Eight Days a Week:
The Economic Hurdles and Advantages for Nontraditional Students in the Bay Area

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Goals

Our group had two main areas of interest, given recent topics we'd been following in the news: the newly passed raise to the minimum wage in California, and the recent approval of tuition hikes at UC Berkeley. Bringing these two issues together, we had seen a series of articles about income inequality and whether or not a college education was the key to restoring a healthy middle class in the United States. In previous decades, college students had been able to graduate debt-free by working minimum wage jobs. However, with the price of tuition rising well above the rate of inflation and minimum wage adjusting more slowly than the rate of inflation, there is a significant gap between how much one could earn while in school and how much a college education costs.

We saw an article in May 2015 issue of *The Atlantic* about Starbucks' effort to help its employees get a bachelor's degree. The majority of minimum wage workers are older than 20, so the ability of minimum wage workers to get a degree is a larger issue. Our goal was to understand how possible it is for a nontraditional student working minimum wage to pay for a college degree in the Bay Area, which is particularly pricey. How affordable is it to go to college while working a minimum wage job? And, given the debt a student-worker would accrue, is the degree worth it?

We decided to address these two questions by creating a narrative structure and walking through a series of visualizations. We broke this into three parts.

1. The first section looks at the extremes: how feasible would it be for a minimum wage worker to pay for college without aid, and graduate debt-free?
2. After making a point about the severity of the gap between school costs and annual income working full-time on minimum wage, the second section moves closer to a real-life snapshot. It examines how much a worker could afford by working a part-time schedule, and what type of aid is offered.
3. The final section looks at whether a college degree is "worth it," given the short-term and long-term outlook it offers.

Given what we found in exploring the data, the overall message we wanted to convey was that there are significant financial barriers to minimum wage workers in the Bay Area becoming nontraditional students and returning to school, but that the long-term economic payoff is worthwhile.

Related Work

You must discuss at least 3 pieces of related work for each student on the project. You must say how your project relates to these readings or projects, and provide an image or sufficient description of the related work for the reader to understand how it is related.

The Upwardly Mobile Barista **- The Atlantic, May 2015 Issue**

The Atlantic's May 2015 cover article, "The Upwardly Mobile Barista," was about Starbucks' new program to help its employees get a college degree with financial support and a crew of people to help with things like academic counseling and financial aid. As they point out in the article, "Between 1970 and 2012, the proportion of American 24-year-olds who came from affluent families and had a bachelor's degree rose from 40 percent to 73 percent—quite an enlightenment period for privileged kids. But over the same period, the proportion of American 24-year-olds who came from low-income families and had a bachelor's degree rose from 6 percent to just 8 percent." The article further stated that the "class-based higher-education divide" explains more about the US's income gap than any other single factor.

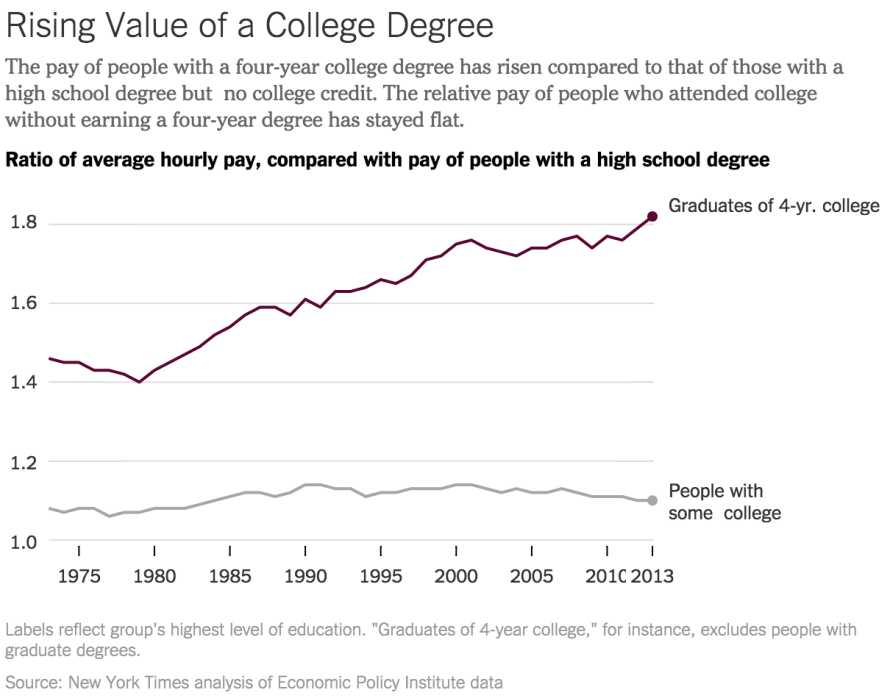
The article primarily focuses on the non-economic issues that prevent lower-income students from finishing college. These include the difficulty of figuring out financial aid and not knowing which classes in which to enroll. However, the Starbucks program is an acknowledgment of how many people are becoming career minimum-wage workers. It is also an acknowledgment of the necessity of and difficulty of attaining a college education for most to be able to bridge the income gap. These were important guiding points for our project. Although we were primarily focused on the financial implications of trying to go back to school as a minimum-wage worker, it gave us a good overview of many of the issues.

Is College Worth It? Clearly, New Data Say **- The New York Times, May 27 2014**

This article was incredibly influential in the later phase of our project. It was one of the most compelling looks at the question of whether a college education is "worth it" from a financial perspective. We hear a lot about astronomic student debt, but how does that compare to the long-term economic outlook for college graduates? It also had references to data that we used in our final form the Economic Policy Institute.

The article offers a simple but effective look at the gap between average hourly pay over time for those with a college degree and without. As they say in the article, "The average hourly wage for college graduates has risen only 1 percent over the last decade, to about $32.60.

The pay gap has grown mostly because the average wage for everyone else has fallen — 5 percent, to about $16.50." They discuss other aspects as well, such as the unemployment rate for those with a college degree (just 3% for those between the ages of 25 and 34).



The article also brought in a juicy sentence from economist David Autor that we used in our project: not going to college will cost you about $500,000 in lost lifetime earnings.

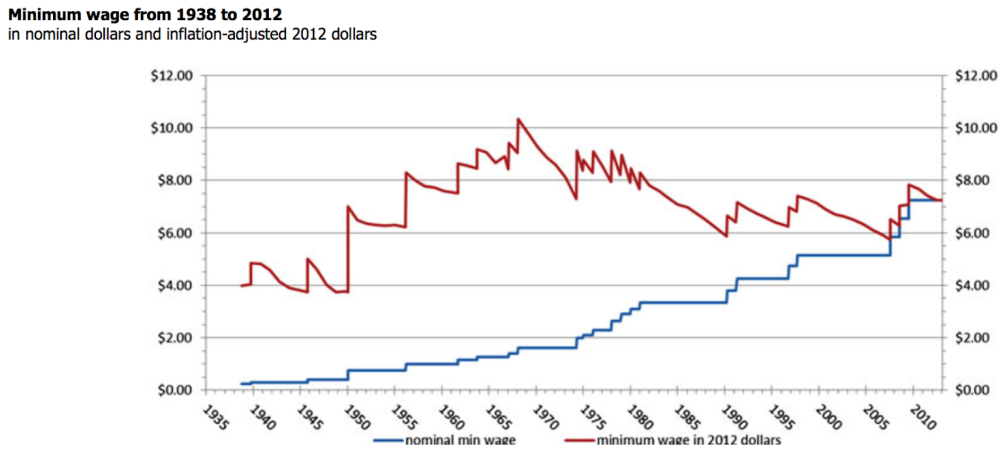
***Can You Live on Minimum Wage?* - *New York Times,* February 9 2014**

In February of last year, the *New York Times* published a calculator to highlight the gap between minimum wage and living wage in each state for a childless worker. First, the reader chooses a state. Then, the calculator allows readers to plug in their personal living expenses for things like housing, transportation, food, and health care. As the user fills in values, the visualization on the right starts updating a bold number on the right with annual budget is left, and shows with a "one pixel per dollar" visualization how much money you have left in your budget. Once you cross over into being in debt, the visualization moves from being green to red, and the pixels fly from the bottom of the page to the top. Finally, users can click on a link at the bottom to see how things would look like with the proposed $10.10 raise to federal minimum wage. (Spoiler, it's still pretty bleak.)

We liked several things about this visualization. The first is how it makes things personal and offers an emotional connection. A reader plugs in his own expenses and feels how dramatically different his annual expenses are from what a minimum wage worker in his state could afford. The final update with the proposed minimum wage also drives home how inadequate minimum wage is to meet expenses even with the bump.

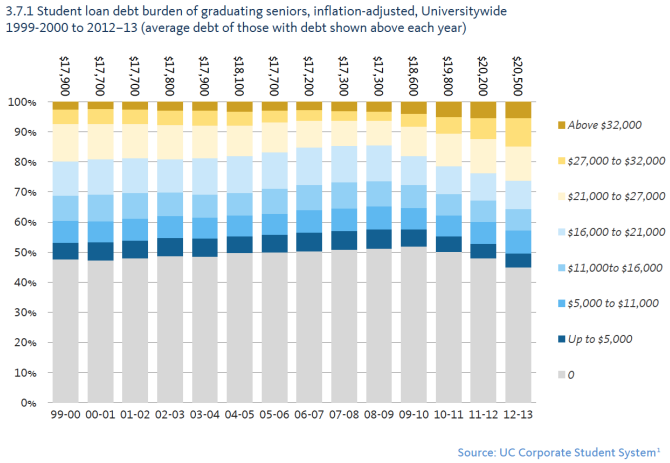
***About Minimum Wage* - US Department of Labor**

This chart, which was an inspiration for choosing our topic in the early stages of the project, illustrates the gap between the nominal minimum wage and its actual buying power as affected by inflation, which has generally declined since the mid-20th century. It vividly illustrates the challenge of supporting oneself on minimum wage, particularly when it loses value as Congress does not raise it for long periods.



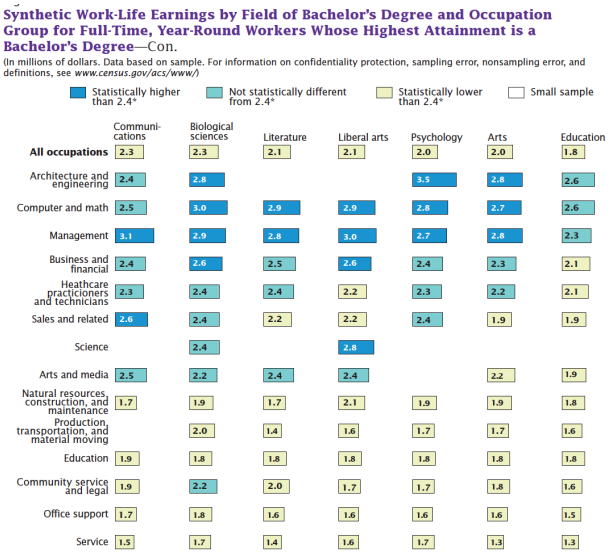
***Background on Cumulative Loan Debt for Bachelor Recipients* - UC Office of the Provost, June 22 2014**

This item was published by the University of California to show that horror stories of underemployed graduates with crushing debt burdens were the exception, rather than the rule, and helped create the context for our final narrative. In addition to useful figures on student debt, it includes a stacked bar chart showing the proportion of students that graduate with different amount of debt, demonstrating that those with extremely high debt were in the minority, while nearly half of UC students graduate with no debt.



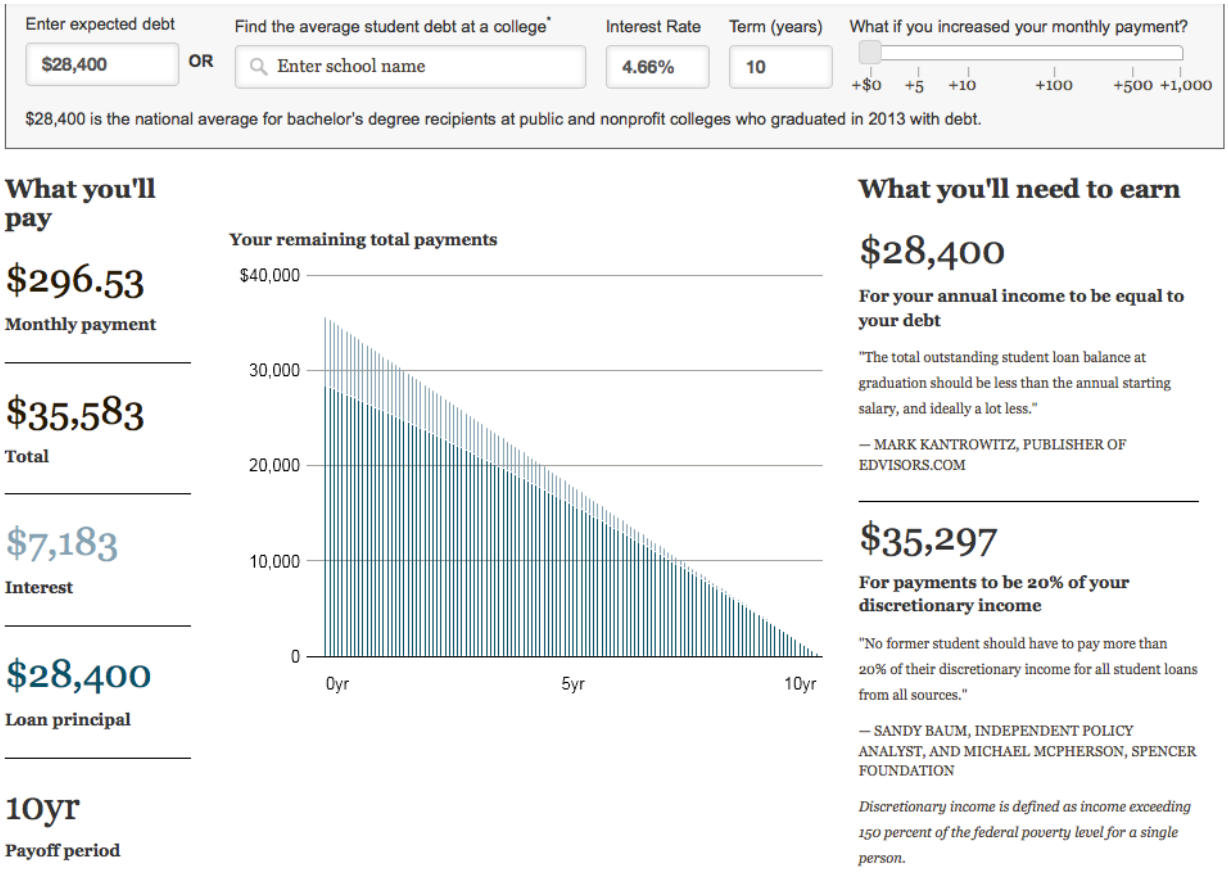
Work-Life Earnings by Field of Degree and Occupation- US Census Bureau, October 2012

This Census Bureau publication shows how much bachelor's degree holders can expect to earn over their working lives, and which combinations of majors and occupations pay more or less than the average $2.4 million. This provided the data and the basis for our linked chart showing the potential earning power of graduates from various Bay Area schools.



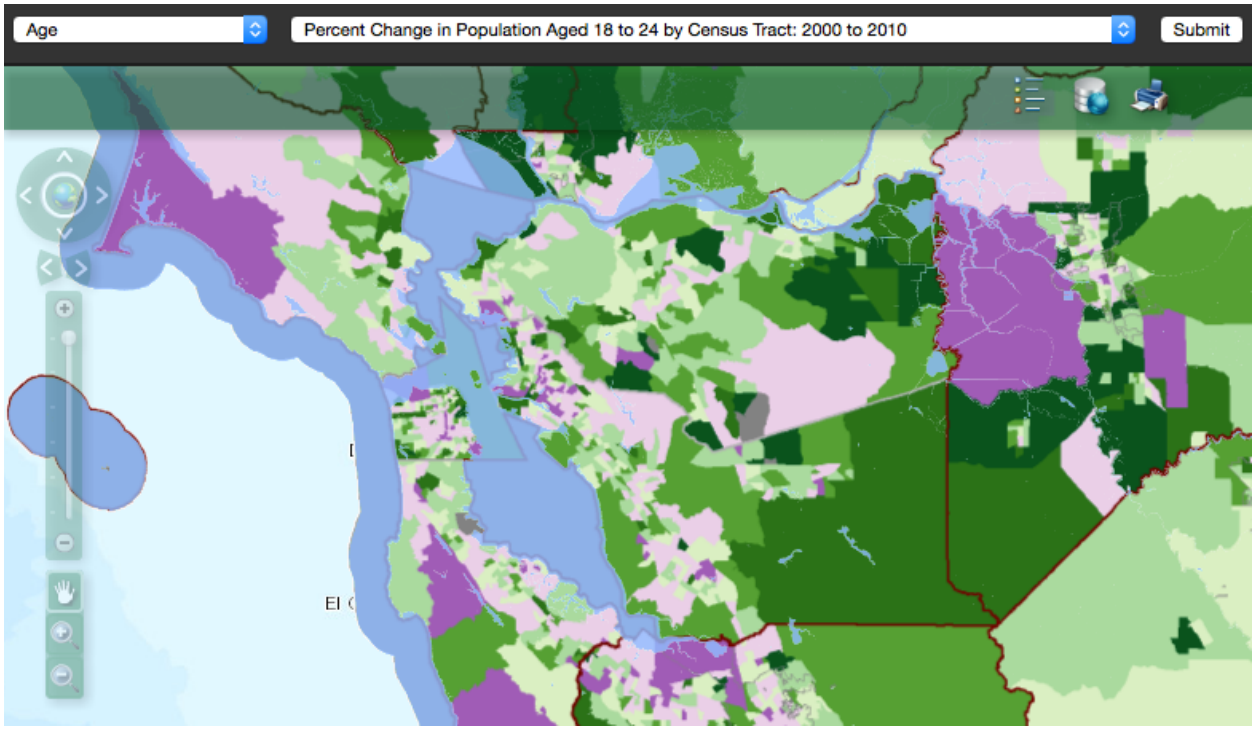
Student Loan Calculator - New York Times, May 16, 2014

The NYTimes student calculator helps visualize remaining loan payments over time, breaking it down by principal and interest. They look at how much a single person needs to make to have payments that are the recommended 20% of their discretionary income. But what does that look like for people in different circumstances, for example single parents and/or low income workers? We wanted to give more context to the loan calculator so users can see how loan payments affect people in different positions. We used the the equation from this article to calculate monthly payments.



US Census Choropleth- United States Census Bureau

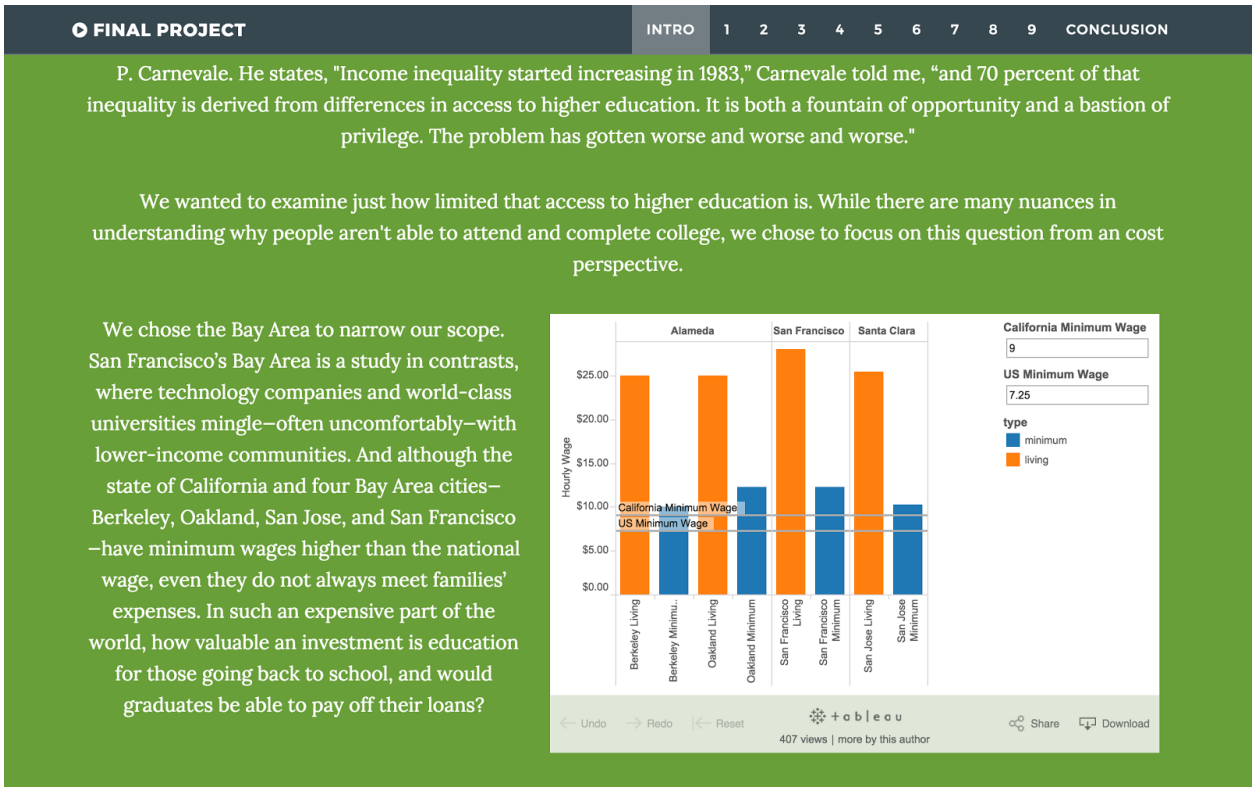
The United States Census bureau choropleth lets users explore data such as median age, race, and population. We saw that this was a useful tool for looking at differences across geography when it isn't crucial to show exact values (indeed, showing exact dollar amounts for living expenses might be misleading, since the living expenses are an estimate and differ across families. As such, the choropleth was a good representation of this 'ballpark').



Where can you Afford to Live in the Bay Area?- The Bold Italic

This infographic shows the living expenses of several cities and areas in the Bay Area. Notoriously high priced areas, like San Francisco, has seen long established communities leave because they cannot afford to stay. We saw that this was another dimension in the big picture of affordability, and wanted to take a closer look at the differences between areas in the Bay Area in our visualization.

Description of the Visualization



Introduction. We began with an explanation of our motivations, including recent news on the topics of income inequality and access to education. Our first visualization plotted the living wage and minimum wage for Alameda County, San Francisco, and Santa Clara counties. We plotted the California minimum wage and US minimum wage as reference lines. The graph illustrates the significant gap between the living wage (from the MIT Living Wage Calculator) and the minimum wage in these counties. It also reflects how severe this gap is even with the minimum wages being higher than the national and state mandates.

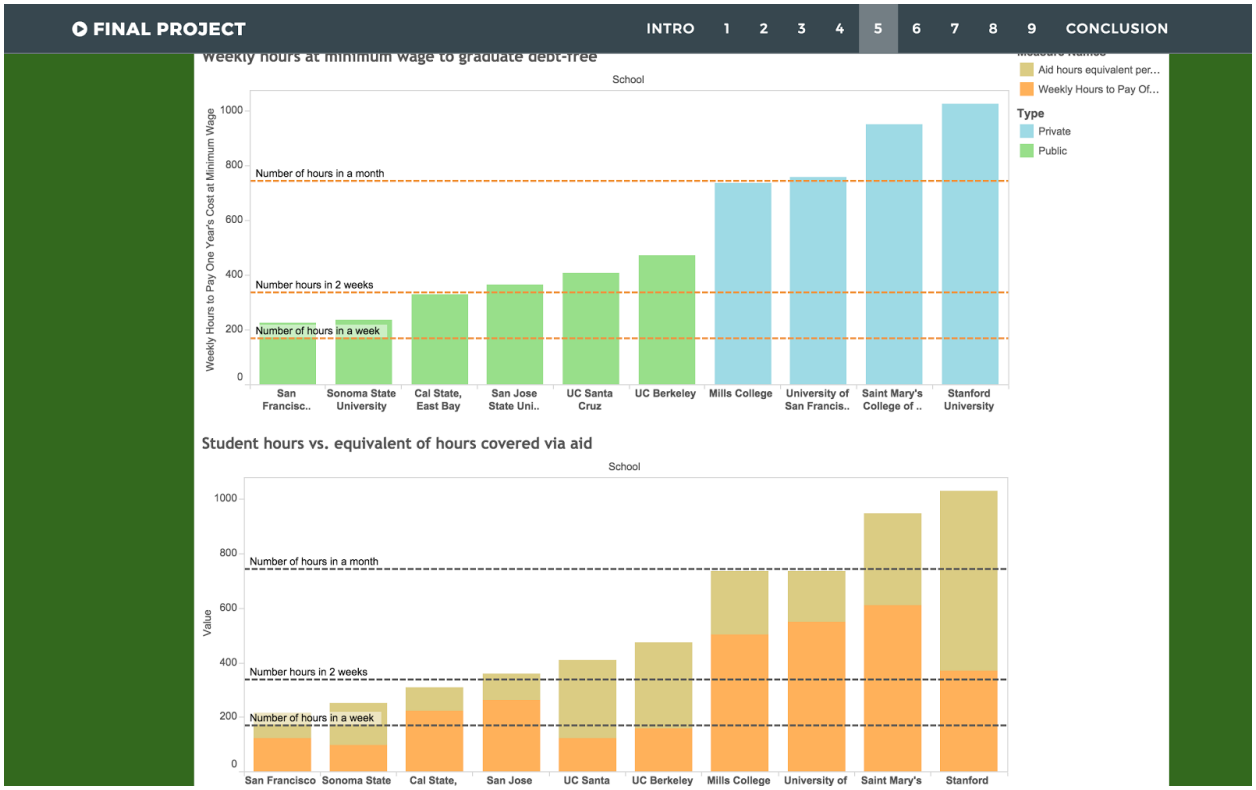
Paying Your Way With Minimum Wage? We examined 10 Bay Area schools from the Cal State system, the University of California system, and private institutions. We found the minimum wage for each of the schools' locations, and divided the total cost (provided by the schools) by the minimum wage to calculate how many hours of labor a student would need to pay for a degree. We then divided that by seven to see how many hours a week a student would need to work at minimum wage to graduate debt-free. To better make our point about potential barriers to entry, we started with three sample schools, San Francisco State University, UC Berkeley, and Stanford University. We also included the number of hours in a week as a reference point.

Cost of Education Covered by Minimum Wage. This visualization was done in tableau. We plotted the weekly hours of minimum wage work to cover one year's school costs— tuition, fees, textbooks, and anticipated outside costs like housing and transportation for 10 schools in the Bay Area. We color coded them by whether they were private or public. We added three reference lines: the number of hours in one week, two weeks, and one month. The reference lines highlight that without aid, even the most affordable schools require more than a week's worth of labor hours.

40 Hours a Week. To break up the Tableau charts and offer some quick facts, we presented a second series of three circles using the same schools as the first one. This time, we calculated annual income working 40 hours a week at minimum wage. We divided the tuition for each school by the annual income to calculate what percentage of a student-worker's income would go towards tuition.

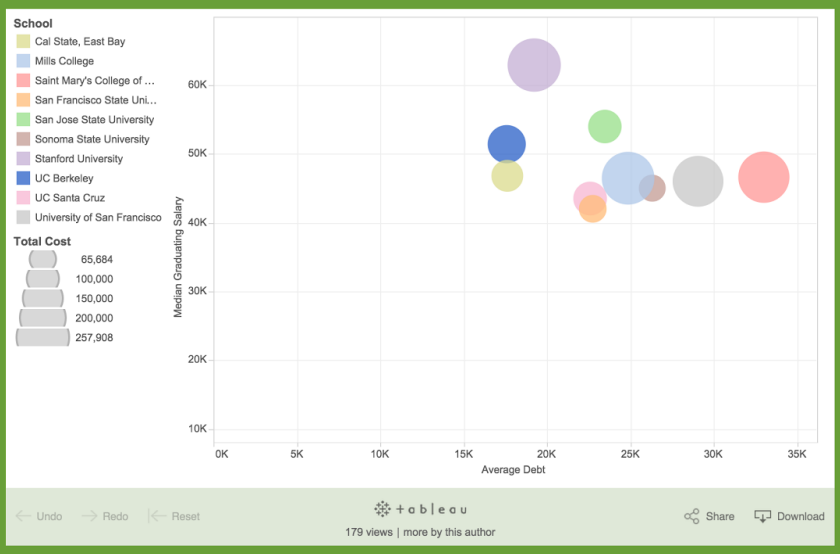
More realistically, a full-time student might work 20 hours a week during the school year, and 40 hours a week during the summer. The gap is even more tremendous when looking at what school-work balance person might reasonably take on. The graph below compares money earned with a reasonable work schedule against the anticipated cost of one year of college.

Gap Between Possible Working Hours and Cost of Education. Now that we'd looked at the extremes and ways in which attending college might seem financially intimidating to a nontraditional student, we wanted to shift our focus to the more practical. We calculated the annual income of a student who worked minimum wage for 20 hours a week during the school year and 40 hours a week during the summer. This seemed like a difficult but possible schedule for a full-time student. In this visualization, we compared the income from working this schedule against the annual cost of each of our 10 schools. It illustrates how large the gap between income and college cost is while using hours a person might actually work.

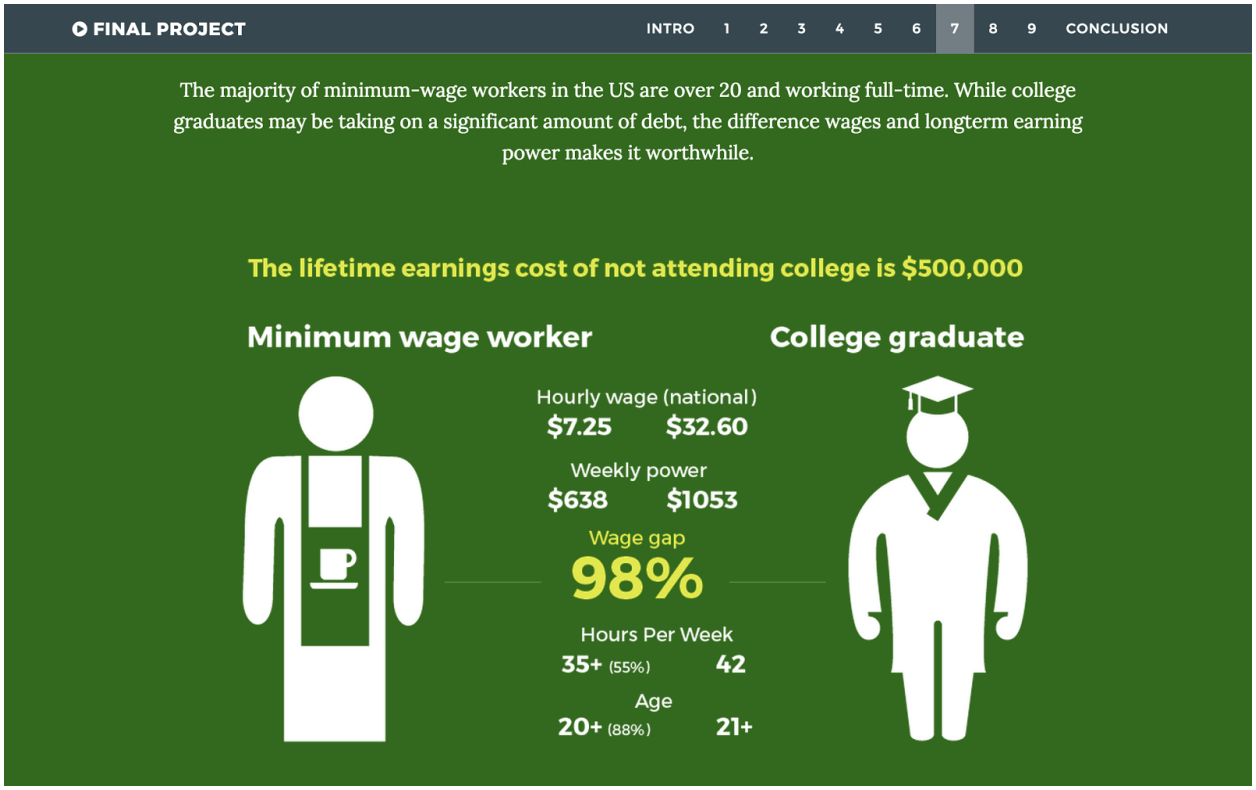


Need-based Aid: Grants and Scholarships. One of the criticisms we received on our initial submission was that our story was oversimplified: although tuition is high, many universities defray the cost with grants and scholarships that help a student while not adding to her debt load. All of the schools we looked at have some kind of need-based aid. The top visualization is the same as above, and used for comparison's sake. The bottom visualization is a stacked bar chart. The bottom, orange bars are hours a student would need to work to pay for a year of school, minus aid. The tan bars are the calculated hours of minimum-wage labor that need-based grants would cover. The picture starts to look a bit different here. For example, while Stanford University is the most expensive, it also has the second-largest relative aid package. Many of the schools start to look more affordable, even though they would all leave the student with some kind of debt.

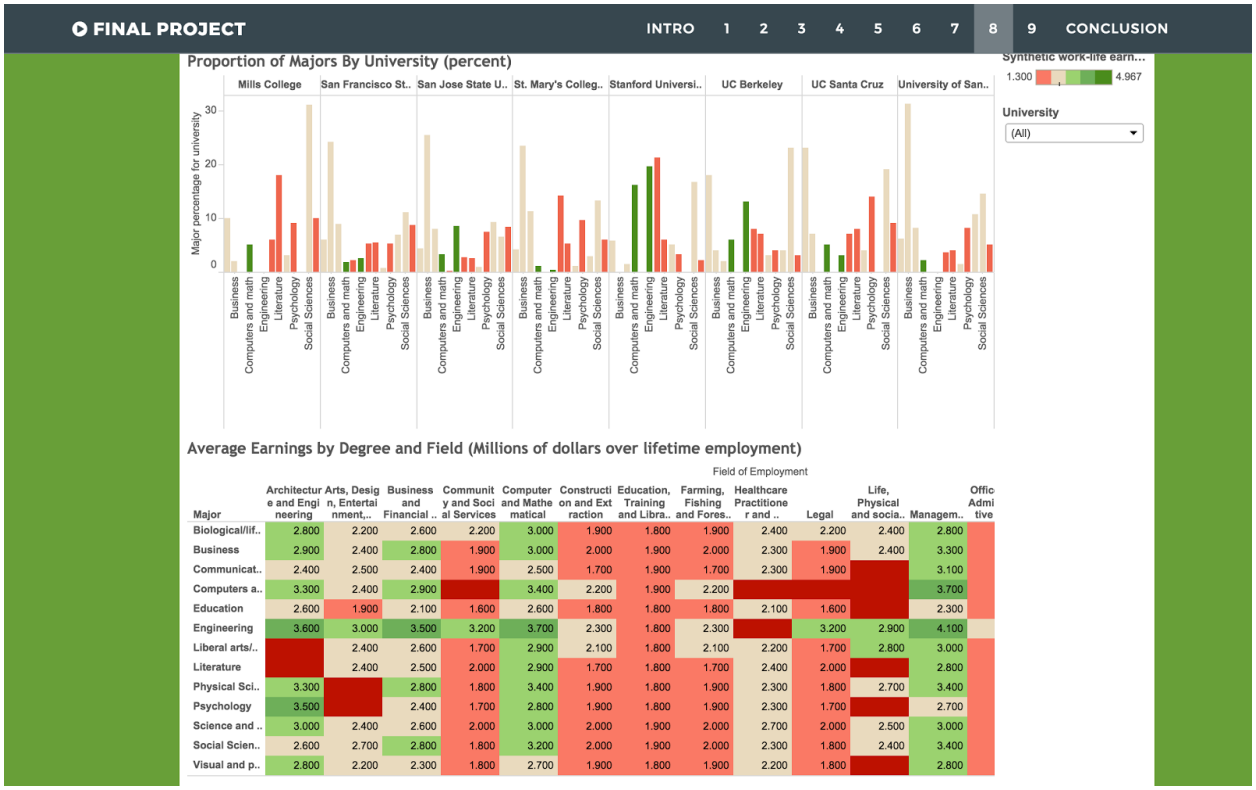
A nontraditional student can anticipate a debt load of anywhere from **$17,619 to $33,000**. The following graphic maps out the average debt upon graduation vs. the median starting salary of recent undergraduates from the colleges we examined. The size of the dot represents the cost of a four-year education.



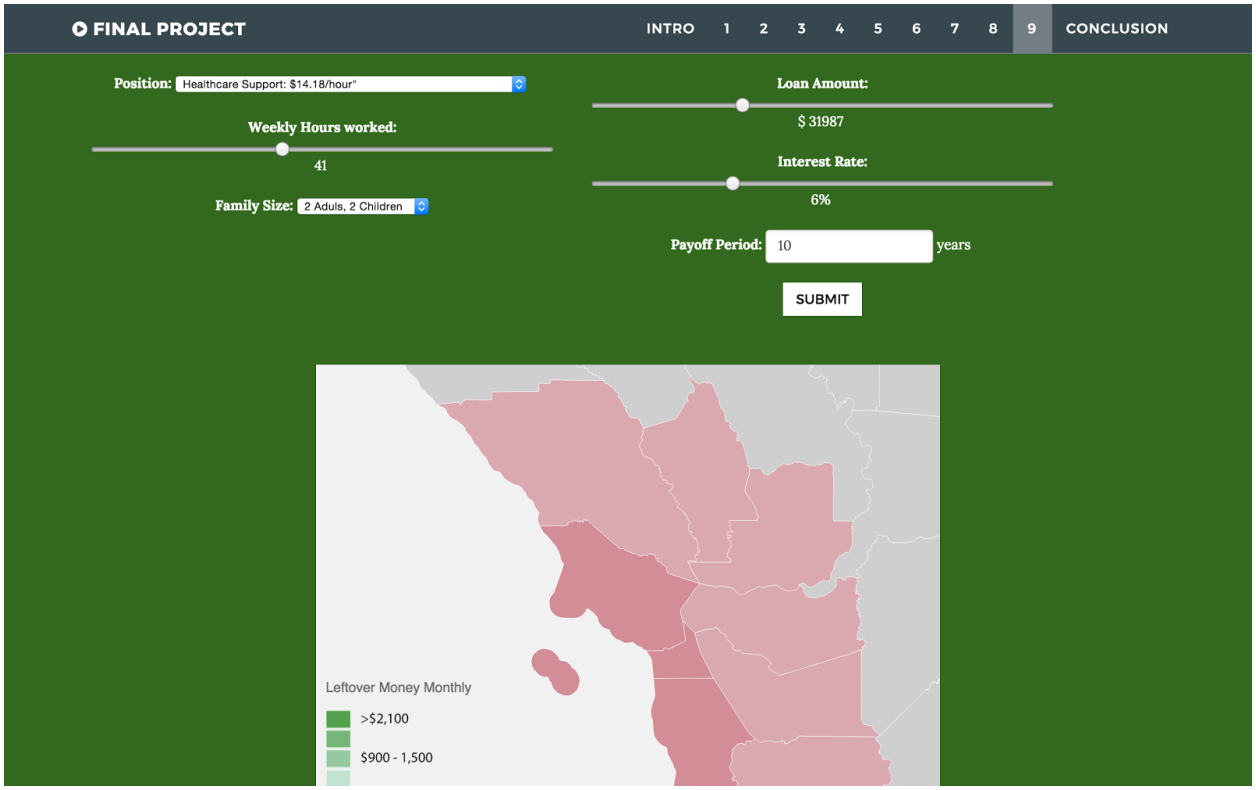
So, Is It Worth It? In this visualization, we plotted the average debt of graduating seniors for each institution on the x-axis. On the y-axis, we plotted the median graduating salary. The size of the dots is the four-year cost of each school. The goal here is to look at what kind of financial outcome a nontraditional student might expect immediately upon graduation. It also allows for comparisons between the schools. For example, Saint Mary's College of California leaves students with the most debt, but approximately the same graduating salary. On the other hand, UC Berkeley is on the lower end of the debt side and has the third-highest income immediately after graduation.



Wage Gap Infographic. In this infographic, we created a side-by-side comparison of a minimum wage worker and a college graduate in the US, using data from the Economic Policy Institute, US Department of Labor, and Bureau of Labor Statistics. The opening information about losing out on half a million dollars is from MIT economist David Autor, and introduces the next focus: long-term value of a college education. The top column of numbers shows the disparity in hourly wage and weekly potential earning power, bring the viewer into the shocking 98% wage gap. The bottom numbers highlight how many minimum-wage workers are adults and working full-time.



Popular Degrees and Future Employment. We used this infographic to take a closer look at college majors and employment. Particularly, how does the major and post-college profession a student might choose influence their earnings relative to other college graduates? We used the Census Bureau statistic of “synthetic work-life earnings,” which is the “expected earnings over a 40-year time period for the population aged 25-64 who maintain full-time, year-round employment the entire time.” A bachelor’s degree holder can expect to earn about $2.4 million over his or her work life. The oatmeal color represents workers who fall into this category of $2.4 million lifetime earnings. The red represents those who fall below, and the shades of green represent how far above the average certain college major-job combinations are. Depending on the degree and field the nontraditional student chooses, he or she can dramatically increase lifetime earnings. Inspired by the Census Bureau graphic shown above, this visualization employs brushing and linking (viewers can click on a specific major in the bar chart to highlight only its potential earnings in the chart below); it also allows viewers to select a single university from the bar chart to see its most popular majors. Because the data is based on national averages, it is somewhat simplified, but the national scope and breakdown by major gives a more accurate picture than the predecessor to this graphic, which was based on the field that was most logically related to the major and the county in which the university was located.



Affordability Calculator. Our last visualization was an "affordability calculator." It was pre-populated with an average financial situation a college graduate might expect, such as $17,000 of debt and a 40-hour work week. The calculator visualizes how much leftover money someone would have in each county, given the values entered in the calculator. It allows the user to explore factors such as job field, family size, and payoff years for student loan affect the affordability of each county. How affordable is it for nontraditional students in the Bay Area who get a bachelor's degree to be in the area? Users can explore the financial burden in different scenarios, including single parent families and individuals or families who have a large student debt but can't find a highly paying job. Manipulating the number of hours that a single parent has to work reveals that the parent has to work an unreasonable number of hours to sustain their family. The choropleth follows visual principles by double coding the information with both intensity and hue. Lighter colors are close to 0, and the colors increase in intensity as their absolute value becomes larger.

What data were used to accomplish the goals.

MIT Living Wage Calculator. We used the MIT Living Wage Calculator to get living wage data for the first visualization and the affordability calculator/choropleth. (Link)

We used the common data sets from Mills College; Stanford University; UC Santa Cruz; UC Berkeley; University of San Francisco; San Francisco State University; San Jose State

University; Sonoma State University; Cal State, East Bay; and Saint Mary's College of California. We used this data for information about the number of total undergraduates and average need-based grants.

We used the tuition information pages from each of the school's websites to get information about the annual tuition and anticipated total annual cost.
The US Census Bureau was the source of information on workers' expected lifetime earnings and demographic characteristics of minimum-wage workers:
http://www.census.gov/prod/2012pubs/acsbr11-04.pdf and
http://www.dol.gov/minwage/mythbuster.htm

The Economic Policy Institute also provided information on minimum-wage worker demographics:
http://www.epi.org/publication/wage-workers-older-88-percent-workers-benefit/

Minimum wage data was available at the following websites:

US Department of Labor and Bureau of Labor Statistics:
http://www.dol.gov/minwage/minwage-gdp-history.htm and
http://www.bls.gov/cps/minwage2013.pdf

California Department of Industrial Relations:
http://www.dir.ca.gov/dlse/FAQ_MinimumWage.htm
City of Berkeley: http://www.ci.berkeley.ca.us/MWO/
City of Oakland:
http://www2.oaklandnet.com/Government/o/CityAdministration/d/MinimumWage/OAK051451
City & County of San Francisco Office of Labor Standards Enforcement:
http://www.sfgsa.org/index.aspx?page=411
San Jose, Office of the City Manager: http://www.sanjoseca.gov/index.aspx?NID=3491

The Bureau of Labor Statistics' Inflation Calculator was helpful in the early stages of defining our project: http://www.bls.gov/data/inflation_calculator.htm

We also used this education loan EMI repayment formula to calculate the monthly payments for the calculator:
https://www.easycalculation.com/formulas/education-loan-repayment.html

We used open source California map json data to draw the California map.
https://github.com/scottpham/california-counties

Which tools were used to accomplish the goals.

We decided to frame our final project as a narrative, stepping through the visualizations and working from the question of how much of a college degree minimum wage could pay for to the actual cost to the economic value of a college education. To do this, we framed our project as a single, scrolling page using the “Greyscale” HTML template from Start Bootstrap.

We cleaned up our data sets and put them in a format we could use using Microsoft Excel.

We created the majority of our visualizations in Tableau. We published all of our visualizations to Tableau’s public server and used their provided embed links to include them in our site template. Some of our visualizations were formatted as single graphs, and others were dashboards to allow side-by-side comparison.

We also used Github to facilitate collaboration at a distance.

We created the affordability calculator using d3. Since we had little experience with d3 before, we added features based on existing examples online. We used a Mike Bostock choropleth (http://bl.ocks.org/mbostock/4060606) for base code, and changed the map/variables and added interactivity. We used this code to help build a tooltip: https://gist.github.com/milroc/2975255

What steps were required to accomplish goals

Individual Designs. We all split up and spent a couple days coming up with potential designs and ways of telling our story. We each sketched at least three ideas, trying to focus on finding different ways of visualizing our data.

Brainstorming and Picking a Design. We came together and walked each other through our designs. We picked our favorite way of visualizing the data for each point we wanted to make, and combined it into a final sketch.

Finding the Data, Cleaning up the Data. We knew that we were going to need data from myriad sources. We each focused on a topic area (tuition, cost of living, and financial aid) and went to find data. We emailed as we found sources, including the format of the sources. Once we had the data set we needed, we worked on cleaning it up and putting it in a format we could use for Tableau and D3, including Excel spreadsheets and JSON. This was a painful part of the process. The common data sets the universities provided have a wealth of data, but they’re formatted as PDFs, one per year. We had to copy-paste the data into a spreadsheet for use, and in many cases had to create our own derived fields (such as the average need-based grant for all students receiving such aid), since the data as it was presented was not necessarily in the form we needed. The Living Wage Calculator had

similar issues; they had a separate page for each county, so we had to copy-paste data for the counties of interest from each page. And although the Census data, Common Data Set, and Living Wage Calculator are all based on the same major and occupation categories, they all aggregated and named them slightly differently, requiring extensive recombination and use of crosswalks. There was also some general reformatting of data that came in CSVs and Excel files so that they were appropriate for Tableau. For the d3 calculator, there weren't maps of just the Bay Area. At first we isolated these counties in a US json map, but the resolution was too low. Then, we isolated them from a California map.

What's the story? We started creating some visualizations in Tableau and doing exploratory data analysis. We had a general idea of what our story would be, that obtaining a bachelor's degree is increasingly unaffordable for nontraditional, lower-income students. However, we weren't yet sure what patterns might emerge, how severe the issue was, and so on. We also weren't yet sure how to scope it: should we look at longitudinal affordability? Should we focus on a comparison of tuition at public vs. private schools? We used the EDA to figure out which were the most compelling visualizations. We had various false starts with other data sets that only told part of the story (for example, only looking at decontextualized food prices compared to the minimum wage over time makes living on minimum wage seem quite manageable).

Planning. For our implementation, we created an HTML template that laid out the basic arc of our narrative with placeholder text. Next, we decided how to implement each of our visualizations. We chose Tableau for most of them, but used d3 for the affordability calculator at the end. We also did some additional research to figure out which articles or papers might offer some good quotes and framing.

Implementation. We split the work and coordinated to build the final visualizations. We coordinated with regular meetings, email, and Github to push changes and integrate our work. We reviewed each other's work and offered feedback.

Feedback and Revision. We showed our visualization to some friends, and got feedback from Marti on Friday. We discovered that it seemed disjointed. We would need to add more visualizations and text to better frame the narrative. We brainstormed to figure out what additional visualizations we'd want—such as some bold, simple graphics to add visual interest and quick takeaways and more detail about the role of financial aid. We also needed to revise some of our existing graphics, such as offering a more nuanced view of the relationship between college major and earning power. We again coordinated both in person and over email and Github to implement a revised version of our project. This required some recombination of data we were using. We also worked to make sure that we were using color consistently. We also facilitated better comparisons in the choropleth by implementing automatically updating sliders giving users immediate feedback when manipulating the variables instead of having to hit 'submit' every time.

What kinds of results you obtained, with a focus on usability tests or responses from prospective or real users.

http://people.ischool.berkeley.edu/~mhitchcock/affordability_bayarea/

Showing real users

We had non-I School users walk through our site with the thinkaloud method. Our questions were what they thought the story was, and how they interpreted each of the visualizations.

Our initial design had a limited number of visualizations. People understood each of our initial visualizations, but had a difficult time understanding what the relationship between them was. They also had suggestions about re-ordering the visualizations and writing a clearer conclusion to emphasize the main point. People were particularly drawn to the affordability calculator, but wanted tooltips for the counties and more information about how the calculations were being made (for example, how much the average wage for each job type was).

Takeaways

- Make it narrative—draw out explicitly the connection between being a full-time minimum-wage worker and access to education.
- Include more intermediary infographics. This was related to the first point. We needed to create a text- and visualization-based story that would lead our users to the conclusion that although there were significant financial barriers to getting a bachelor's degree, the long term economic benefit makes it worthwhile.
- Break it up a bit. The initial version was Tableau visualization-heavy. We decided to incorporate punchier "soundbites"—weekly hours worked at minimum wage to pay for a year of UC Berkeley, a side-by-side comparison of minimum wage and and college graduate workers, etc.—to increase visual interest and offer more users easy to digest chunks of information.

Division of Labor

Task/Visualization	Contributors
Site layout and visualization integration	Meredith (100%)
Data collection and cleanup	Ellen (40%), Jordan (40%), Meredith (20%)
Affordability calculator (choropleth)	Ellen (100%)

Explanatory text	Jordan (50%), Meredith (50%)
CA vs. US minimum wage visualization	Jordan (100%)
“Paying Your Way on Minimum Wage” and “Gap Between Working Hours and Cost of Education” Bubbles	Meredith (100%)
“Cost of Education Covered by Minimum Wage” and “Need-Based Aid” (hours of work to cover costs graphics)	Meredith (100%)
“So, Is It Worth It?”	Meredith (100%)
“Wage Gap” Infographic	Meredith (100%)
“Popular Degrees and Future Employment”	Jordan (100%)
D3 tree chart of living wage by family type and occupation (eliminated from final presentation)	Jordan (50%), Ellen (50%)

Thumbnail

Software created

Our live demo is available here:
http://people.ischool.berkeley.edu/~mhitchcock/affordability_bayarea/

Our code and image assets are available in the public Github repository here:
https://github.com/meredithah/minwage_tuition.

Also to turn in:

1. (In addition to the report, uploaded separately) A small thumbnail image (100x100 pixels) to be used to illustrate your visualization on the course final project web pages.

2. Software created, to the degree this is possible. I realize there may be issues with sharing data, or datasets may be too large to share directly; links to repositories, or the software itself without the data is acceptable. Also, if you used external software packages you may include only the software your team wrote.

You will be turning this in as a project group. Please use the Final Project Groups assignment group to turn in your files.