Narrative Visualization

Messaging

My objective was to create a narrative visualization that would dispel the common misconception that airline flight delays are inevitable and largely beyond human control. If their flight is delayed, most people assume that extreme weather or time-consuming security checks are to blame. In reality, those two factors are responsible for less than 7% of flight delays. In the large majority of cases, flight delays are due to factors under carrier control, such as required aircraft arriving late, overbooking, poor scheduling, inefficient cleaning and resupply of aircraft, faulty maintenance and weather response procedures, damaged runways, air traffic control errors, and more.

Narrative Structure

I wanted to lead the viewer down a path that begins with ridding them of their misconception that flight delays are almost always due to unavoidable extreme weather or security concerns, and ends with the idea that most flight delays are preventable. I first present the various categories of causes and their relative contribution to flight delay. Then I discuss in greater detail the three that are most likely to delay flights. Next, the narrative focuses on one of those three, National Aviation System (NAS) delays, and it's various subcategories. One of those subcategories is non-extreme weather, which the user is invited to explore next. Finally, the user is presented with a discussion of potential delay factors that aren't captured by any of the standard government categories mentioned earlier. These include things like geographical region, flight distance, and size of airline.

Since the messaging is linear, moving from general to increasingly specific topics, and gradually building the case that flight delays are preventable, it was natural choose a slide show as the narrative structure for this project. Each slide gives the user the opportunity to drill down into the details of the topics presented there.

Visual Structure

Each scene consists of a single slide, which is contained within a *div* HTML tag. Transitioning to the next or previous slide involves swapping the contents of the *div* tag. A prominent header is used to keep the user oriented and provide some sense of what each slide is about. Each slide reads from top to bottom via scrolling, with no opportunity for the user to become lost. Drill down details are available *in situ* and immediately, without requiring the user to navigate back and forth to different locations, or to wait for content to load. Ques embedded in the body of the text inform the user of drill down opportunities, and annotations arranged along the top of many of the charts make it easy for the user to

see that it's possible to zoom, include/exclude sets of data, or download a chart as an png image file. Navigation arrows are prominently displayed at the top of each slide, and written ques are included in the text, making it easy for the user to move between slides.

Scenes

The Web site contains the following four scenes (slides):

1. *Performance*
   a) *Discussion*: airline on-time performance and the five categories of factors that degrade on-time performance.
   b) *Chart*:
      1. performance category vs. percent of operations delayed
   c) *Drill down opportunities*: hover over chart bars to see precise percentages for delayed operations and delay time.
   d) *Transition*: user can click on arrow to move to the next slide.
2. *Are Delays Preventable?*
   a) *Discussion*: the relative contributions of the five categories to flight delays, and introduction to five subcategories of NAS.
   b) *Charts*:
      1. year vs. percent of total delay time for the five categories of delay
      2. subcategories vs. percent contribution to NAS delayed operations and delay time
   c) *Drill down opportunities*: hover over dots on line chart to see exact values; hover over chart bars to see comparison of exact values for operations and time; zoom into regions of chart; include/exclude a dataset; download image of chart.
   d) *Transition*: user can click on arrow to move to the next or previous slide.
3. *Weather*
   a) *Discussion*: the influence of weather on total and NAS delay.
   b) *Charts*:
      1. year vs. weather's share of total and NAS delay
      2. month vs. weather/non-weather share of NAS delay time
      3. month vs. average weather delay
   c) *Drill down opportunities*: hover over bars to see comparison of exact values for total and NAS delays, and for weather and non-weather delays; zoom into regions of chart; include/exclude a dataset; download image of chart.

d) *Transition*: user can click on arrow to move to the next or previous slide.

4. *Other Factors*

a) *Discussion*: flight distance, geographical region, and comparison of individual carriers; concludes by re-emphasizing the preventable nature of delays.

b) *Charts*:

1. distance group vs. average arrival delay

2. average arrival delay by carrier

3. average weather-related delay by carrier

c) *Drill down opportunities*: hover over bars to see comparison of exact values; zoom into regions of chart; include/exclude a dataset; download image of chart.

d) *Transition*: user can click on arrow to move to the first or previous slide.

Each scene has a consistent look and feel. The same set of colors, legends and annotations are repeated among all of the charts, except for the single line chart, where clarity required an annotation for each line instead of the standard legend that was used on the other charts. The annotations respond to user actions within a scene. So, for example, if the user clicks on a dataset in the legend of a chart, the corresponding data and legend entry are grayed out, letting the user focus on the remaining data and making it clear that some data are currently hidden. Hovering over a chart often reveals additional details and drill down options. The annotations make it easier to compare things like extreme and non-extreme weather, operation percentages and time percentages, avoidable and unavoidable delays, and so on. And those comparisons help to express the message of the narrative, in particular, the fact that most flight delays can be avoided by the airlines.

Parameters

Parameters are used to track the current scene being viewed, the state of each chart, such as whether or not a tooltip should be shown, and, if so, the content of the tooltip, which datasets are currently visible or hidden in a chart, which set of annotations should be visible, and so on.

Triggers

User clicks and mouse movements trigger state changes in the narrative visualization. For example, a Javascript functions listens for mouse clicks on the navigation arrows and changes a state variable used to load the appropriate slide into the *div* DOM element used to contain them. Affordances such as changes in the mouse pointer when hovering over a clickable element informs users of their drill down and navigation options. Standard icons for actions like zoom and download are also used, providing the user with a context that feels familiar and intuitive.

Conclusion

All of the above factors contribute to a narrative visualization that is easy to navigate, intuitive, provides opportunities to drill down for greater detail, and, importantly, is very effective at conveying the intended message.