Visualization Design and Redesign

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CS 448B: Visualization
Fall 2023

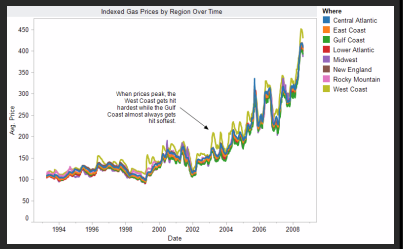
1

Announcements

2

A2: Exploratory Data Analysis

Use Tableau or Vega-Lite to formulate & answer questions



First steps
- Step 1: Pick domain & data
- Step 2: Pose questions
- Step 3: Profile data
- Iterate as needed

Create visualizations
- See different views of data
- Refine questions

Author a report
- Screenshots of most insightful views (8+)
- Include titles and captions for each view

Due before class on Oct 16, 2023

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Visualization Tools for A1

Tableau
- Drag-and-drop interface with additional advanced options
- Requires student license for installation (request license ASAP)
- Yifan will be hosting an intro tutorial **Friday 2-3pm**
  - Zoom link is on Canvas & course website

Vega-Lite
- Refer back to week 1 & 2 notebooks
- Learn ahead with week 3 notebooks
- Visit OH to check your answers

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A1 Review

5

Design Considerations

Guides: Title, labels, legend, captions, source!

Expressiveness and Effectiveness

- Express the facts and only the facts
- Avoid unexpressive marks (lines? gradients?)
- Use perceptually effective encodings that match data type
- Don't distract: use faint gridlines, pastel highlights/fills
- The "elimination diet" approach – start minimal

Support comparison and pattern perception

- Between elements, to a reference line, or to counts
- Use reader-friendly units and labels

6

Design Considerations

Group / sort data by meaningful dimensions

Transform data (e.g., filter, log, normalize)

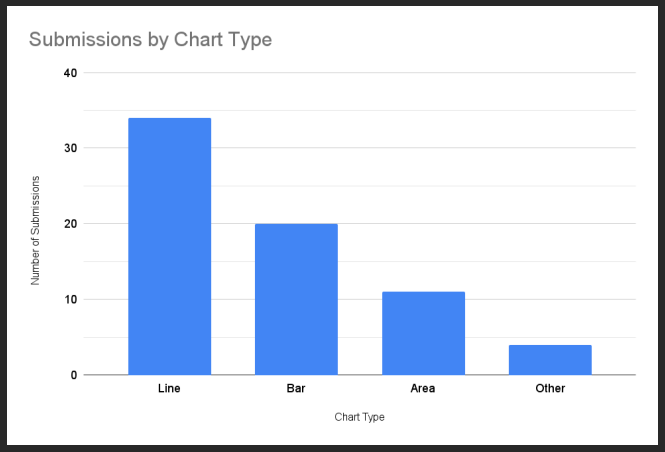
- Are model choices (regression lines) appropriate?

Reduce cognitive overhead

- Minimize visual search, minimize ambiguity
- Appropriate size, aspect ratio, legible text
- Avoid legend lookups if direct labeling works
- Avoid color mappings with indiscernible colors

Be consistent! Visual inferences should consistently support data inferences

7



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Line Charts

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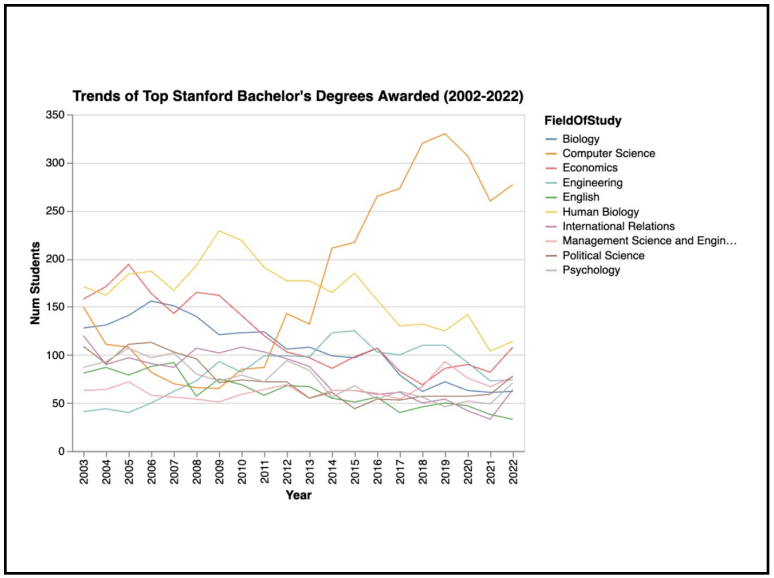

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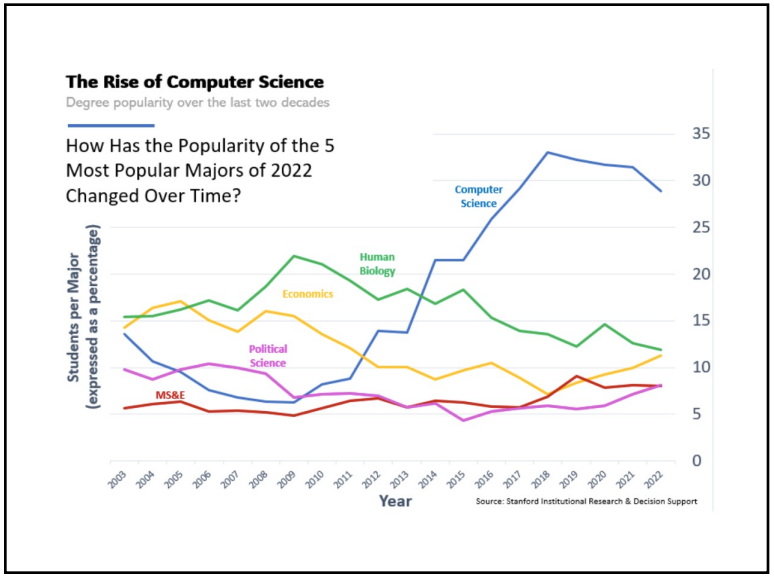
The Rise of Computer Science
Degree popularity over the last two decades
How Has the Popularity of the 5 Most Popular Majors of 2022 Changed Over Time?
Computer Science
Human Biology
Economics
Political Science
MS&E
Students per Major (expressed as a percentage)
Year
Source: Stanford Institutional Research & Decision Support

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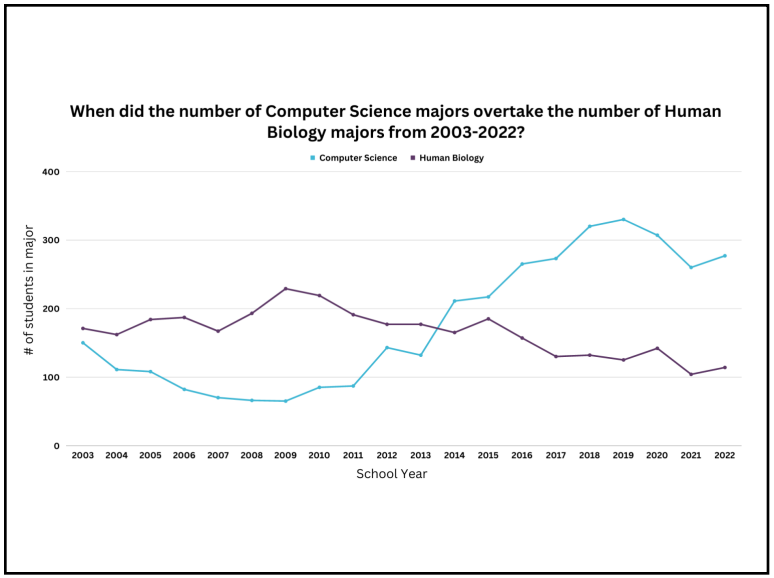
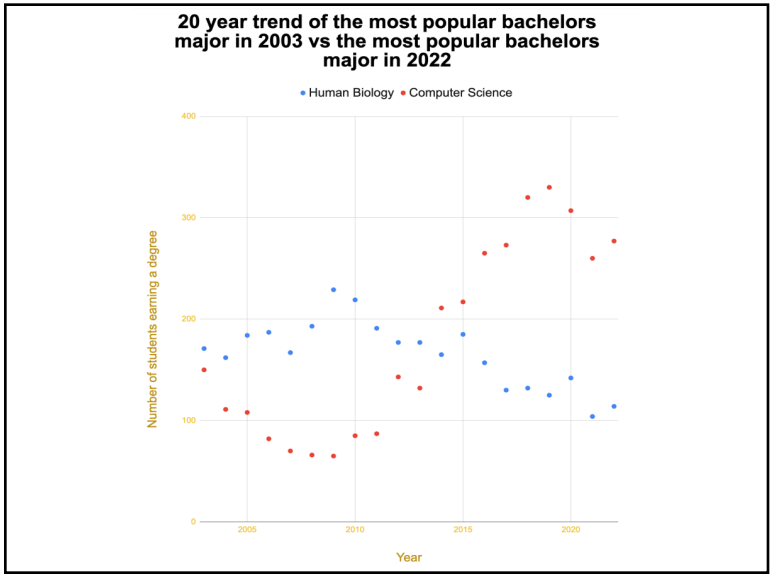
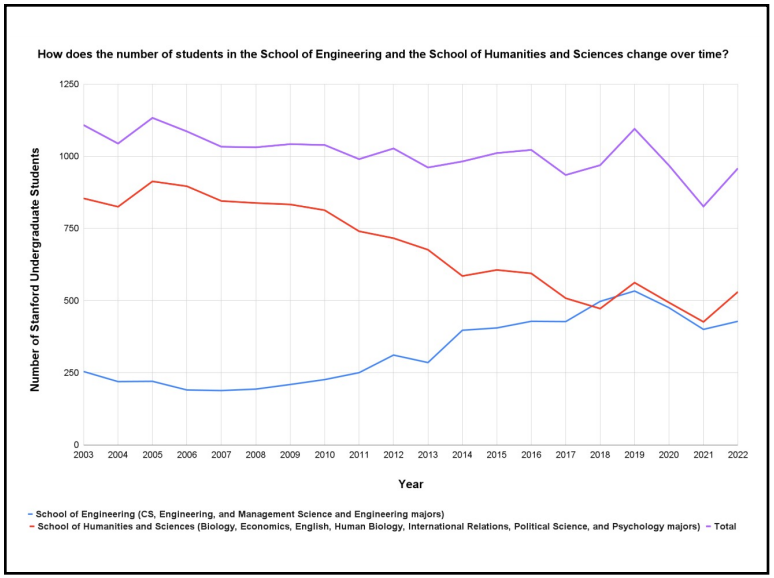

When did the number of Computer Science majors overtake the number of Human Biology majors from 2003-2022?
Computer Science
Human Biology
# of students in major
School Year

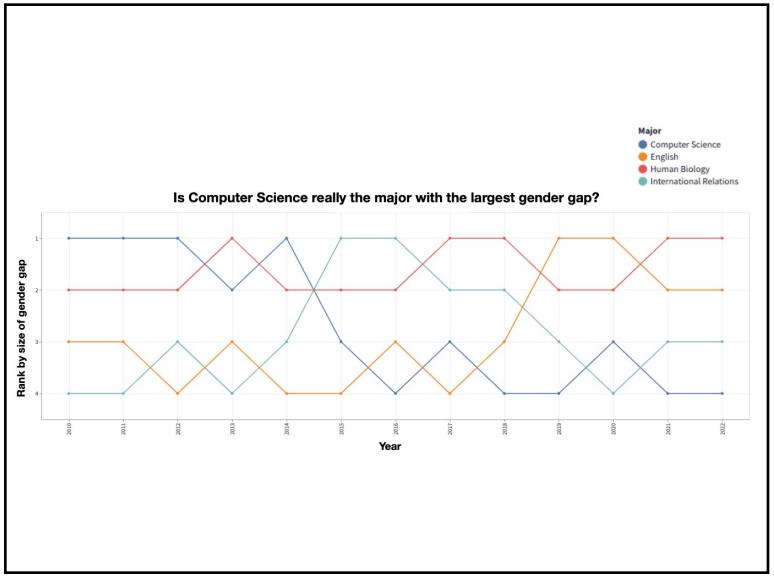
12


20 year trend of the most popular bachelors major in 2003 vs the most popular bachelors major in 2022
Human Biology
Computer Science
Number of students earning a degree
400
300
200
100
0
2005
2010
2015
2020
Year

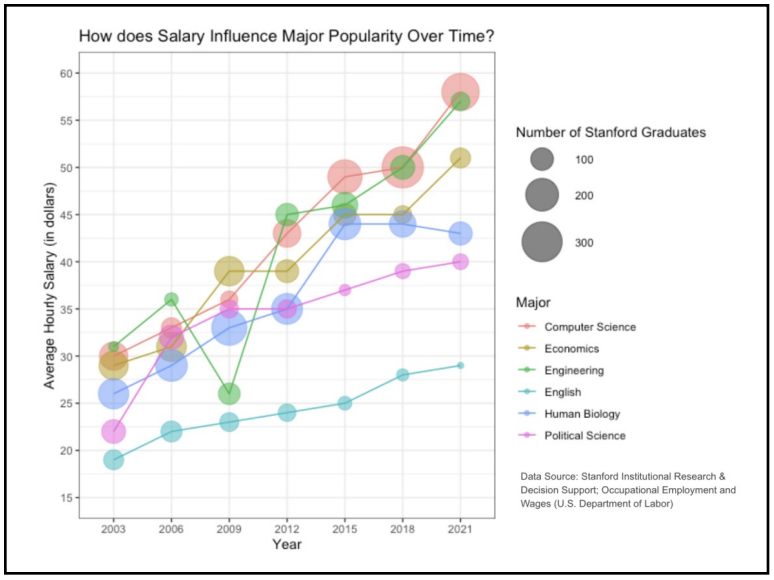
13


How does the number of students in the School of Engineering and the School of Humanities and Sciences change over time?
Number of Stanford Undergraduate Students
1250
1000
750
500
250
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year
School of Engineering (CS, Engineering, and Management Science and Engineering majors)
School of Humanities and Sciences (Biology, Economics, English, Human Biology, International Relations, Political Science, and Psychology majors)
Total

14


Major
Computer Science
English
Human Biology
International Relations
Is Computer Science really the major with the largest gender gap?
Rank by size of gender gap
Year

15


How does Salary Influence Major Popularity Over Time?
Average Hourly Salary (in dollars)
Year
Number of Stanford Graduates
100
200
300
Major
Computer Science
Economics
Engineering
English
Human Biology
Political Science
Data Source: Stanford Institutional Research & Decision Support; Occupational Employment and Wages (U.S. Department of Labor)

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Bar Charts

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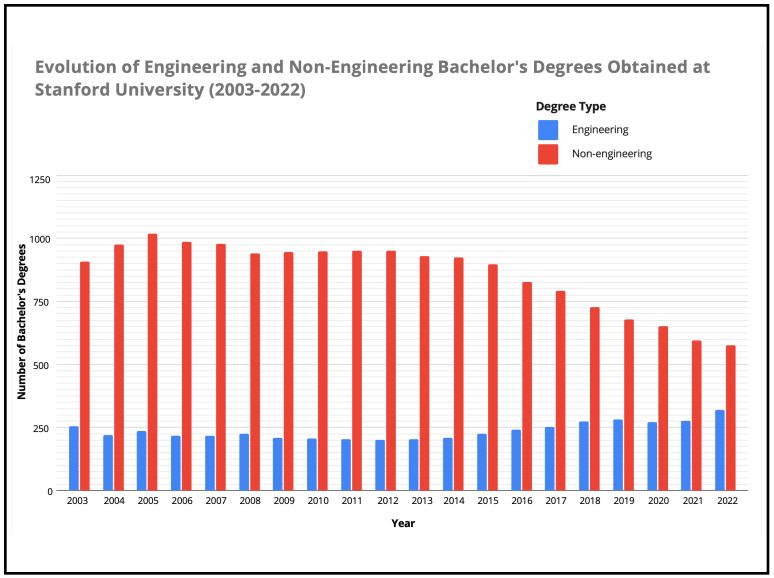

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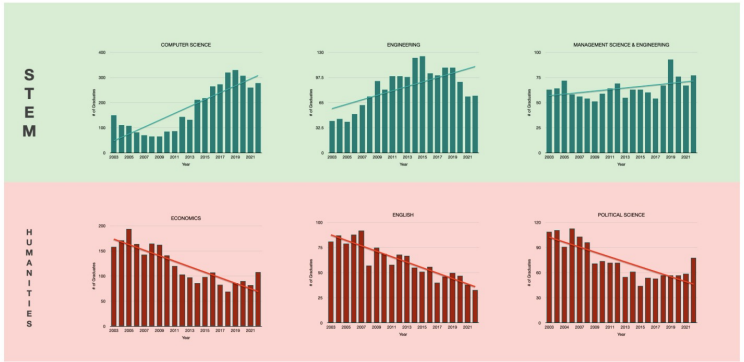
ARE STEM DEGREES GAINING POPULARITY VERSUS HUMANITIES DEGREES?



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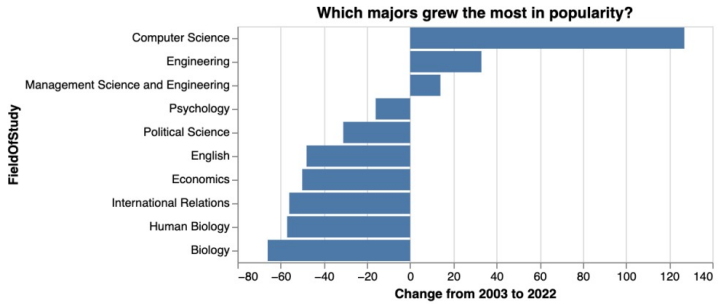

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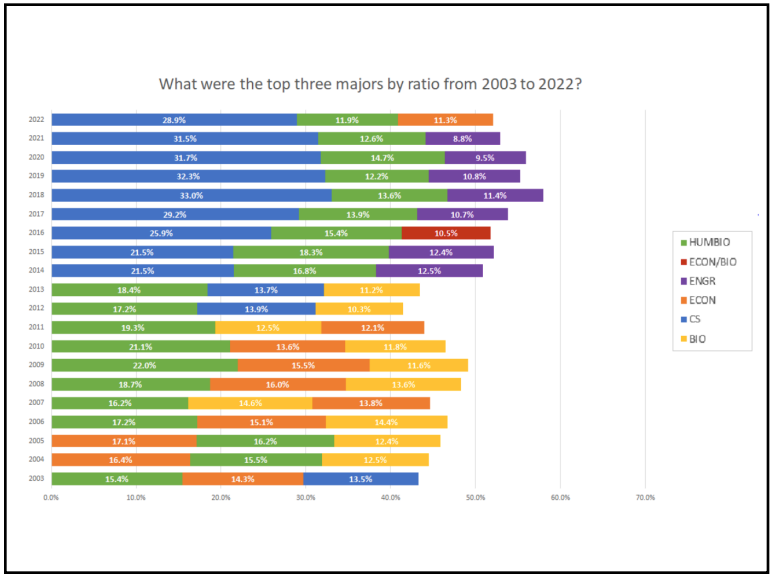
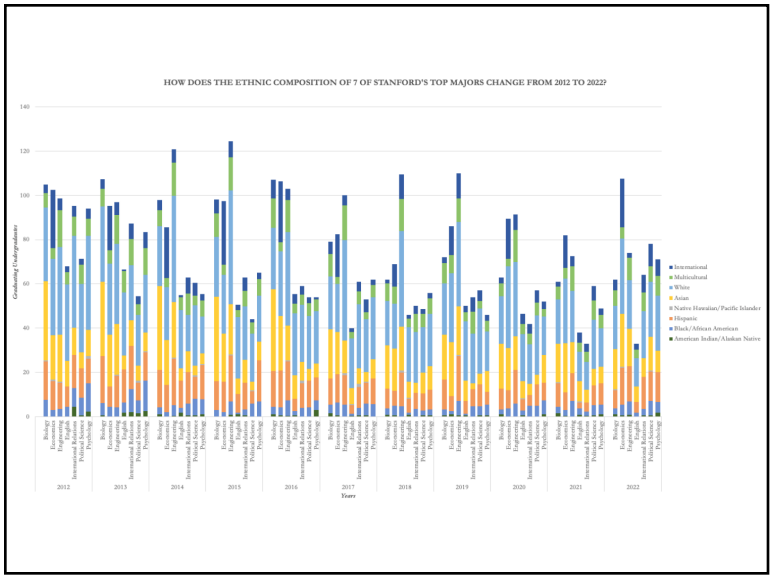

What were the top three majors by ratio from 2003 to 2022?
2022 28.9% 11.9% 11.3%
2021 31.5% 12.6% 8.8%
2020 31.7% 14.7% 9.5%
2019 32.3% 12.2% 10.8%
2018 33.0% 13.6% 11.4%
2017 29.2% 13.9% 10.7%
2016 25.9% 15.4% 10.5%
2015 21.5% 18.3% 12.4%
2014 21.5% 16.8% 12.5%
2013 18.4% 13.7% 11.2%
2012 17.2% 13.9% 10.3%
2011 19.3% 12.5% 12.1%
2010 21.1% 13.6% 11.8%
2009 22.0% 15.5% 11.6%
2008 18.7% 16.0% 13.6%
2007 16.2% 14.6% 13.8%
2006 17.2% 15.1% 14.4%
2005 17.1% 16.2% 12.4%
2004 16.4% 15.5% 12.5%
2003 15.4% 14.3% 13.5%
0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0%
HUMBIO
ECON/BIO
ENGR
ECON
CS
BIO

21


HOW DOES THE ETHNIC COMPOSITION OF 7 OF STANFORD'S TOP MAJORS CHANGE FROM 2012 TO 2022?
Graduating Undergraduates
Years
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
International
Multicultural
White
Asian
Native Hawaiian/Pacific Islander
Hispanic
Black/African American
American Indian/Alaskan Native

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Stacked Area Charts

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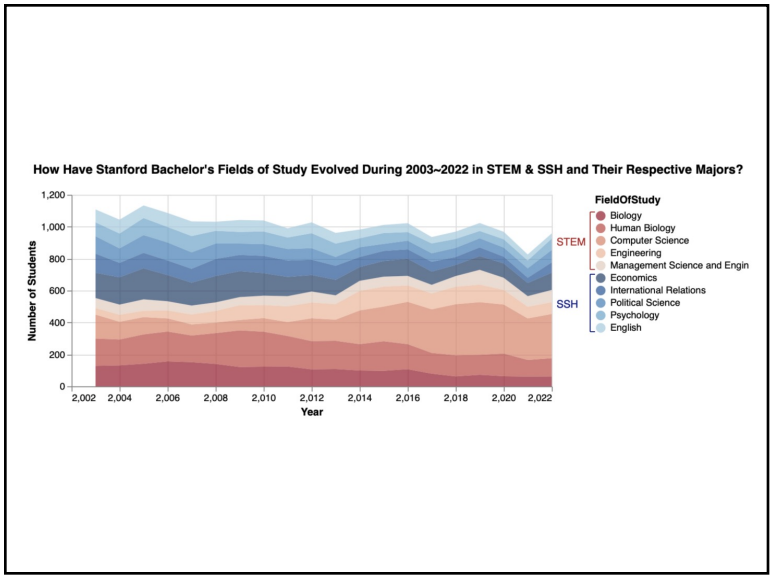

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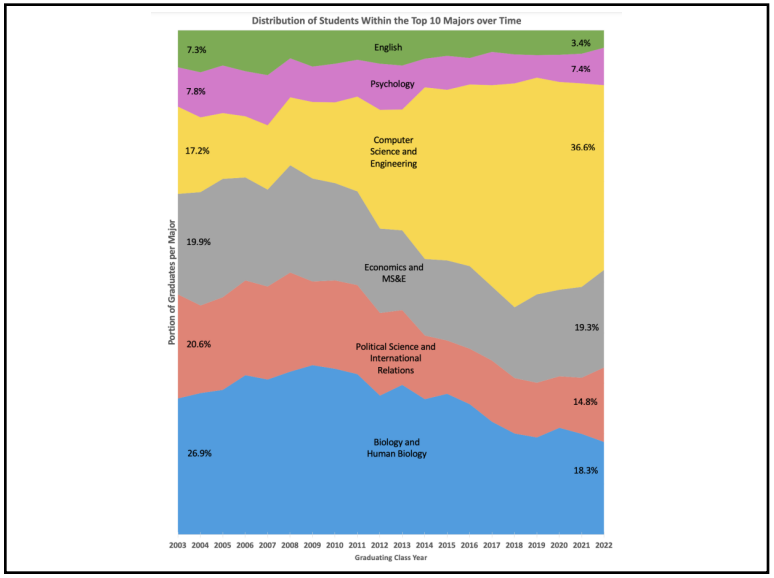

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Other Chart Types

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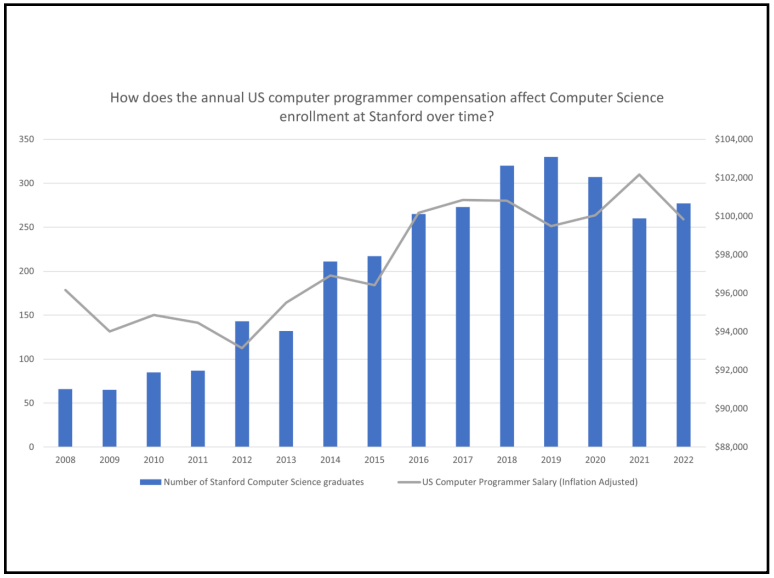
How does the annual US computer programmer compensation affect Computer Science enrollment at Stanford over time?
350
300
250
200
150
100
50
0
$104,000
$102,000
$100,000
$98,000
$96,000
$94,000
$92,000
$90,000
$88,000
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Number of Stanford Computer Science graduates
US Computer Programmer Salary (Inflation Adjusted)

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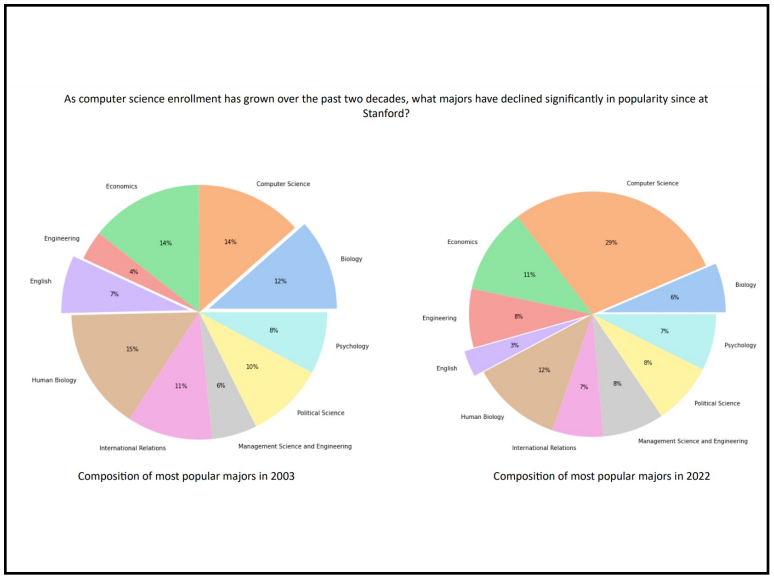
As computer science enrollment has grown over the past two decades, what majors have declined significantly in popularity since at Stanford?
Economics
Computer Science
Engineering
Biology
English
Psychology
Human Biology
Political Science
International Relations
Management Science and Engineering
14%
14%
4%
12%
7%
8%
15%
10%
11%
6%
Composition of most popular majors in 2003
Computer Science
Economics
Biology
Engineering
Psychology
English
Political Science
Human Biology
International Relations
Management Science and Engineering
29%
11%
6%
8%
7%
3%
8%
12%
7%
8%
Composition of most popular majors in 2022

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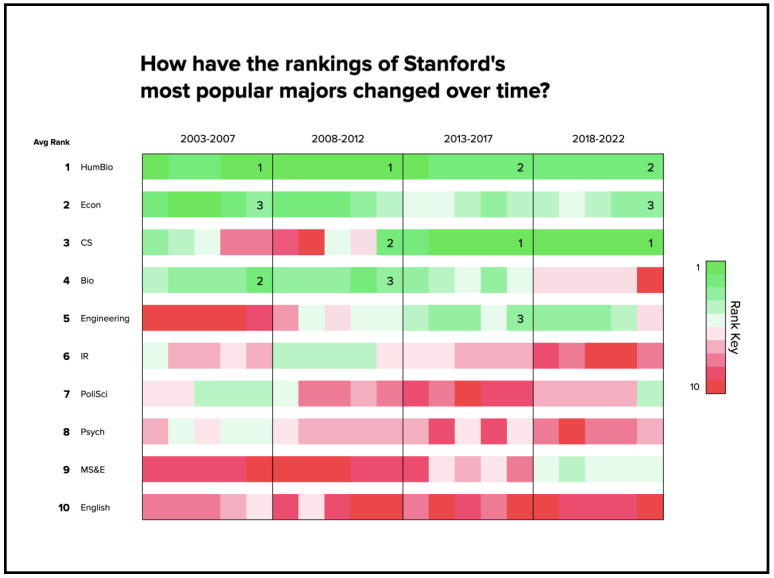
How have the rankings of Stanford's most popular majors changed over time?
Avg Rank
2003-2007
2008-2012
2013-2017
2018-2022
1 HumBio
2 Econ
3 CS
4 Bio
5 Engineering
6 IR
7 PoliSci
8 Psych
9 MS&E
10 English
Rank Key
1
10

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