Woodstock, PSYC 579
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WC: 598

Event Perception Can Aid Visualization

Many designs, including diagrams, information visualizations and statistical graphics, can be improved with a consideration of human event perception. Here, I tackle an educational example using three different designs and suggest ways that the information conveyed by each can be improved by considering the underlying sequence of events.

Complex actions like walking and running can be understood as a series of events on a short timescale. Suppose you want to write a textbook chapter that explains the gait pattern of a tyrannosaur. It is difficult to convey in few words the many simultaneous events taking place in the knees, hips, trunk and tail, suggesting a need for diagrams. Parish, Sperling and Landy (1999) found that sign language gestures presented at a low frame-rate were better-perceived when chosen frames conveyed greater change. Further, Newtson and Engquist (1976) found improved memory for motion sequences in videos that focused on breakpoints, "the points at which the most physical features are changing," (Zacks & Tversky, 2001). In the same way, a multi-frame diagram of a walking tyrannosaur should focus on the points of maximum change in motion and put emphasis on the start of new motions, rather than simply using equal-interval snapshots. Thus, gait diagrams could be more effective if they emphasize specific events and motions taking place within them.

Events can also be perceived on long timescales. Suppose your dinosaur textbook will also discuss evolutionary relationships between species. Biologists use 'phylogenetic trees' to show the order species diverged evolutionarily. Information visualizations like these allow users to externalize memory loads that would otherwise be onerous (Munzner, 2009). Figure 1 depicts ten fossil families distinguished by branches diverging from a common line that connects aquatic reptiles and birds. Key evolutionary divergences are presented (and perceived) in parallel as a set of round nodes. The relationships between species are not easily committed to memory because the node objects are not meaningful by themselves. In order to convey the anatomical changes that occur at branching nodes (and thus improve recognition), one could draw the ancestor species found at each node using a view of the animal that most-emphasizes the difference between it and its offspring. These pictures, combined with visual cues for directional motion present in many comics (see McCloud, 1993) imply the gradual evolutionary shift from one species to another that is otherwise difficult to convey in a static image.

Perceiving events well can also reveal trends in data. Suppose you want to conclude your dinosaur textbook with a discussion of the meteorite that crashed into Earth in 65 million BC, releasing a cloud of iridium that blanketed the planet. Proof of the iridium cloud's occurrence rests on core-sample measurements from different-age rocks. A simple, vertical plot of these data (figure 2, left) appears to show that iridium levels vary by the depth of the core sample, but the addition of a salient trendline (figure 2, right) reveals the horizontal trend that the designer wants to convey. From this plot, it is clear that an iridium event began abruptly, trailing off as time went on. By calling attention to the point of maximum change in the plotted core samples, the designer helps the user to perceive that an event occurred there.

The examples provided here are just a snapshot of the design realms where a thoughtful emphasis on event structure can benefit perception. Whether events occur on a short or long timescale, whether they relate to simple diagrams or complex data visualizations, understanding

that humans can recognize the start and end of temporal stimuli can help designers make those stimuli more intuitive and informative.

References

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Newtson, D., & Engquist, G., (1976). The perceptual organization of ongoing behavior. *Journal of Experimental Social Psychology*, 12, 436-450.

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Zacks, J. M., & Tversky, B. (2001). Event structure in perception and conception. *Psychological Bulletin*, *127*(1), 3–21. http://doi.org/10.1037/0033-2909.127.1.3

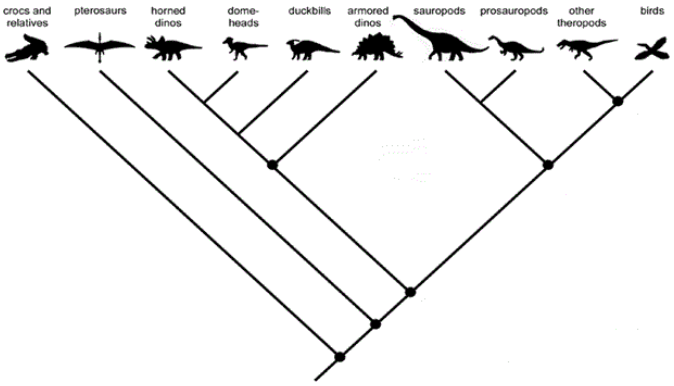

Figure 1: Phylogenetic tree depicting dinosaurs' evolutionary divergence.

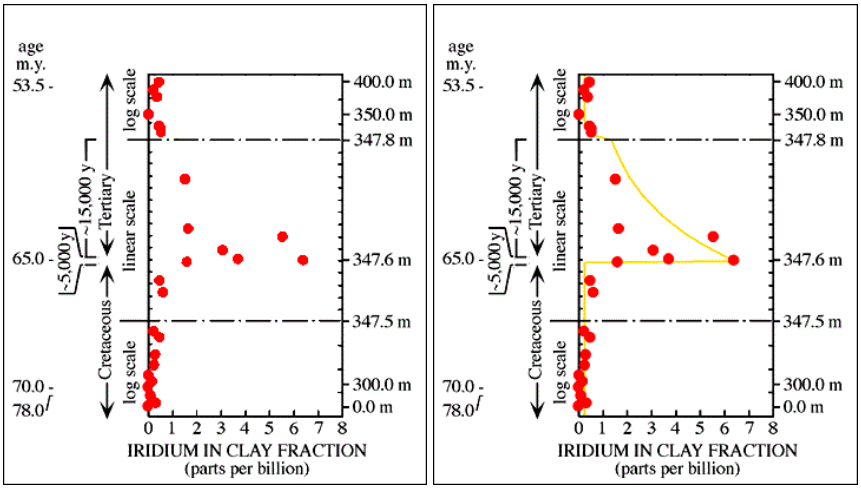

Figure 2: Statistical graphics benefit from elements that depict events in data.