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**CS416**

**Data Visualization**

**A Drill-Down Narrative Visualization of Major Market Crashes**

**Messaging:** The primary message communicated through my narrative visualization is an understanding of the dramatic impact and recovery pattern associated with three significant market crashes. The focal points are the Dotcom Bubble, the Financial Crisis of 2008, and the COVID-19 crash. By displaying these market fluctuations, I aim to educate viewers about the cyclical nature of the economy, the volatility of the stock market, and the resilience that follows significant downturns.

**Narrative Structure:** I designed the narrative visualization to adhere to the "drill-down" story structure. Starting with an overarching view of the market trends from 1999 to 2023, users are given the opportunity to delve deeper into the specific crashes through clickable annotations. This design structure marries the concept of a guided narrative with user-driven exploration, ensuring a consistent storyline while providing an interactive experience.

**Visual Structure:** The visual structure of the narrative visualization consists of the webpage layout and the data-driven visualization embedded within. The webpage layout includes a consistent header section with the page title and navigation links to transition between different scenes (Home, Dotcom Bubble, Financial Crisis, and COVID-19 Crash).

Each scene's visual structure is a combination of textual content and an interactive candlestick chart created using D3.js. The textual content provides context and an overview of the event, while the chart visualizes specific data pertaining to that event.

The understanding and navigation within the scene are facilitated by a clearly structured layout. The textual analysis is placed above the chart and clearly demarcated with headings. The chart itself is interactive, allowing users to hover over data points to view more specific details. In addition, the X and Y axes of the chart are clearly labeled to provide context for the data visualization.

The important parts of the data within each scene are highlighted using annotations. For instance, the peak and bottom of each market crash are clearly marked and annotated. The percentage drop from the peak to the bottom is calculated and displayed, drawing the viewer's attention to the scale of the market crash during that particular event. This enables the viewer to focus on critical data points.

The transitions between scenes are facilitated through the navigation links present at the top of each webpage. Clicking on these links smoothly transitions the viewer to the selected scene. The consistency in the visual structure and layout across scenes helps the viewer understand how data from one scene connects to the data in the other scenes. The continuity in the design and the persistent nature of the chart type (candlestick chart) across scenes also aid in this understanding. It allows for a comparative view of how different events impacted the market in terms of scale and duration.

To summarize, the visual structure was designed to provide a clear, informative, and engaging experience, allowing viewers to understand and compare significant financial events effectively.

**Scenes:** The visualization is segmented into four main scenes. The first scene presents an overview of the market trends from 1999 to 2023, underlining the three pivotal crashes. Following scenes each focus on a specific crash, delving into the intricacies of the Dotcom Bubble, the 2008 Financial Crisis, and the COVID-19 crash. I ordered the scenes chronologically to mirror the real-world progression of these events, ensuring an intuitive flow to the narrative.

**Annotations:** In this narrative visualization, annotations play a critical role in highlighting the key points in the data and supporting the overall messaging. The template followed for the annotations is the d3-annotation library's d3.annotationCallout and d3.annotationXYThreshold. These were chosen for their aesthetic appearance and functionality, allowing for a clear and concise description of critical points in the data.

The annotations are designed to support the messaging by highlighting the peaks and bottoms of the financial crises. For example, in the Financial Crisis and COVID-19 Crash pages, the annotations explicitly mark the highest and lowest points in the market during these periods. They provide specific data (price and date) and context for these events, thus enhancing viewer understanding.

In the JavaScript code, these annotations are generated dynamically using the d3-annotation library. For example:

A black background with text

Description automatically generated

Here, the **note** object contains the title and label for the annotation, which are displayed to the viewer. The **x** and **y** values determine the position of the annotation, which is calculated based on the date and price data. The **dx** and **dy** values offset the annotation from the point of interest, ensuring the annotation does not obscure the data point itself.

The annotations remain static within a single scene; they do not change as they represent fixed points in time. Their primary role is to serve as an informative guidepost for the viewer, providing context and enhancing the understanding of the data presented.

**Parameters:** The state of the visualization is controlled by key parameters including the selected crash and specific data points under examination. These parameters inform the construction of each scene, dictating what is displayed and the level of detail presented. They also enable dynamic responses to user interactions, allowing the state of the visualization to adapt while maintaining context.

**Triggers:** In this narrative visualization, there are two main types of triggers that guide the viewer through the story. The primary ones are the navigation bar links at the top of the page and the bubbles on the home page. When clicked, both take the viewer to a more detailed analysis of a specific financial crash, allowing them to 'drill down' into the data of their interest. This allows the viewer to navigate between different sections of the narrative, effectively changing the 'state' of the narrative.

Another subtle trigger in the visualization is the window resize event in the JavaScript code. This event listener is set up to redraw the charts when the window size changes, maintaining the visualization's readability and clarity on different screen sizes. This is not a trigger in the traditional sense as it doesn't change the story's state, but it is a key part of making the narrative visualization accessible and engaging for all viewers.

**User Interactions:** My visualization offers the viewer a chance to interact and explore the data at their pace. Once presented with the overview, users decide the path of their journey. This balance of guidance and freedom enriches the user experience, making the exploration more engaging and the gleaned insights more memorable.

**Design Limitations:** Despite the robust analysis and interactive design, this visualization, like any, has its limitations. It cannot encapsulate every nuance and variable contributing to these complex economic events. The visualization should be seen as an introduction and broad overview, rather than an exhaustive account.

**Learning Outcome:** The primary learning outcome from this narrative visualization is an enhanced understanding of the dynamics of significant market crashes. Users will gain insights into how drastic market drops are often followed by steady recoveries, underlining both the cyclical nature and resilience of economies.

**In Conclusion:** With a combination of thoughtful design decisions, user interactions, and effective use of narrative visualization techniques, this project provides an insightful journey through major market crashes. It offers users a more profound understanding of market dynamics, equipping them with knowledge that can inform their future economic decisions. As the world continues to navigate an era marked by rapid technological advances and economic uncertainties, the lessons learned from these past crashes become increasingly relevant.