GEODEMOGRAPHICS AND BIG DATA:
THE CHANGING STUDENT LANDSCAPE AT
TEXAS CHRISTIAN UNIVERSITY, 2005 – 2014

by

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GEODEMOGRAPHICS AND BIG DATA:

THE CHANGING STUDENT LANDSCAPE AT

TEXAS CHRISTIAN UNIVERSITY, 2005 – 2014

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ABSTRACT

"Big Data," a term that has come to symbolize the data revolution of the twenty-first century, exists in virtually every field across the globe today. Some colleges and universities are now beginning to join this movement through renewed focus on data analytics and geodemographics. Geodemographic variables such as distance, gender, ethnicity, and test scores all factor into where a student decides to go to school and how successful they are there. If properly harnessed in a geographic or spatial context, student information has the potential to provide great insight for institutions. Utilizing geodemographic data, this research seeks to examine the changing landscape of the student body at Texas Christian University between 2005 and 2014 through the use of Geographic Information Systems, interactive computation, and desktop analytical platforms.

ACKNOWLDEGEMENTS

I would like to thank my supervising professor, Dr. Walker, for pushing me to step out of my comfort zone throughout the duration of this project, and for always believing in my abilities, especially when I struggled to believe in them myself. I would also like to thank Dr. Roet and Professor Morgan for serving on my committee and providing me with valuable feedback. Finally, I would like to recognize and thank the Office of Institutional Research at TCU for providing me with all of the data I requested for my honors thesis. Without the help and support of Cathan, Melissa, and Leanne, this project would not have been possible. Thank you all.

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INTRODUCTION

Over the past decade, we have experienced an intense data explosion. Broadly speaking, this vast amount of information is known as "Big Data," a term that has come to symbolize the data revolution of the twenty-first century. Such data exists in virtually every field across the globe today, and some colleges and universities are now beginning to join this movement through renewed focus on data analytics. If properly harnessed in a geographic or spatial context, student information has the potential to provide great insight for institutions. Specifically, geodemographic analysis in a university setting has applications in a number of areas, including improving recruitment methods, aiding admissions decisions, focusing development, and enhancing the overall student living and learning experience.

At this time, Texas Christian University is on the precipice of a great change as it transitions from a regional institution to a national university. For instance, 2012 marked the first year in which the incoming freshman class consisted of more out-of-state students than native Texans. This dramatic shift in the university's student base has significant implications for TCU moving forward. While many people simply attribute these changes to the success of TCU's football program, they fail to understand the reality in which certain trends are not necessarily representative of the full student body. Case in point, even though a majority of TCU students now come from out-of-state, only approximately 30 percent of the 2014 Horned Frog football team was from somewhere other than Texas. This is just one example of the many ways proper data analytics and geodemographics can clarify exactly how the student body is transitioning, reasons for

such an occurrence, and what these differences might bring for the future of the university.

Utilizing geodemographic data, this research seeks to examine the changing landscape of the student body at Texas Christian University between 2005 and 2014 through the use of Geographic Information Systems, interactive computation, and desktop analytical platforms. Specifically, it studies the shifting spatial distribution of TCU students over time; investigates the relationship between standardized test scores and undergraduate academic performance; and analyzes the geodemographic characteristics of students to better understand the university's primary market.

REVIEW OF LITERATURE

Geodemographic variables such as distance, gender, ethnicity, and test scores all factor into where a student decides to go to school and how successful they are there. In her publication "Birds of a Feather," Susan Mitchell defines the term geodemographics as the "analysis of people by where they live." The importance of studying geodemographics stems from the idea that where you come from says something about who you are. If we accept this notion as true, it is fair to say that, to a certain extent, people who come from the same place are similar, especially regarding characteristics like socioeconomic status, race, and interests or hobbies. As such, the age-old mantra "birds of a feather flock together" is an important concept in the study of geodemographics as it applies to university enrollment.[1]

In recent years, the college admissions process has experienced profound changes at institutions all across the United States. With an increasing number of students applying to college, universities are now taking a more holistic approach to admissions,

[1] Susan Mitchell, "Birds of a Feather," *American Demographics* (1995): 3-4.

rather than simply filling spots. This modern system is based on three general objectives: quantity (the number of students to be accepted and enroll), quality (based on academic ability and extracurricular involvement), and diversity (in terms of race/ethnicity, geographic location, academic discipline, gender, etc.). To keep up with and improve upon these changes, many post-secondary institutions have begun to use new forms of technology in the admissions process, including geographic information systems (GIS).[2] The use of GIS in institutional research is particularly helpful for analyzing statistical differences between students from various geographic regions. According to research from the Admissions Office at Ohio State University, areas most likely to produce desirable students are similar to areas that yielded such students in the past.[3] As such, the admissions office uses this information to decide where to develop new geographic markets and where to maintain efforts in current markets.[4] This is a matter where geodemographic analysis can prove to be highly beneficial in the increasingly competitive environment of higher education.

At many colleges and universities, standardized tests such as the SAT and ACT are a significant determinant for admission. While several studies show that standardized test scores generally are a good indicator of academic success, discrepancies still occur based on student geodemographics.[5] For example, it is now widely acknowledged that the demographic composition of a student's high school soundly predicts their future SAT scores and freshman GPA. As such, many well-known colleges have de-emphasized the

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[2] Victor Mora, "Applications of GIS in Admissions and Targeting Recruiting Efforts." *New Directions for Institutional Research*, no. 120 (2003): 15.

[3] Ibid 15-16

[4] David Blough, "Integrating GIS into the Survey Research Process." *New Directions for Institutional Research*, no. 120 (2003): 44-51.

[5] Manuel Granados, "Mapping Data on Enrolled Students." *New Directions for Institutional Research*, no. 120 (2003): 34.

importance of standardized test scores in their admissions process over the past decade. In 2001, the University of California (UC) system introduced a new procedure called the "Four Percent Plan," which ensured admission to high school students ranked in the top of their graduating class, regardless of SAT or ACT scores. The following year, UC implemented a comprehensive review plan that further reduced the significance of SAT scores in their admission process. While some critics of this plan argue that diminishing the SAT's role in the admissions process will undoubtedly result in a "less qualified entering class," many tend to downplay the reality in which a lower socioeconomic status correlates directly with educational inequality and conversely with standardized test scores. While experts on the other side agree that "students from disadvantaged backgrounds are simply not as well prepared to succeed in college," they argue that "the SAT should be credited, not blamed, for measuring this shortfall."[6]

When it comes to admission and enrollment goals, a university's mission, service region, and strategic vision are the largest influencing factors for recruitment. At highly selective colleges and universities, e.g. Ivy Leagues and major research universities, recruitment programs focus primarily on attracting prospective students based on their high school academic performance in relation to the current student body. Geodemographic factors including geographic region, gender, race/ethnicity, religious affiliation, and economic status are secondary considerations. In other words, these schools seek students with a high probability of success. This is because the success of university students directly contributes to the overall reputation of their school. In order to remain competitive with other institutions, it is important for universities to retain the

[6] Jesse Rothstein, "College Performance Predictions and the SAT." *Journal of Econometrics* 121 (2004): 297-299.

maximum possible number of enrolled students. As such, understanding which factors correlate with and influence university retention can help institutions develop a larger and better-qualified student body.[7] However, this is not the case for the majority of U.S. colleges and universities, which serve a mission-directed population and cannot recruit "solely based on a student's probability of graduating."[8]

A recent "big data" study of Enrollment Management (EM) trends conducted by the National Student Clearinghouse (NSC) and ACT found "linkages between a student's college choice, a student's level of fit with the school's degree programs, and a student's resemblance to other students in the selected college major."[9] Results from the study indicated that students were more likely to complete their degree on time and with a higher overall GPA if they exhibited a higher level of "fit" with the college and major in which they were enrolled. Unfortunately, students often favor factors of convenience or cost over student-institution fit when making their enrollment decision. While most students ultimately enrolled at their first choice college regardless of ACT scores, students with higher composite scores did have a higher rate of enrollment at first choice institutions. As such, "schools will need very compelling recruitment programs to alter students' early college choice inclinations."[10] Furthermore, the study concluded that "most students are more likely to select a school based on its geographic distance from their home" as well as initial interest.[11]

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[7] Samuel Rohr, "How Well Does the SAT and GPA Predict the Retention of Science, Technology, Engineering, Mathematics, and Business Students." *Journal of College Student Retention: Research, Theory and Practice* 14, no. 2 (2012): 196.

[8] Jay Goff and Christopher Shaffer, "Big Data's Impact on College Admission Practices and Recruitment Strategies," in *Building A Smarter University: Big Data, Innovation, and Analytics*, ed. Jason Lane, (Albany: State University of New York Press, 2014), 100.

[9] Ibid, 99.

[10] Ibid, 102.

[11] Ibid, 100-101.

Location has a natural influence on people's attitudes and inclinations about a university. For instance, awareness of an institution tends to be higher amongst people in its immediate vicinity and lower amongst people farther away. Perceptions also differ from region to region, even if the level of awareness is the same. Furthermore, spatial relationships between the student and university change on an individual basis.[12] Referred to as the "golden circle" principle, the geographic area from which 80 percent of a college's primary student market resides can be a useful analytical tool in the field of enrollment management. Since the 1990s, a vast majority of students in the U.S. "have selected a college or university within their home state and have primarily considered colleges within a two-hour driving radius of their home." The previously mentioned ACT and NSC study corroborates these findings, concluding that students have limited mobility and most universities' "golden circle" is much smaller than previously assumed. For all ACT-tested college freshmen in 2011, for example, 80 percent remained in their home state and the median distance between home and their selected college was just 51 miles.[13]

DATA AND METHODS

With desktop business intelligence and analytical platforms such as Tableau and ArcGIS, universities "can initiate Big Data enrollment management processes with the mechanisms necessary to build richer student and institutional competency profiles." Such profiles could enhance student-institution match through the study of key

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[12] David Blough, "Integrating GIS into the Survey Research Process." *New Directions for Institutional Research*, no. 120 (2003): 44-51.

[13] Jay Goff and Christopher Shaffer, "Big Data's Impact on College Admission Practices and Recruitment Strategies," in *Building A Smarter University: Big Data, Innovation, and Analytics*, ed. Jason Lane, (Albany: State University of New York Press, 2014), 101.

geodemographic data.[14] For this study, the Office of Institutional Research at TCU provided two primary datasets, which were extracted from the office's master database and delivered in the form of Excel spreadsheets. Both datasets consist of student information from the past decade, specifically the fall of 2005 to the fall of 2014. The first dataset can be considered a "pre-enrollment" record, as it contains geographic, demographic, and academic data for each student prior to their time spent at TCU. Specifically, the variables included in this extract were student ID, home address, enrollment term, gender, ethnicity, SAT scores (with breakdowns of the critical reading, math, and writing portions), ACT scores, and the admit test type – which states whether the admissions office used the student's SAT or ACT scores to make their decision. The second dataset is unique in that it contains multiple entries for each student, specifically age, classification, major, college, semester hours, semester GPA, cumulative hours, and cumulative GPA for each semester they were enrolled at TCU. Due to this configuration, it is possible to track a student's progress throughout their undergraduate career.

Using the home addresses from the first dataset, I geocoded a point for every student from the United States who has attended TCU since 2005. I chose not to include international students because this study focuses on regional differences across the U.S., which does not work in a global context. The Environmental Systems Research Institute, or ESRI's World Geocoding Service provided an accurate output for the geocoding process, ultimately resulting in 17,125 student data points to which demographic and academic information was joined. From these points, I used the XY to Line tool to create desire lines in order to calculate the average Euclidean distance traveled between two

[14] Jay Goff and Christopher Shaffer, "Big Data's Impact on College Admission Practices and Recruitment Strategies," in *Building A Smarter University: Big Data, Innovation, and Analytics*, ed. Jason Lane, (Albany: State University of New York Press, 2014), 105.

points with latitudinal and longitudinal coordinates – in this case the student's home and TCU. With these points and distance measurements, it is possible to look at temporal shifts and changing trends in the student landscape. This information is truly foundational, meaning it can be built upon in order to examine differences between variables like ethnicity or gender. Such analyses can then be utilized across campus, from the Office of Strategic Marketing to University Council.

After geocoding the addresses and calculating their distance from TCU, I began the process of exploratory data analysis. As described by John Tukey in his seminal work on the topic, "exploratory data analysis is detective work," both numerical and graphical.[15] The bulk of the detective work for this study was carried out using the IPython Notebook, a "web-based interactive computational environment where you can combine code execution, text, mathematics, plots and rich media into a single document."[16] Because of these features, the IPython Notebook is an excellent environment for examining and manipulating data, creating visuals, and logging the entire workflow process. As its name suggests, the IPython Notebook uses the Python programming language, which is rapidly becoming the introductory programming language of choice at universities across the country due to its relatively simple syntax, yet robust computational abilities.

Most of the initial data work for this study relied on the pandas library for Python, which provides easy-to-use structures for data preparation, analysis, and modeling. With pandas, you can read in a .csv file from Excel, change data types, rename columns, and group data by fields. For instance, I used groupby methods with the second dataset in

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[15] John Tukey, *Exploratory Data Analysis*, (Reading, Mass.: Addison-Wesley, 1977), 1.

[16] Fernando Perez and Brian Granger, "IPython: A System for Interactive Scientific Computing," *Computing in Science & Engineering* 9, no. 3 (2007): 22.

order to identify and retain only the final semester record for each student so it would be suitable for the analysis I planned to do. This involved grouping the data frame by student ID, then specifying an inline function using the lambda operator to index the data frame so it identified and returned the max number in the semester column for each student. Due to the four-digit naming conventions used by TCU, each subsequent semester has a higher numerical value than ones previous. Each semester begins with a 4, which denotes the 21st century or year "2000." The next two numbers signify the specific year, such as 09 – 2009 or 13 – 2013. Finally, the last digit designates the semester – 3 for spring, 5 for summer, and 7 for fall. As such, the last semester a student is enrolled at TCU will always have the largest numerical value. Other libraries proved to be helpful for the data wrangling and visualization process in the IPython Notebook, including numpy, seaborn, qgrid, and matplotlib. These libraries also make it easy to export tables so they can be used in other programs like Microsoft Excel, Tableau, or ArcMap.

After completing the data cleanup and exploration process, I exported each dataset from the IPython Notebook and joined them to the points feature class in ArcMap using the unique student ID field. From there I created summary statistics for a number of variables (e.g. year, distance, college, region, etc.) and started visualizing the results using Excel and Tableau. With the simple mission to "help people see and understand data," Tableau enables users to quickly and easily analyze data and create interactive visualizations primarily for the purpose of business intelligence.[17] Such visualizations foster deeper understanding of data and ultimately paint a clearer picture of the changing landscape of students at TCU.

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[17] "About Us," *Tableau Software*, accessed March 5, 2015, www.tableau.com.

RESULTS

Between 2005 and 2014, TCU's golden circle more than quadrupled in area from 590,638 sq. miles to 2,476, 640 sq. miles. As seen in Figure 1, the university's primary student population has grown from a predominantly regional market centered on Texas to a national market spanning across the country. While the entering freshman class size has increased steadily over the past ten years, this map shows that the overall geographic diversity of students has also improved over time. Outside of Texas, however, the types of places students are coming from are relatively similar. Generally, most TCU students live in suburban communities surrounding major metropolitan areas. Although several in-state students still come from smaller towns and rural regions, a majority fit with the national trend from big city suburbs. Figure 2 illustrates these geographic changes over time. Broken down by freshman class from 2005 to 2014, points of student home locations have been aggregated into 50 kilometer hexagons in a process called hex-binning. The hexagons with the darkest color have the highest density of students. Although shifts between consecutive years are not especially notable, the student landscape looks markedly different over the ten-year period. For instance, the density of students from Texas has decreased, while the density of students from the east and west coasts is much greater.

Since 2005, the average distance between a student's home and TCU has doubled from approximately 260 miles to 520 miles (as of 2014). Figure 3 breaks down the average distance traveled from home to TCU by college for the years 2005, 2009, and 2013. While each college experienced a positive increase in average distance between the years, significant differences exist between them. For instance, the average distance

traveled by students in the AddRan College of Liberal Arts increased by just 12 miles from 2005 to 2009. During that same period, the College of Fine Arts experienced an average distance increase of 92 miles – the greatest change of any college for those years. However, as of 2013 the College of Fine Arts has the lowest average distance traveled at 388 miles, up just 68 miles since 2009. Between 2009 and 2013, every other college experienced an average increase of more than 200 miles. Several factors may be responsible for this drastic difference between the College of Fine Arts and the other six colleges. First, during this period the United States economy was still suffering from the 2008 recession. As such, many college students may have been more reluctant to pursue a major in the fine arts given that they are associated with lower earning potential and higher rates of unemployment. Of those students who still chose a fine arts major at that time, some may have enrolled in a public institution or one closer to home for added cost savings, thus causing TCU's College of Fine Arts to lose potential students.

On the opposite end of the spectrum is the Schieffer College of Communication with an average travel distance of 625 miles in 2013. This is a huge jump from the 2009 average of 333 miles and was the largest increase of the seven colleges. Interestingly, the total number of communication students has steadily decreased over the past ten years. Therefore, the increase in average distance travelled must indicate that students in the Schieffer College of Communication are coming from regions further away. Any number of reasons could be responsible for the College of Communication attracting students who live greater distances from TCU. Perhaps the college offers scholarships to out-of-state students, or has degree programs not widely offered elsewhere. In November of 2013, the university Board of Trustees voted to rename the College of Communication in

honor of notable TCU alumnus Bob Schieffer. Now represented by a prominent public figure, it will be exciting to see whether the college can begin to draw more students and grow its population.

While the distance averages from Figure 3 are interesting and informative on their own, a deeper understanding of the changing landscape of TCU can be attained when they are paired with relational student population size as shown in Figure 4. This stacked bar graph displays the student population (as a percent) for each college from 2005 to 2013, offering insight into the fluctuations or stability of different academic areas at TCU. Currently, the Neeley School of Business is home to the highest proportion of students, at just over 27 percent in 2013. In recent years, Neeley has gained recognition as one of the top business schools in the nation, undoubtedly resulting in its steady increase of students. Behind Neeley, the College of Science & Engineering and AddRan College of Liberal Arts are the second and third most populous schools at TCU, respectively. Since 2005, both of these colleges have maintained a relatively steady population size accounting for approximately 17-18 percent of the students at TCU. Both colleges offer a wide variety of majors, housed in a number of notable departments and led by distinguished faculty and staff. Together, Neeley, AddRan, and Science & Engineering accounted for roughly two-thirds of the student population in 2013. The remaining students are distributed amongst the Harris College of Nursing & Health Sciences, the College of Fine Arts, the Schieffer College of Communication, and the College of Education. While TCU's Nursing and Health Science programs have grown over the years, Fine Arts, Communication, and Education have all experienced declines in student population.

Regardless of what program students enter once they enroll at TCU, the results show that where they come from and how far away they live influence their level of preparedness for college, as measured by standardized test scores. As seen in Figure 5, students from different regions of the United States averaged vastly different scores on the critical reading and math portions of the SAT test. For instance, students from the Noncontiguous region of the U.S. (i.e. Hawaii, Alaska, and Puerto Rico) scored 20-30 points below the TCU average for each section. On average, students from the Appalachian Highlands region scored the highest on the critical reading test, while students from the Midwest and Heartland received the top math scores. Remarkably, the Appalachian Highlands is the only region where the average critical reading score was higher than math. While only three points separate the two test portions, the distinction is still significant. Perhaps the school systems in Kentucky, North Carolina, Tennessee, Virginia, and West Virginia place more emphasis on English/Language Arts education, or lack robust math and science programs. It is also possible that students from certain states or even cities within the region perform remarkably higher or lower than the standard, thus skewing the overall average. The largest gap between critical reading and math scores occurs in the Pacific Coast region, which consists of California, Oregon, and Washington. However, the scores for this region correspond closely to the average scores for all of TCU, in which students score approximately 20 points lower on critical reading than math. A reason for this gap could be the growing prominence of the business and science programs at TCU. Although TCU remains an institution centered on liberal arts, an increasing number of students are coming here and majoring in areas involving math and science – perhaps as a result of getting higher scores on the math portion of the SAT.

Although the SAT is the most common standardized test taken by high school students to demonstrate their readiness for college, certain regions and schools favor the ACT test instead. According to findings from a national study conducted in 2012 by the National Student Clearinghouse and ACT, students who earn higher composite ACT scores tend to go to college a greater distance away from home. Figure 6 shows a graph of the results from this study, paired with similar results from TCU. The national average data includes students who attend community college, so the numbers are understandably lower than the TCU averages. However, with TCU students there is an exponentially greater upturn in miles traveled between the six ACT score brackets, especially across the lower range. A curious difference between the national and TCU averages is that the top-scoring students actually have a slightly lower average distance than those in the second-highest bracket. This result is intriguing given that the national average distance increases significantly between the top two brackets. One explanation for this difference is that TCU simply does not have many students who score in the highest bracket. While the university's standing has improved drastically in recent years, there are still a number of institutions, both within Texas and across the U.S., ranked higher than TCU. Since students with higher standardized test scores receive more college acceptances, and often more scholarships, we can safely assume that they would be more likely to choose a higher-ranking university than TCU. Still, both the national and university trends support the understanding that high-performing students have more college choice options, and therefore travel greater distances to wherever they ultimately enroll.

As previously stated, the purpose of high school students taking standardized tests like the SAT and ACT is to indicate their preparedness for college and predict how well

they will perform in undergraduate courses. In general, TCU students with higher test scores tend to have higher GPAs, thus supporting the belief that standardized tests are good indicators for college success. However, if the student population is broken down by variables such as ethnicity or college, the correlations become less obvious. Figure 7 shows the relationship between average SAT scores and GPA for TCU students broken down by college. On average, students from the College of Science & Engineering score the highest on the SAT (1600), yet have one of the lowest average GPAs. Conversely, students from the College of Education have the highest average GPA at TCU, yet score low on the SATs. This inverse relationship contradicts the idea that we can gauge student success at college based on test scores. While results such as average SAT and GPA scores are useful, it is important to consider other factors when examining the relationship between them. For instance, TCU's College of Education grades largely on a mastery basis, meaning they encourage students to resubmit assignments until they prove their proficiency and total comprehension of a topic. For this reason, education students often make higher grades and therefore have higher average GPAs. On the other hand, the College of Science & Engineering rigorously tests students on their skills and abilities in a strict lab environment, where grades are less fluid or variable.

Another interesting and informative way to analyze the changing landscape of students at TCU is through the lens of gender. It is common knowledge at TCU that the student body skews heavily female, due in large part to the robust and active fraternity and sorority life present on campus. Yet, as Figure 8 shows, the gender breakdown of TCU students varies by region. The southwest region has the highest percent female student population (nearly 65 percent), while New England has the lowest at

approximately 47 percent. Since men are often seen as more independent and self-reliant, perhaps it is not as big of an issue for them to choose a college a greater distance away from home. This reasoning could explain why fewer women than men come from New England and the Pacific Coast, which are some of the furthest regions from TCU. It would also explain why a higher proportion of women come to TCU from closer regions, including the Southwest, Mountain West, and Heartland.

Once at TCU, female and male students also vary between college and choice of major. The College of Science & Engineering, for instance, fits the general trend at TCU in which there are a higher percentage of female students than males. However, certain majors within the college have a drastically different gender breakdown. Figure 9 shows every science and engineering major split based on student gender. Though some majors have something close to an even 50/50 split (e.g. environmental science or chemistry), others have a considerably higher proportion of one gender or the other. For example, child development and nutrition are both female dominant fields, whereas the opposite is true for computer science and engineering. These distinctions reflect endemic societal norms in which men are encouraged to think logically and problem solve, while women learn to be nurturing and emotionally in-tune. The fact that such drastic imbalances still exist at TCU, especially given the overall gender demographic, is a challenge for administrators in terms of recruitment as they try to even out the overall student population without being discriminatory or biased. At the same time, professors may experience issues as they attempt to teach and relate to classes that skew heavily male or female.

CONCLUSION

Based on all of this data, it is clear to see how much the student landscape at TCU has changed over the last ten years. Both physically and compositionally, this campus is not the same as it was in 2005. There are more students overall, and more who are coming from greater distances across the country. Furthermore, the minority population has increased, along with student-readiness as measured by standardized tests. Certain colleges and programs at TCU are gaining national recognition, and as such the university is no longer only in competition with other small regional private schools like SMU and Baylor. All of these changes are important for university administration to know and understand, in order to better-direct efforts in areas such as recruitment, admissions, development, and student life. For instance, realizing the differences between a student's home environment and that of TCU, especially if they come from far away, could help recruiters stay relevant and tailor their information to entice prospective students.

Moving forward, one aspect of TCU student geodemographics that demands further inquiry is the topic of ethnicity. Although such analysis was not feasible in the scope of this study, examining ethnic breakdowns within the student body would provide extremely useful and interesting information, particularly in relation to variables such as mean GPA and choice of major. Another way to expand upon this geodemographic study would be to look at the relationship between student performance and financial aid received from TCU. It is no secret that TCU is an expensive place to attend, so scholarships and financial aid can factor significantly into a student's enrollment decision and ultimately how they perform once here. For instance, some students might feel

pressure to earn a higher GPA in order to maintain their merit-based scholarship. If said student lives a greater distance from TCU, they could potentially lack a strong support system at school and struggle even more academically. These are the types of issues a university in TCU's position must consider in order to stay relevant and support its changing student population.

While a data-driven approach can help wrangle the copious amounts of information available to universities and yield great insights about students, the human element still remains extremely important. For instance, student "fit" is not as easily measured as something like distance from home. Therefore, this data-intensive study could be greatly enhanced by qualitative student survey information. While geodemographics are great for identifying what students are like before they get to TCU, understanding how they develop and change during their time spent here, as well as how satisfied they are with their overall TCU experience, would be invaluable for the university. Although a number of university entities, from the health center to the alumni association, conduct student surveys, very few, if any, pair their results with student geodemographic data. As such, an important segment of student information may be missing. However, if TCU can successfully utilize both of these methods in the years to come, we can expect to see even greater changes and improvements in the student landscape.

FIGURES

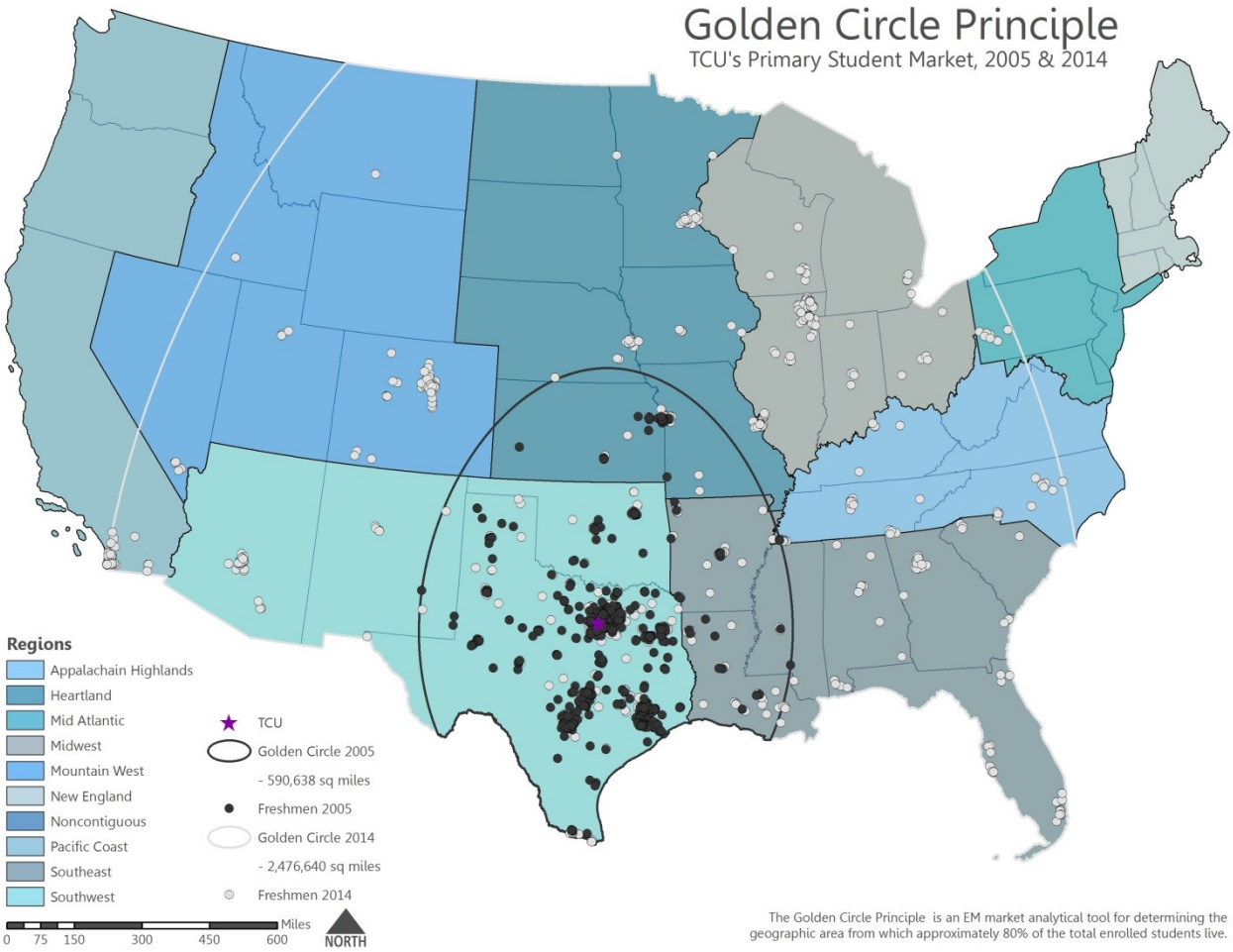

Figure 1: TCU Golden Circle 2005 and 2014.

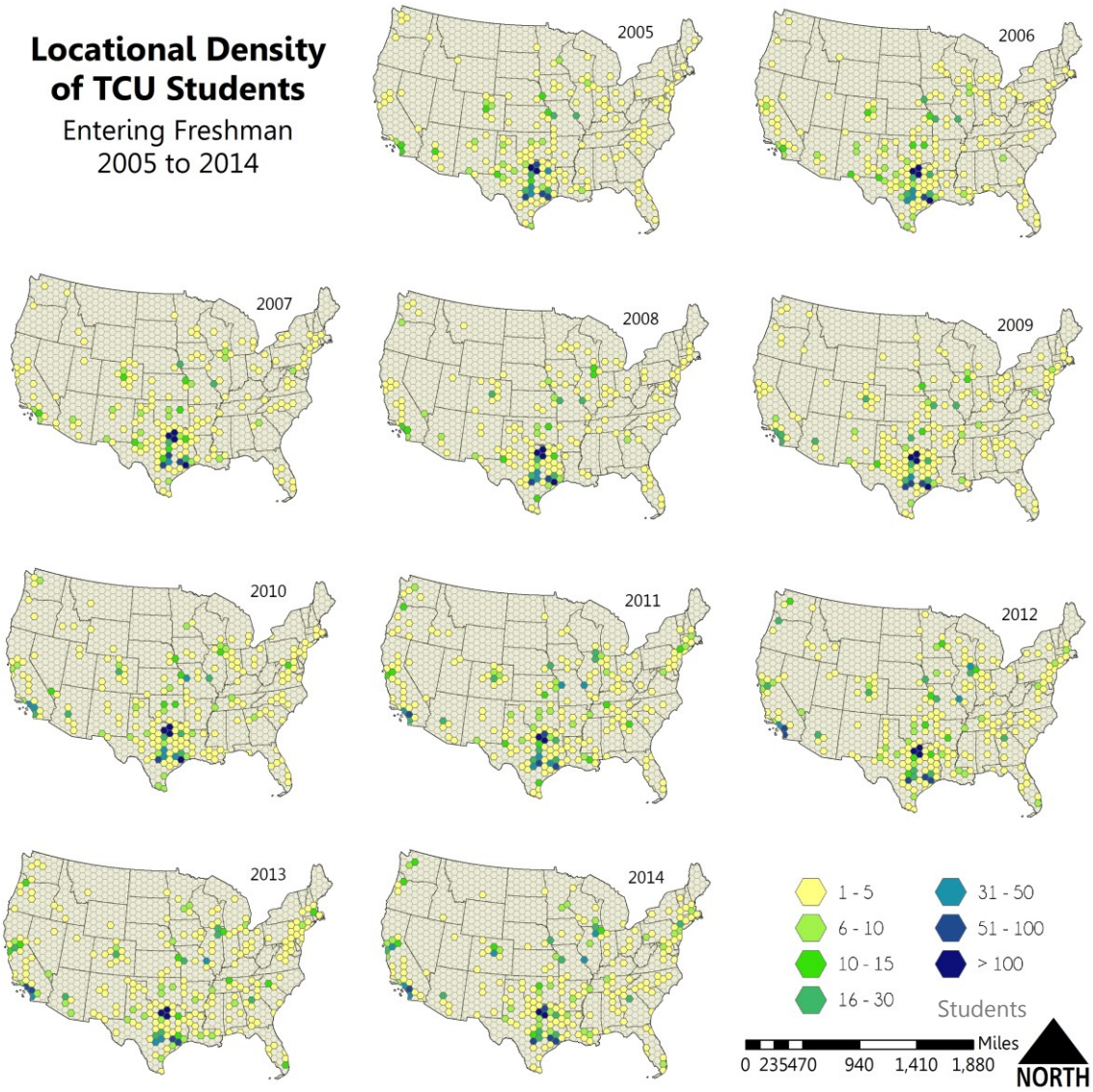

Figure 2: Small Multiples Map of Student Home Location Density from 2005 to 2014.

Figure 3: Dot Plot of Distance by College for 2005, 2009, and 2013.

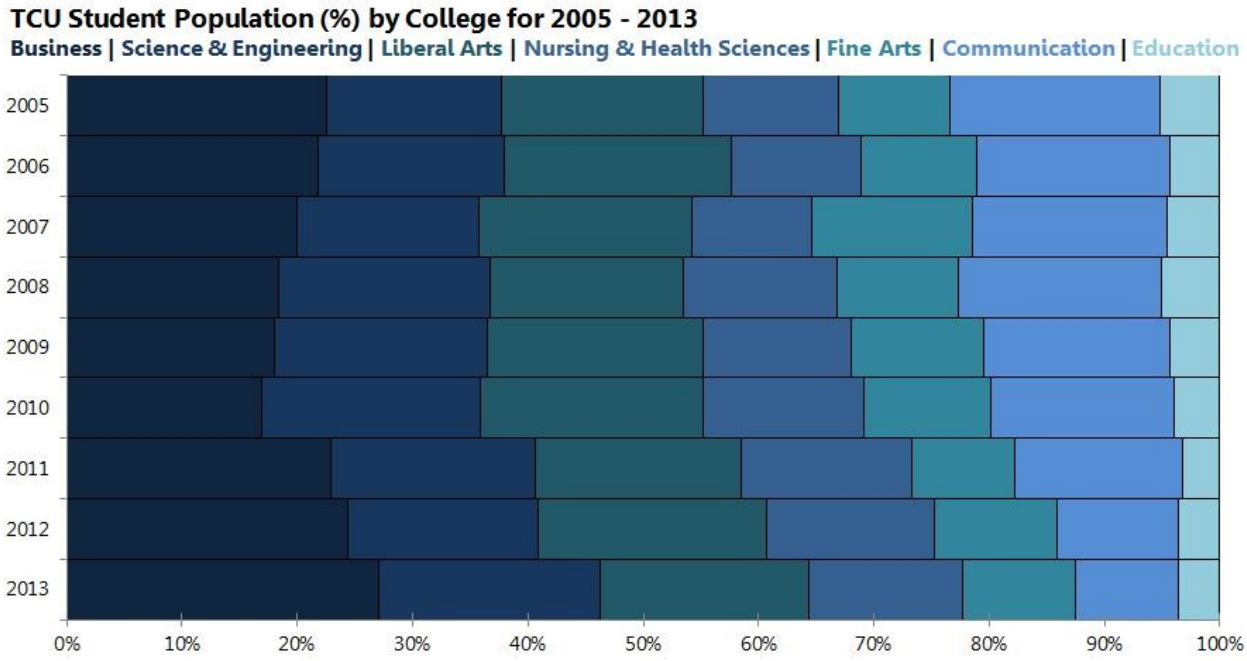

Figure 4: Stacked bar graph of student population by college from 2005 to 2013.

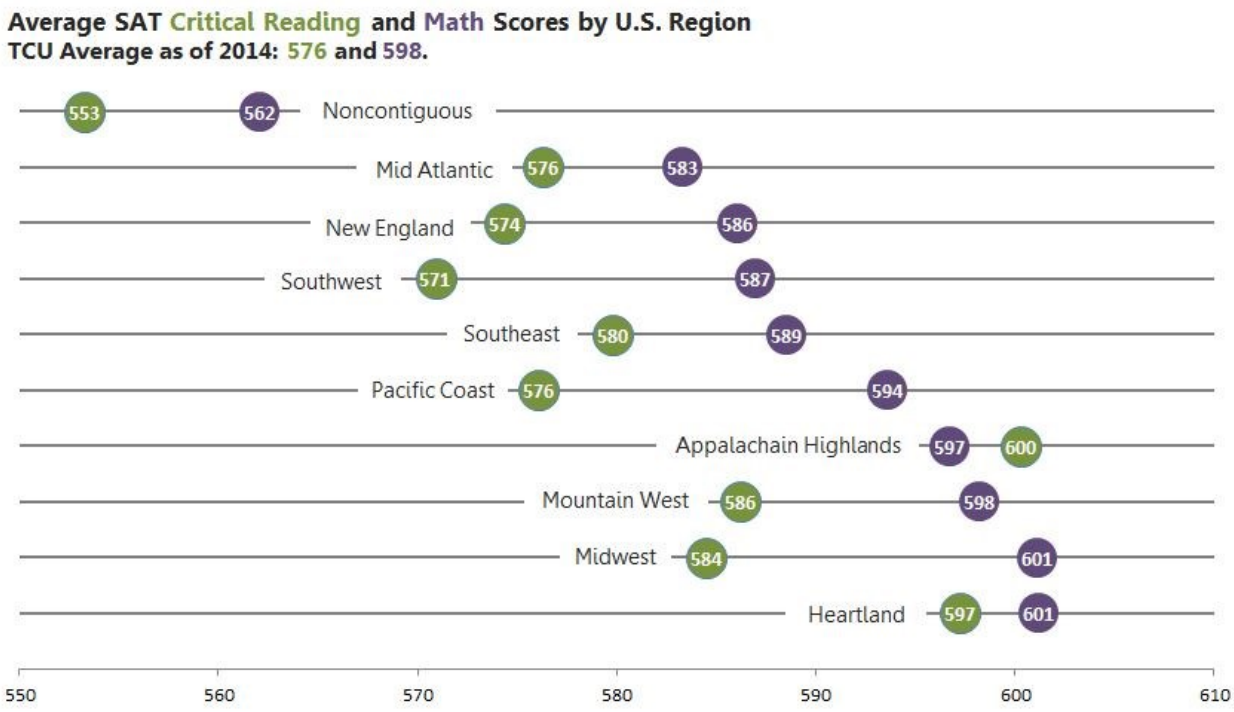

Figure 5: Dot plot showing the average SAT critical reading and math scores by region.

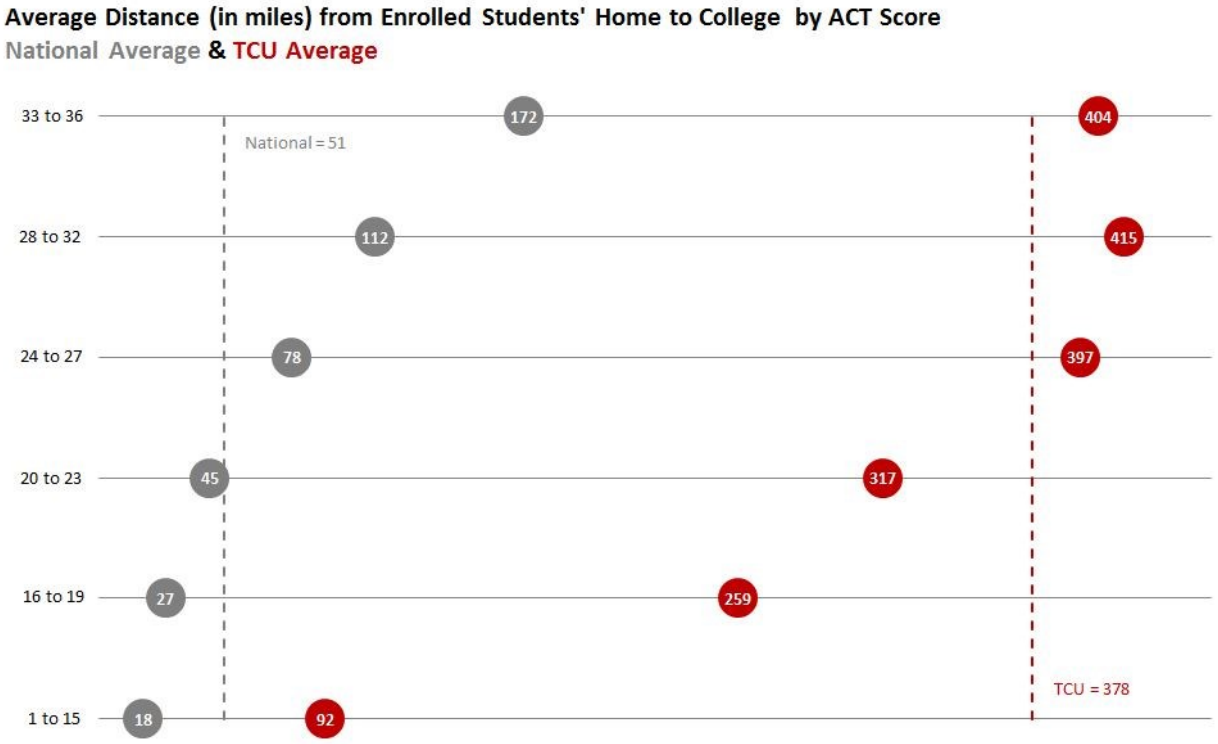

Figure 6: Dot plot showing the national and TCU averages for distance by ACT score brackets.

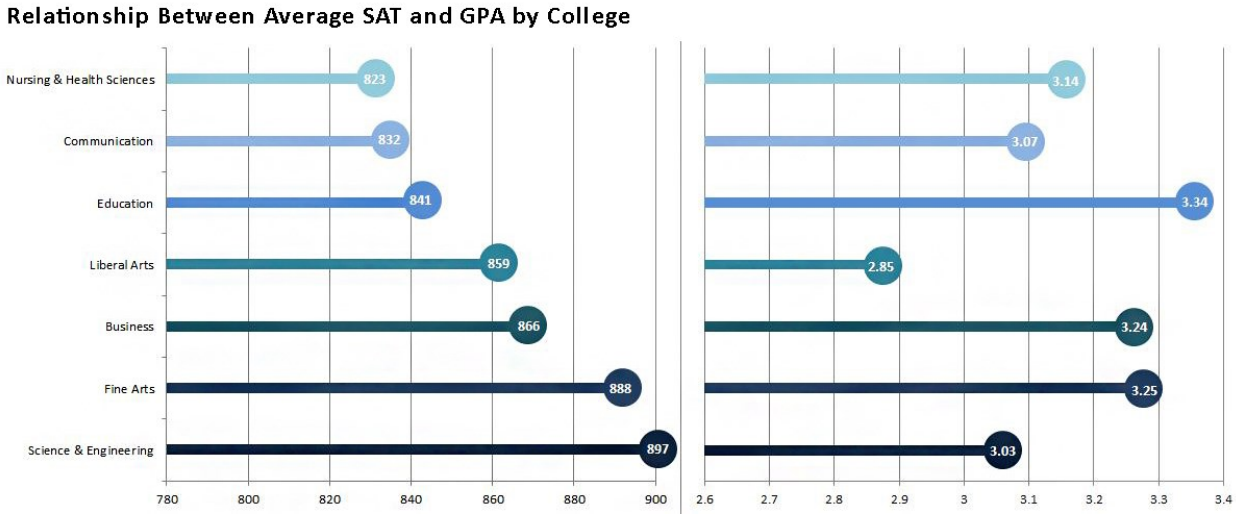

Figure 7: Average SAT scores and GPA by College.

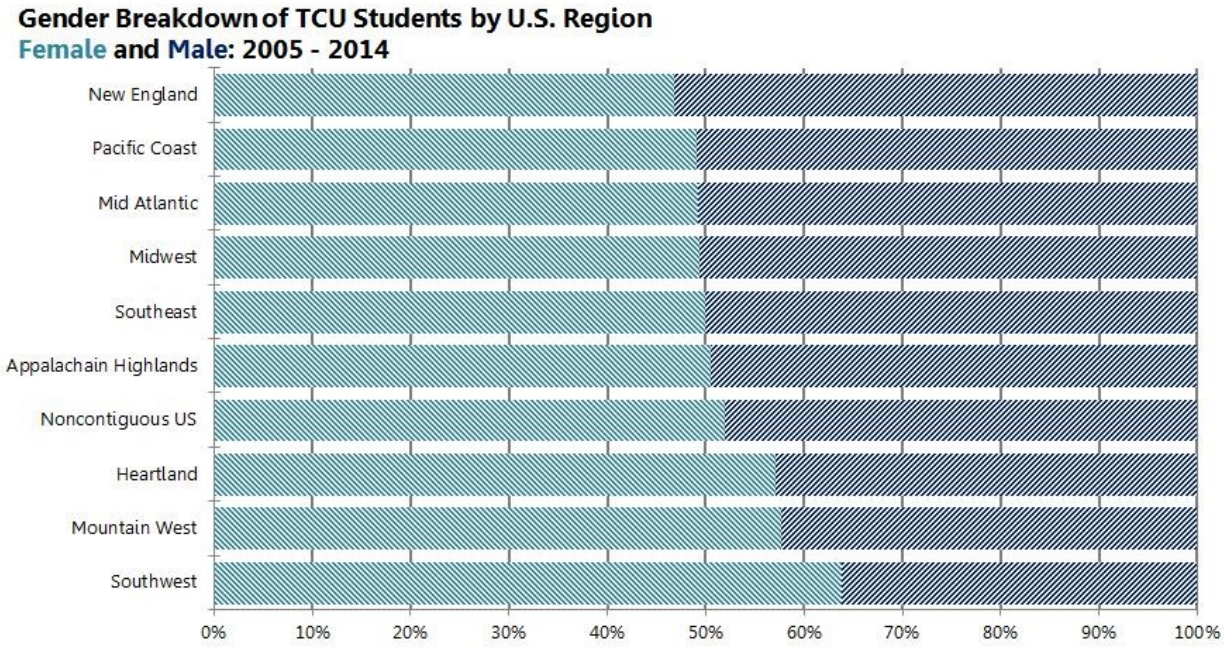

Figure 8: Stacked bar graph showing the gender breakdown of TCU students by region.

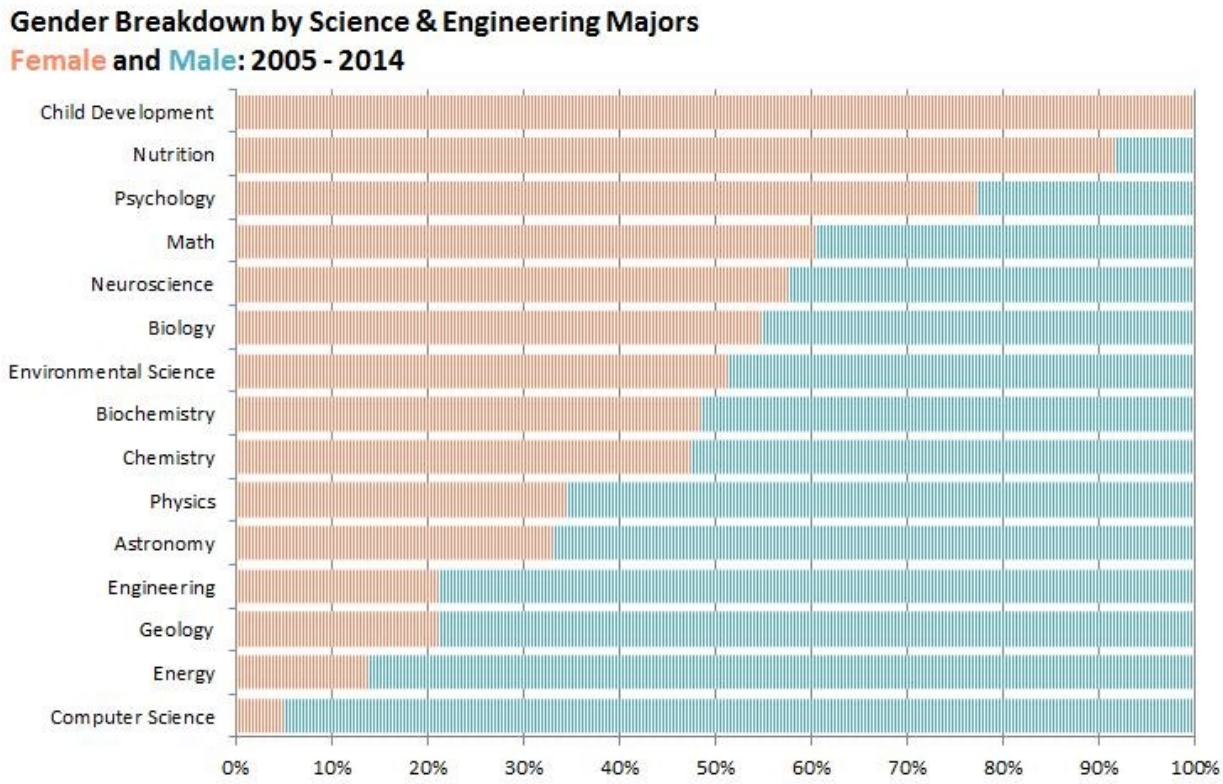

Figure 9: Stacked bar graph showing the gender breakdown by major for Science & Engineering.

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