Time and Motion
Part 2: Using Motion and Animation

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Motion Graphics

- Animations are often called “Motion Graphics”
- Using animation tends to make visualizations
  - More engaging
  - More memorable
  - Reused more often
- Often, are a “trailer” for a more detailed website/data set

Amount of Data Communicated

- Animations actually tend to communicate less data (in terms of amount) than other methods
  - Viewer's attention tends to be directed/focused
    - Can present only limited info at a time
    - Not able to study/digest
    - Though, pause/replay/etc. can help this
  - Overall cognitive load is increased
    - Need to keep in mind what is seen throughout the video/animation

Two General Categories

- Animation is directly aligned with a variable
  - An aid to display
- Animation is part of a more general presentation
  - Used to tell a story

Animating a Single Variable

Scaling Time

- Simplest use of animation
- The time dimension of animation is just a scaled version of time data
  - e.g. 1 year = 1 second, 1 day = 5 seconds, etc.

- Example 1 – 200 countries, 200 years, 4 minutes

Mapping Variable to Time

- Can map another variable to time
- Should be at least ordinal if not numerical
  - e.g. from smallest to largest, lowest to highest, last to first, etc.
  - Give each element some number of seconds
- Need to explain the mapping/values
  - Won't be obvious otherwise

- Example 2 – Gold Reserves by Country

Use of Time

- Can speed up or slow down time to emphasize or deemphasize particular points
  - Slow down to emphasize and give the viewer time to look closely

The Role of Audio

Multiple Channels

- In many motion graphics, you can also make use of sound
  - Voiceover narration
    - Ensure it is matched well
    - Human voice is more relatable than computer
  - Background music
    - Use to set mood/tone
    - Careful – make sure it really enhances
  - Sound effects
    - Use sparingly to highlight key events
- When forming script, should map both visuals and the audio that will accompany

Narration

- Should be scripted first
- Very limited in amount
  - 2 minutes of animation:
    - About 15 short sentences
    - About 250 words total
- Use to complement the visualization, not to repeat
  - The main communication is the visual

Text on Screen

- Adds visual clutter
  - Tough to read and see visualization simultaneously
- Adds to cognitive load
  - another process through visual system
- Ensure any text is either:
  - Non-repetitive with narration or
  - Used in conjunction with narration for critical emphasis or information
- However, sometimes can’t be avoided for closed captioning/accessibility

Script and Story

Creating a Script

- For a more general animation, need to script similar to any movie/video
- Plan out entire sequence, time for each part, story you are wanting to tell
- Will convert this to a sequence of storyboards/individual shots and transitions

Forming the Story

- Framing
  - What is the kind of story; what's your goal?
  - Examples:
    - List (here's the data)
    - Myth-busting (people think about this wrong)
    - How-to (what the data can help you do/learn)
    - Topical (how current thing X is reflected in data)
    - Personal Story (how this affects you)
  - Key part of the whole story, since everything should relate to it

Forming the Story

- But/However
  - Need to create “tension” in the story
  - “However” (something unexpected/surprising)
    - Leads to a “Therefore” resolution
  - If just one such point, usually about halfway through the script (after setup/introduction)
- Wrap-up
  - Leave viewer with message to follow up
  - e.g. URL to visit, action to take
  - Or just conclusion

Script Notes

- Gaps are good
  - Don’t need to fill in every detail; viewers are used to making connections in video
- Be flexible
  - Sticking rigidly to script is not always possible
- Be interesting in speech
  - Vary sentence length
  - Switch between formal/informal, or poetic/direct
  - Use figures of speech/metaphor
  - Be sure it sounds like speaking, not writing
- Shorter and faster is better
  - Keeps attention

The Overall Approach

- Script is broken up into scenarios/frames
  - Each with a distinct purpose, topic, etc.
  - Often can be laid out in storyboards
- Different approaches to presenting scenes
  - Slideshow: Transition from scenario to scenario in linear/explaining fashion
  - Bird's Eye view: Overview, zoom in and out of larger view, or move through landscape
  - Changing scenery: Fixed infographics, changing background as story changes
  - Scene-by-scene: Motion picture approach, with transitions from scene to scene

Animating Data

Animating Charts

- Build out from the zero-point of the axes
- Shapes representing data animate away from the axes/origin
  - Columns grow up or down
  - Lines animate left to right
  - Pies build clockwise form 12 o'clock

Animating Numbers/Titles

- Numbers will count up
- Bubbles/dots (in scatter plot) will grow or pop in
- Fade in title/label elements

Animating Objects

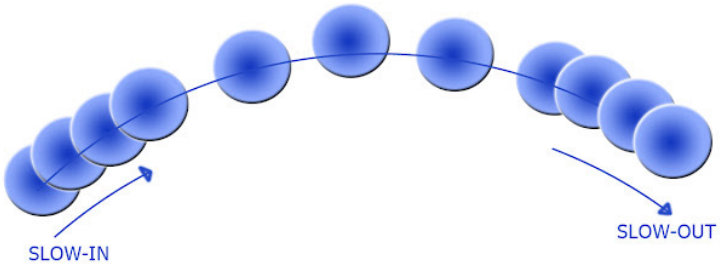
- Tend to grow up and to right, shrink down and to left
- Left implies backward, right forward
- Up/Down can be used in different ways
  - Growth/Decline
  - Higher/Lower in a hierarchy
- Zoom in for detail, out for overview

Transitions

- Fades of elements/scenes helps to maintain continuity
- Match cuts tend to transition at a point where frame contents are similar
  - Highlights similarity
- Smash cuts transition between two very different elements
  - Highlights differences
- Jump cuts skip over some time – can be disconcerting, but dramatic

Easing In and Out

- Key idea: to transition from one thing to another, better to start and end slow and be faster in middle, rather than uniform speed
- Slow in and slow out is one of Thomas & Johnston's 12 principles of Animation
  - Some of these principles are applicable for data visualization, as well



http://pollygwinnettcaa.blogspot.com/2016/10/disneys-12-principles-of-animation.html

Multimedia Principles

Mayer's 12 Principles for Multimedia Learning

- Richard Mayer presented 12 principles for multimedia learning
  - 2014
  - Most apply to motion graphics as well
- Follows principles of dual channels (visual and audio) and limited cognitive capacity

Principles of Multimedia Learning

1. Multimedia
   - Use a combination of words and visuals
2. Coherence
   - Exclude extraneous information
3. Signalling
   - Use cues to draw attention to important information
4. Redundancy
   - Don’t present same material in multiple ways

Principles of Multimedia Learning

5. Spatial Contiguity
   - Keep text and visuals close together
6. Temporal Contiguity
   - Keep voice narration in line with visuals
   - Keep visuals and explanation on same screen
7. Segmenting
   - Break information into smaller segments rather than one continuous unit
8. Pre-Training
   - Ensure users know basic principles before seeing application

Principles of Multimedia Learning

9. Modality
   - Visuals are best accompanied by spoken, not written, words
10. Voice
   - People respond best to real human voice
11. Personalization
   - Use a conversational style rather than formal style when speaking
12. Image
   - People can learn better from visuals than from a “talking head”