

IT UNIVERSITY OF COPENHAGEN

**Combining Visual Cues and Narrative Data
Visualization to Mislead Using An Untruthful
Infographic**

Data Visualisation and Data-driven Decision Making (BSDVDDM1KU)

Spring Semester 2025

Authors:

William Olfert Michelsen (wimi@itu.dk)

Wiktor Pedrycz (wipe@itu.dk)

Submission Date:

16th May 2025

THE DATA VISUALIZATION

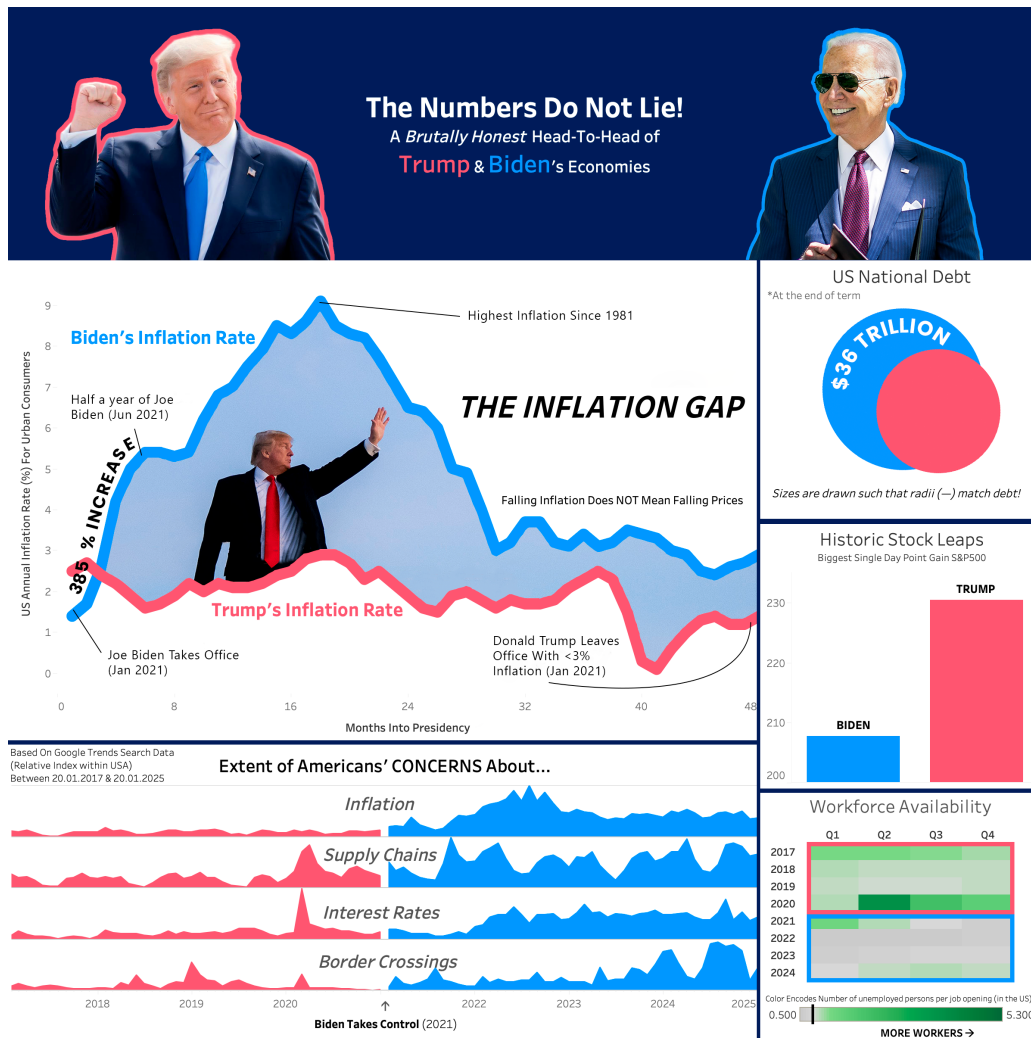


Fig. 1: Data-visualisation Infographic
Photographs: Courtesy Donald J. Trump and Joseph R. Biden Jr. Presidential Libraries

DESIGN CHOICES

With our infographic, we sat out to create a visualization that is intentionally misleading, while using elements from narrative data visualization to strengthen and communicate a narrative, complementary to the deceitfulness of the visualization's charts. To be clear, all data in Fig. 1 are untouched and sourced from reliable, recognized sources. All data are factually correct, to help isolate the impact of our misleading visual design. The following sections describe our design choices, explaining both the techniques used and the reasoning behind them. We aim to display the power of narrative data visualization, while also showing how truthful data, combined with selective narrative framing and visual techniques, can easily be made misleading.

Elements of Narrative Data Visualization

Our visualization is an infographic that combines various charts that convey individual messages, and contribute to an overall narrative: Trump good, Biden bad. In data storytelling, the annotation layer is typically considered the

layer of what you choose to include, highlight, and explain in your narrative (Ren et al., 2017). In our infographic, this layer consists primarily of textual explanations, visual boundaries, and imagery. We make use of this layer to help convey the infographic's narrative. Specifically, through this layer of the infographic, we make an effort to treat the US national economy like the two presidents' property. This frames each president as the sole hero, or culprit, of the economies and Americas of their time. This overall narrative is simplistic, and one-sided. We hope this increases persuasiveness by exploiting human preference for simple explanations (Lombrozo, 2007). Our charts exploit this too, as most of them are limited in their consideration of extraneous factors and layers of detail, which Cairo (2016) calls breadth and depth respectively.

In their book, Padilla et al. (2020) describe how visual boundaries can lead viewers to develop cognitive categories, viewing continuous uncertainty data as categorical. We adapt and use visual boundaries similarly here to support our infographic's narrative. The aim is to make the viewer develop cognitive categories about the time periods

depicted throughout the chart. We will elaborate on specific examples from the annotation layer when we explain the choices behind the constituent charts.

During development, we stuck to the principal that everything presented should technically be true. Instead, we mislead through obscuring relevant context and using various visual cues that are either directly deceitful, or aim to increase the chance of misinterpretation. This naturally made a simplistic narrative more practical.

Our layout follows Segel and Heer (2010)'s martini-glass structure: We expect the top-left, large, 'Inflation Gap' chart, using recognizable imagery to be viewed first, being the most author-driven due to heavy commentary through the annotation layer. Subsequently, viewers are free to explore other charts. We expect the other charts to be simple enough, especially given the use of titles, for the user to not veer off too far from the narrative we have already introduced. We expect viewers should then see story beats that fit, or reinforce, the narrative already established. We expect, given the sensitive topic, that allowing viewers to seemingly reach their own conclusions from 'honest numbers' (framed in the header) can be more memorable. We are effectively exploiting what Cairo (2016) describes as the storytelling bug; once the viewer starts detecting these patterns, i.e. Biden being worse, they will ideally develop their own cause-and-effect stories.

Most of our charts make use of heavy framing in their titles. By framing, we mean the cue that tells the viewer how to think about the data. These titles range from oversimplified presentations of the variable(s) involved in the chart, to emotional, catchy titles meant to steer the viewer toward a predetermined interpretation of the data. 'Workforce Availability' is an example of the former, while 'The Inflation Gap' is an example of the latter. All of it serves to underscore and communicate the narrative.

Lastly, why do we not allow for viewer interaction? Interaction may allow the viewer to explore different levels of breadth and depth of the data. We expect this to quickly shatter the overall narrative, and the charts' ability to effectively mislead.

Infographic Header & Use of Color

"Show don't tell." - We never explicitly say what the viewer should believe. In fact, we frame the infographic as letting sheer facts crown a 'winner', by conducting a "...brutally honest..." comparison. The is deliberate to make the visualization appear more neutral, strictly adhering to the numerical facts, and subsequently appearing more convincing.

Our infographic's header primarily serves to increase the beauty of our chart, something Cairo (2016) points to as an important part of keeping a viewer engaged in your visualization. It also serves as a color legend for the rest of the chart: Anything turquoise is associated with Joe Biden, while anything pinkish-red is associated with Donald Trump. Their names are used again in the annotation layer, throughout the infographic, but only when it serves the overall narrative, or strengthens the individual message of a chart. For our actual choice of color we followed two general principles: Account for the audience's cultural associations of color, as it may facilitate decoding of the visualization

(Coscia, 2021). We do this by associating Trump and Biden with the colors of their respective political parties, although slightly modified for visual clarity and aesthetics. Secondly, we keep the number of distinct colors low to avoid any kind of potential information overload.

Charts

The Inflation Gap

This chart plots the annual inflation rate for urban consumers over the course of the presidents' terms. The chart type used here is what Cleveland and McGill (1984) have called a 'curve-difference chart'. What it really is, are two line charts, where the vertical distance between them, at a given point, encodes some important variable. In our case, this variable is what we call the 'Inflation Gap'. This is actually the main variable that we want to show with this chart as it fits with the narrative of the entire visualization; Trump *himself* created a better economy than Biden. Cleveland and McGill (1984) recommended to avoid such charts because they do not allow for accurate, numerical comparisons. Here, we are not concerned with that, for a couple of reasons: Firstly, the difference in inflation is convincing enough on its own, that we are willing to sacrifice some functionality, as the message remains clear, while also being more aesthetically pleasing. It also facilitated our use of narrative devices. For instance, we have a picture of Trump that may be interpreted as him literally holding high inflation at bay. Also, by having two individual, colored lines, we were able to easily assign blame and praise implicitly through our annotation layer, with annotations like "Biden's Inflation Rate". No matter the order in which the viewer reads the annotations, the narrative of the chart is clear; Trump left the US with a low inflation rate, and, due to Biden's leadership, the US experienced the worst inflation it has seen in more than 40 years.

Another visual cue used to mislead is the dual-esque x-axis, 'Months Into Presidency', which the inflation rate is plotted against. This was preferred over explicit dual axes as it obscures the actual years, even though dual axes are also typically considered misleading. The viewer may naturally map notable events onto the years, such as the worldwide COVID-19 pandemic that begun in 2020, or Russia's invasion of Ukraine in 2022. By considering more context, the overly simplistic narrative may be less persuasive.

Historic Stock Leaps

This chart highlights the largest single-day point gain of the stock market index S&P 500. The chosen statistic is a cherry-picked number without any point of reference or meaningful significance. Measures such as percentage change over a longer period of time would be a far more reflective number of each president's policies, rather than a single large number. In this chart, the primary visual manipulation is the truncation of the y-axis. The bar graph representing Trump's point gain appears to be around 4 times larger than the one corresponding to Biden's. However, if the viewer were to examine the numbers on the y-axis, they would find that the difference is much smaller than what their intuition likely told them upon initial viewing. A bar chart was preferred here, over something like a lollipop chart,

because we felt that it was more striking, especially at a glance, while bringing less attention to the exact values. Ideally, this prevents the viewer from feeling like they need to closely examine the y-axis, which would ruin the illusion.

National Debt

This chart plots the US national debt at the end of each president's term with proportionally sized symbols for comparison. This metric is yet another way of distorting the viewer's perception, by depriving the reader of context and relevant comparison, through display of a single large number. Another misleading visual cue is how the national debt is encoded in the radii of the circles. This is an effective way to mislead because what the viewer perceives is a difference in area, however the radius of circle does not scale linearly with its area (Coscia (2021)). By including a tacit tutorial on how to compare the circles, the chart maintains an air of fairness, even though the perceived difference between the symbols will be bigger than if they had been encoded more truthfully. The circles have also been deliberately placed such that the difference in area appears as stark as possible, while comparing the radii is obnoxiously difficult, disincentivizing the viewer from even trying. The annotation layer is used to support all these manipulative, visual cues. The national debt associated with Biden is highlighted such that the viewer is able to see it being a significant number. The national debt associated with Trump is not explicitly revealed, as due to the previously mentioned techniques, it appears around 50% smaller. In reality, the national debt at the end of Trump's term is approximately \$27 trillion, only 25% smaller (U.S. Department of the Treasury. Fiscal Service, n.d.).

Workforce Availability

The graph titled "Workforce availability" is a heatmap representing the unemployment per job opening from 2017 to 2024 divided by quarters with each presidency highlighted, through the use of a visual boundary. The visual boundaries serve to make the viewer think in simple, cognitive categories. Specifically, that the unemployment in each framed period is solely a consequence of the president at the time, rather than being influenced by the past, present, and predictions of the future. The chart also uses an arbitrary choice of divergent binning, entirely made to make Trump look good and Biden look bad. Visual boundaries can be problematic because the viewer may think they are there for a specific, important reason, which may not be the case at all. The choice of significance level for a confidence interval is often used as an example (Padilla et al., 2020). We employ a similar idea here. By having a visual boundary on the binning legend itself, a viewer may think that it is there because it encodes something important, like a recommended level by some government institution. As said, in reality the binning is completely arbitrary.

Americans' Concerns

Although plotting a trend over time, this plot uses an area chart, rather than a line chart. Impromptu testing told us that area charts make it easy to decode that 'concerns', as we framed it, are higher under Biden than Trump. Accurate

numerical assessments are not a concern. The inflation chart is deliberately placed at the top. Once again, this arguably exploits the storytelling mind bug. We expect the viewer to look at this chart after the 'Inflation Gap' chart, meaning they should be ready to start connecting story beats when seeing this trend. Also, given it is the chart with the most obvious difference between the presidents, it may facilitate the viewer in seeing the general pattern, which is that the 'concern' is higher under Biden in the rest of the area charts. A visual boundary, in the form of a gap between the area charts, is employed to emphasize what is driving the narrative: The presidents' are solely responsible for the Americas of their time. Lastly, the y-axes are completely obscured, and have been individually scaled so the present differences in the data are as noticeable as possible.

REFERENCES

- Cleveland, W. S., & McGill, R. (1984). Graphical perception: Theory, experimentation, and application to the development of graphical methods. *Journal of the American statistical association*, 79(387), 531–554.
- Lombrozo, T. (2007). Simplicity and probability in causal explanation. *Cognitive psychology*, 55(3), 232–257.
- Segel, E., & Heer, J. (2010). Narrative visualization: Telling stories with data. *IEEE transactions on visualization and computer graphics*, 16(6), 1139–1148.
- Cairo, A. (2016). *The truthful art: Data, charts, and maps for communication*. New Riders.
- Ren, D., Brehmer, M., Lee, B., Höllerer, T., & Choe, E. K. (2017). Chartaccent: Annotation for data-driven storytelling. *2017 IEEE Pacific Visualization Symposium (PacificVis)*, 230–239.
- Padilla, L., Kay, M., & Hullman, J. (2020). *Uncertainty visualization*. PsyArXiv.
- Coscia, M. (2021). The atlas for the aspiring network scientist. *arXiv preprint arXiv:2101.00863*.
- Google Trends. (n.d.). *Inflation, supply chains, border crossings, interest rates*. Retrieved May 14, 2025, from <https://trends.google.com/trends/>
- SP Dow Jones Indices LLC. (n.d.). *S&p 500 [sp500]* [Data set]. Federal Reserve Bank of St. Louis. Retrieved May 16, 2025, from <https://fred.stlouisfed.org/series/SP500>
- U.S. Bureau of Labor Statistics. (n.d.-a). *All items in u.s. city average, all urban consumers, not seasonally adjusted [cuur0000sa0]* [Data set]. Retrieved May 15, 2025, from <https://data.bls.gov/timeseries/CUUR0000SA0>
- U.S. Bureau of Labor Statistics. (n.d.-b). *Number of unemployed persons per job opening, seasonally adjusted [jolts uepjjob]* [Data set]. Retrieved May 16, 2025, from <https://www.bls.gov/charts/job-openings-and-labor-turnover/unemp-per-job-opening.htm>
- U.S. Department of the Treasury. Fiscal Service. (n.d.). *Federal debt: Total public debt [gfdebttn]* [Data set]. Federal Reserve Bank of St. Louis. Retrieved May 16, 2025, from <https://fred.stlouisfed.org/series/GFDEBTN>