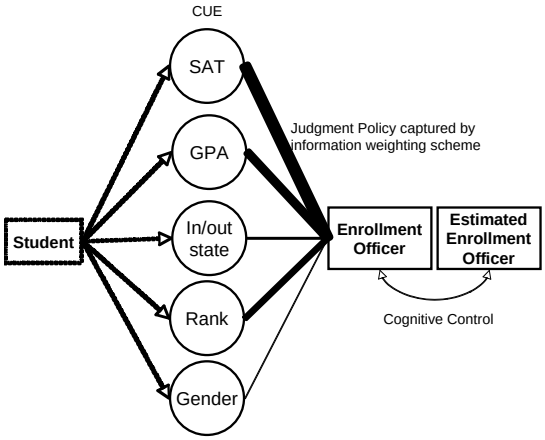

Figure 2. Lens model of enrollment officers making judgments whether to accept or reject applicants. Thickness of the lines connecting the cues with the enrollment officers may represent the importance of the cue forming the judgment. This is shown only for illustration purpose.

Additionally, the modeling framework provides methodological underpinnings in that the analysis methods are structured to identify the probabilistic relationships between the information presented and the judgments entertained by decision makers(i.e., ESOs). Utility of this lens model for this study relies precisely on these facts that the model provides judgment policies by providing information on the weight scheme employed by the judges(in this case, the enrollment officers). Figure 2 shows a lens model of enrollment officers making dichotomous decisions(accept/reject) based on a group of information(SAT, GPA and others). The dotted lines indicate infeasibility, i.e., how much is the individual "worthy or qualified" of being admitted? Among many parameters to describe the judgment policy and performance, produced by the lens model analysis, the judgment policy represented by the correlation coefficients from the multiple regression analysis is the most important parameter to understand one's policy on how each piece of information(cue) is considered in forming the final judgment. Therefore, the model produces the precise impact or contribution of each piece of information to the enrollment officers' judgment policy.

Additionally, SDT analyzes performance based on a 2X2 table of the outcome of the actual cases. Basically in SDT, a person considers a multitude of stimulus dimensions and summarizes this into an observation along

a binary continuum of strength of evidence for one alternative or the other. Two types of performance measures are derived from SDT; sensitivity and response bias. Within the context of this study, sensitivity, denoted as d', refers to how well ESOs detect those who were accepted/rejected based on the strength of the cues (signal). The index is a difference between two z-scores of two probabilities(hit and miss in SDT terms), and ranges from 0 to a practical limit of 4. On the other hand, response bias is a measure of decision criteria varying on a continuum from conservative and risky(see Swets (1996) for more detail).

3.3 Methodology

The objectives of this project are to use a LM analysis to examine the decision-making process of ESOs in accepting first year male and female students into the College of Engineering(COE) at North Carolina A&T State University(NCA&TSU); and to determine whether there is gender bias in the admission process. The research question to be answered by this study is whether or not the judgment policies of the ESOs are affected by the gender in the admission process. Fifty of previously judged applications were randomly selected and used throughout two experiments. Each of these 50 profiles was repeated once to examine the consistency of judgments, making a total of 100 application profiles. In experiment 1, ESOs were not given the gender factor while in experiment 2; they were given the gender factor.

3.3.1 Analysis of Previous Records

Lens model analysis on the previous records was first conducted to capture the admission policy. However, it was not feasible to know which ESO made each judgment; the judgment policy captured must be considered as aggregated judgment policy including all ESOs. Although logistic regression analysis is the recommended analysis method when it involves dichotomous judgments, Dalgleish(1988) showed that the ordinary least square regression analysis(OLS) is used if researchers are interested in only the Lens Model parameters(LMPs) and cue weight distribution, not prediction of outcomes. Therefore, OLS was used for data analysis throughout the study.

$$\hat{Y} = .47 + .045Residency + .238GPA - .055Class + .274SAT + .152Gender$$

Analysis on the previous records resulted in the euqation below:

However, beta weights which can be used to calculate relative weights are more intuitive to statistically naïve readers. The relative weights of these cues reveled that two scores(SAT and GPA) took 77.7%(41.6 and 36.1 respectively), while the gender cue received highest cue weight among the three relatively less weighted cues(Residency, Class rank, and Gender, received 3.3%, 8.4%, and 10.6%, respectively).

4. Experiment 1

4.1 Participants

Five ESOs were recruited from the Office of Admissions at NCA&TSU. Prior to testing, each subject was asked to complete a demographical questionnaire. Participants 2, 5, and 7 were female and participants 4 and 6 were male. All ESOs have worked less than 2.5 years at this institution. It was reported that the average number of applications that each ESO reviewed in a normal day was between 30 and 40, which made about 1,000 applications in a year. Participants were also asked to rank the cues based on subjective importance. Results showed that the state minimum requirement followed by the residency cue was emphasized more than any other cues.

4.2 Procedure

Prior to testing, a brief demonstration of the program was provided to make participants familiar with the judgment task. The previously analyzed applications were used as data to construct a simple computer program showing the necessary four cues(without gender), shown in Figure 3. Participants had to determine whether to accept or reject an applicant into the College of Engineering using the cues. The gender of the applicant was not provided in Experiment 1.

4.3 Results

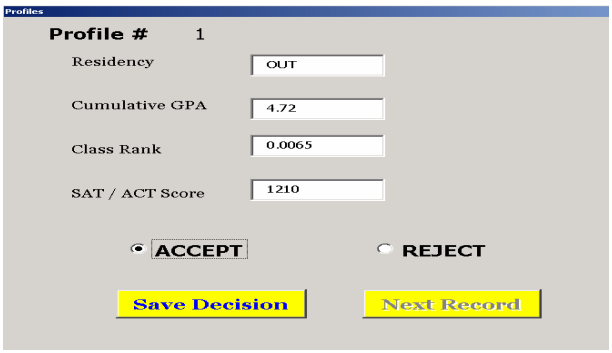

Figure 3. Computer program used in this study of judgment tasks.

As discussed, OLS and correlation analyses were conducted to identify cue weight distributions and correlation coefficients. Table 1 shows the beta weights and relative weights calculated based on the beta weights. As shown, ESOs 4, 5, and 6 placed the most importance on the GPA and the least importance on class rank. ESO 2 put more importance on class rank but little on GPA.

Table 1. Beta weights and relative weights(within the parenthesis in percent) for each ESO. Relatively more emphasized cues by each ESO are in bold

		ESO 2	ESO 4	ESO 5	ESO 6	ESO 7
Beta (relative −%) weights	Residency	−.02 (2.2)	0.044 (5.1)	0.122 (13.6)	0.059 (7.1)	0.024 (1.8)
	GPA	−.123 (13.3)	0.319 (**37**)	0.323 (**35.9**)	0.321 (**38.7**)	0.623 (**47.4**)
	Class rank	.458 (**49.7**)	0.178 (20.7)	0.079 (8.8)	0.076 (9.2)	−0.307 (23.4)
	SAT	.321 (**34.8**)	0.32 (**37.2**)	0.375 (**41.7**)	0.373 (**45**)	0.36 (**27.4**)

Finally, ESO 7 placed more importance on SAT with little importance on residency.

Figure 4 also shows this distribution of these relative cue weights. As can be seen, four ESOs showed very similar cue weight distribution while one ESO(ESO 2) showed a somewhat unique pattern by emphasizing Class Rank while de−emphasizing GPA at the same time.

Additionally, ESOs were asked to rate the four cues based on their perceived importance in making admission judgments, shown in Figure 5. In this figure, the lower the number(closer to the middle), it is stated as more important than other cues. Three ESOs(2, 5, & 6) showed the same judgment strategy; they stated that

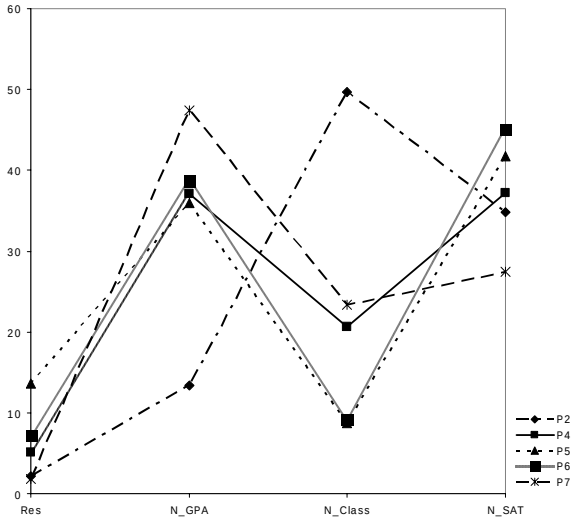

Figure 4. Distribution of relative weights on each cue by participants. ESO 2 showed somewhat unique judgment strategy by emphasizing class rank while deemphasizing GPA at the same time.

the residency cue was the most important cue, followed by GPA, SAT, and Class rank. The other two ESOs showed similar strategies, emphasizing GPA, and SAT more than the other cues. The discrepancy between the

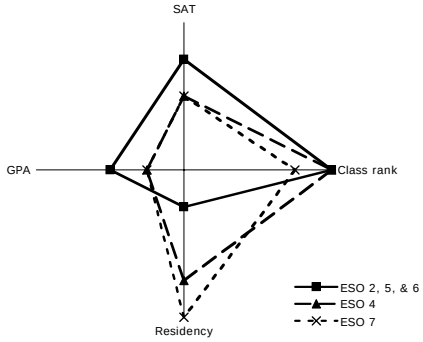

Figure 5. Perceived cue importance by ESOs. Given the ESO, the closer to the middle, the more importance the ESO placed on the cue.

perceived and actual judgment strategies will be discussed in the discussion section.

4.4 Lens Model Parameters

Multiple regression and correlation analyses were used to reveal the LMPs for each individual ESO, shown in Figure 6. Overall, all ESOs showed expected levels of performance; high in achievements(r_a), cognitive control

(R_s), and linear knowledge(G) while maintaining low levels of unmodeled knowledge(C). Note that the three parameters(achievement, linear knowledge, and unmodeled knowledge) were calculated by correlating ESOs' judgments with the previous accepted/rejected students profiles. Therefore, high levels of correlation simply

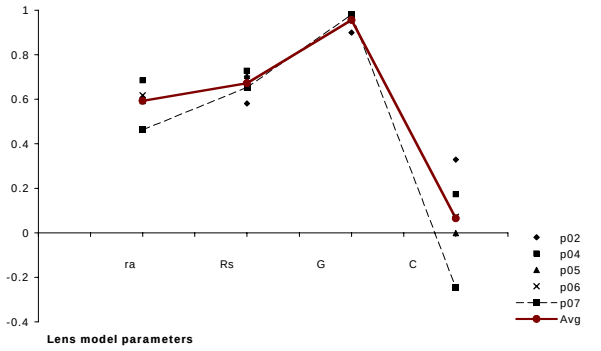

Figure 6. Lens model parameters of ESOs. The solid line connecting the levels of the LMPs shows the average, while the broken line shows ESO 7.

indicate that ESOs' judgments were in accordance with previous judgments.

For the achievement(r_a), there is high correlation for the ESOs, especially for ESOs 4, 5, 6. For G, there is also high correlation for all ESOs except, ESO 7, which is only moderately correlated showing somewhat lower level of judgment performance. For unmodeled knowledge(C), ESO 4 has a reasonably accurate application of his knowledge of predictive but unmodeled relationships. However, the low values for ESOs 2 and 7 seems to suggest there might be cues considered that were not represented in the judgment task. Finally, for the cognitive control(R_s), the data shows that all ESOs have a good degree of control over the execution of their judgment policy.

5. Experiment 2

5.1 Participants/Procedure

The second experiment was conducted by giving the gender cue to ESOs to see how this cue would impact their judgment policy and performance. Therefore, 5 cues were used in this experiment. However, instead of 100 profiles used in the first experiment, randomly selected 50 applications were used and each application was repeated twice, creating 100 judgments for each ESO. For this experiment, one additional female ESO (ESO 1) participated, increasing the total number of participants from 5 to 6. Other experimental procedures were the same.

5.2 Results

The results from the second decision tasks including the gender cue are based on the decisions of 6 ESOs. As done previously, regression equations were created for all of the ESOs. The regression equations for the original judgments remained the same. Figure 7 represents a beta weight comparison of all the ESOs. In this case, ESO 1 has a different judgment policy whereas ESO 7 is more in line with the other ESOs.

5.3 LMPs and Cue Weights

For the ESOs 2, 4, and 6, GPA was most important while gender, SAT, and class rank were least respectively(Table 2). For ESO 1, more importance was on residency and least on gender. For ESO 5, only slightly more importance was placed on gender than GPA with the least importance cue being class rank. For ESO 7, class rank was the most important cue with gender being the least.

Table 2. Beta weights and relative weights(within the parenthesis in percent) for each ESO. Relatively more emphasized cues by each ESO are in bold

		ESO 1	ESO 2	ESO 4	ESO 5	ESO 6	ESO 7
Beta (relative -%) weights	Residency	0.19 (15.6)	0.12 (9.6)	0.08 (7.3)	0.05 (4.4)	−0.01 (0.6)	−0.20 (15.8)
	GPA	0.18 (15.1)	0.60 **(49)**	0.17 (15.5)	0.53 **(49.4)**	0.47 **(45.9)**	0.15 (11.9)
	Class rank	0.34 **(28.6)**	−0.07 (5.5)	0.50 **(45.6)**	0.04 (3.4)	−0.06 (5.4)	0.46 **(37.3)**
	SAT	0.42 **(35.3)**	0.38 **(31.4)**	0.33 **(30.2)**	0.36 **(34.3)**	0.45 **(44.2)**	−0.32 **(26)**
	Gender	0.06 (5.4)	0.054 (4.4)	0.01 (1.3)	−0.09 (8.5)	0.04 (3.9)	−0.11 (9.1)

Figure 7 depicts the distribution of relative cue weights of each individual ESO. As can be seen, there seem to

be two distinctive judgment strategies; whether GPA receives more importance than Class rank or vice versa. Three ESOs(1, 4, & 7) judgments, shown in connected lines, resulted in higher relative cue weight on Class rank while the other ESOs results show were higher on GPA. Note that in the Experiment 1, for ESO 7, GPA was the cue that received higher weight than any other cues. Therefore, ESO 7's strategy for the second experiment was shifted, resulting in different judgment strategy.

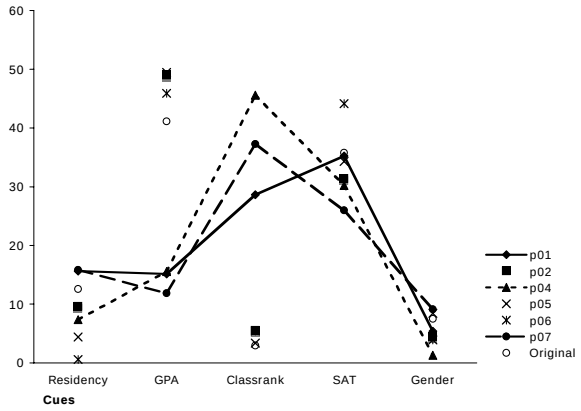

Figure 7. Distribution of the relative cue weight by 7 ESOs. Three ESOs(connected lines; 1, 4, and 7) showed different cue weight distribution patter from the rest.

However, none of the ESOs showed any significant emphasis on the gender cue.

The LMPs were determined by performing a correlation analysis. Based on the results, for the r_a, there is high correlation for the ESOs, with the exception of ESO 7. For G, there is also high correlation for all ESOs except, ESO 7, which is only moderately correlated. For unmodeled knowledge(C), the ESOs other than ESO 2 have less than a reasonably accurate application of their knowledge of predictive but unmodeled relationships. The low values for the ESOs could show there were some cues(possibly gender) that were not represented in the judgment policy. As with ESO 1, the negative correlation definitely points toward some unmodeled knowledge in the judgment policy. Finally, for the R_s, the data shows that all the ESOs have a high degree of control over the execution of their judgment policy. However, ESO 7's control is marginal. See Figure 8 below:

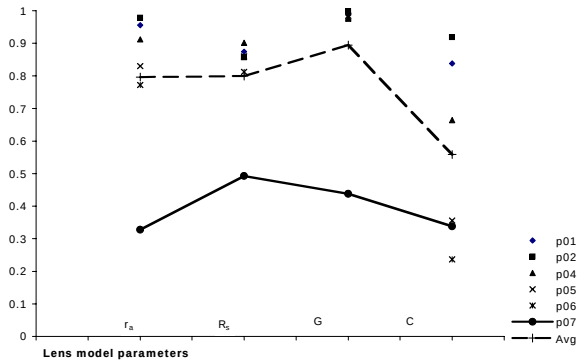

Figure 8. Lens model parameters of the 7 ESOs. The average of each parameter is shown in the dash line for emphasis.

5.4 Analysis from Signal Detection Theory

Judgment data obtained from the ESOs were classified according to the gender. These results may reveal the response bias that ESOs may have by separating from the sensitivity. Table 3 shows contingency matrix for both gender. The data shows that 81% and 82%(male and female respectively) of the accept decisions made did not change from the previous decision. On the other hand, 19% of the decisions for the male applicants and 18% of the decisions for the female applicants who were previously accepted were changed to reject. Of the rejected applicants, 97% and 99% of the decisions remained rejected for both the male and female respectively. Finally, there were only a small percentage of rejected applications that became accepted at 3% for males and 1% for females. Two parameters, sensitivity (d') and response bias(β), were calculated based on the probabilities. Within the SDT analysis, sensitivities of ESOs were quite distinguishable(3.26 for female applicants, 2.78 for male). The same is also true for the response bias(9.7 for female applicants, and 3.99 for male).

Table 3. Matrix for the decision on female and male (in parenthesis) applicants

		Original profiles		Total
		Accept	Reject	
ESOs' decision	Accept	107(127)	1(6)	108(133)
	Reject	24(29)	107(197)	131(226)
	Total	131(156)	108(203)	239(359)

6. Discussion and Conclusions

Due to such efforts made by governments and private organizations, women's participation in STEM areas has shown some increases during the past decades. However, it seems that it has yet to reach the level where our society would take advantage of diverse composition. In this respect, academic institutions throughout the US are the first frontier of promoting women's role in STEM areas, and have taken a variety of approaches, such as providing more education opportunities for girls in high school, better mentoring and counseling services for university students, and conducting research on gender differences resulting in motivation or willingness to participate in STEM areas. However, understandably, little attention has been provided to examine the judgment strategies and policies of college admission. Therefore, this study attempted to examine the judgment policies of the college admission personnel, Enrollment Service Officers(ESO). This would provide a chance to understand the relative lower level of participation or at least rule out the possibility of bias against women, proven otherwise. Previous applications were analyzed from the lens model perspective, followed by two experiments to examine how the ESOs' judgment policy would change without the gender factor present and how important the gender factor played a role in the admission judgments.

Overall, the results seem to suggest that the gender was not a factor in college admission decisions. Analysis of the previous applications showed minor contribution of the gender factor into the judgments(about 15% in relative weight), next to two official scores(SAT and GPA). Note that this is an aggregated judgment policy because the decision maker was not recorded, therefore unknown. Subsequent experiments revealed similar results in that ESOs' judgments were in accordance with the previous judgments without the gender cue present. These results further indicate that the gender was not considered as one of the judgment criteria. However, idiographic examination revealed that the ESO 7(female, and the most experienced ESO among the 6 participants) changed her strategy when the gender factor was present, shown in Figure 4 & 7. Without the gender, the order of importance based on the relative weight was GPA, SAT and Class(very close with each other), and Residency. When the gender was present; however, the order became SAT, Class rank, GPA, Residency, and Gender. Although the gender was marked with least importance, GPA factor became significantly less important(from first to fourth place).

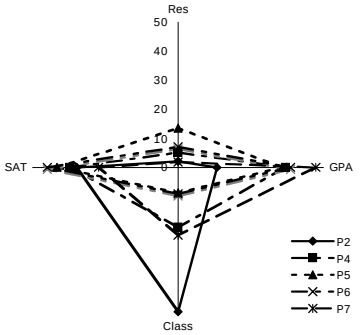

Figure 9. Distributions of relative cue weights by ESOs. Unlike Figure 5 (perceived cue weight), the farther away from the middle, the heavier the relative cue weight is, given the ESO.

Additionally, there were discrepancies between the perceived strategies(shown in Figure 5) and actual judgment strategies used by ESOs in terms of cue importance as shown in Figure 9. Note that the perceived importance was based on the reported rank(1, 2, 3, & 4 – the lower the number, the more importance the ESOs reported) by ESOs while the importance from the judgment policies were in the beta weight(percentile – the higher the number, the more important each cue was). There could be several explanations about this paradigm shift. One is that the perceived strategies can be based on policies and guidelines determined by administration as to where focus should lie. However, as each ESO became more familiar with the types of applications they received, each developed his or her own judgment strategies. Also, it may be feasible due to the ESOs ability to change cue importance based on the individual criteria. As shown, an additional cue caused the importance to shift.

The SDT analysis showed that the ESOs were able to differentiate those who were previously accepted from rejected regardless of the gender(d'=3.26 for female and 2.78 for male). It also showed that the ESOs' judgment criteria was very conservative, based on the response bias(β). However conservative, the judgment criteria for

the female applicants was more conservative than for the male applicants. This fact may indicate that for female applicants, there needs to be a stronger emphasis on other aspects of the signals,(in this case other scores such as SAT, GPA, etc.), to be accepted in the College of Engineering. However, note that there were fewer misses(reject those who were accepted before) or false alarms(accept those who were rejected before) for female than for male. In this situation, the results may be simply caused by a potentially higher level of judgment performance.

7. Future Research

One way to support human judgment performance in general, is by utilizing the cognitive feedback. Unlike the conventional outcome feedback that shows simple "correctness" of judgments, the cognitive feedback contains and shows the probabilistic relationships between the information considered and the judgments made by the human. In the current setting, studies demonstrating the superior performance of the cognitive feedback over the outcome feedback has been well documented (Balzer, Doherty, & O'Connor, 1989; Bisantz & Seong, 2001; Doherty, & Balzer, 1988; Doherty, & Reilly, 2001; Seong, 2002; Seong, & Bisantz, 2000; Seong, 2005)

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