Author

Michele Bernasconia, Raffaello Seri

Title

What are we estimating when we fit Stevens' power law?

Venue

Journal of Mathematical Psychology

Citation Count

3

Year

2016

Aim

Their aim was to discuss what we are actually measuring when we apply Stevens's Power Law in practice, and to give an explanation of why we should care. They also suggest changing the way the final exponents are calculated between an overall average and a weighting function for individual participants.

Conclusion

This paper taught us how to go about calculating the exponents from the dataset as a whole for our project, and what to look for to see if our results were significant. We noted that they suggested the range of the stimuli actually affects the results, which led us to adopt the 1-100 scale across all 4 visualization types for consistency.

Author:

Bauer, Ben

Title:

Does Stevens's power law for brightness extend to perceptual brightness averaging?

Venue:

The Psychological Record

Year:

2009

Aim:

Their goal was to discuss the possibility of using Stevens' Power Law to estimate a constant brightness level instead of single point. Stevens originally used individually points and flashes to look into brightness and this paper intended to discuss if the process was applicable for brightness in a surrounding environment.

Conclusion:

Their experiments successfully proved that Stevens' power law could be used to estimate the perception of brightness outside of a single point source. The estimation of the exponent they found was .7, so they found that people underestimate the brightness of the environment they are in.

How it informs us:

We decided to adapt this process to the visualization space because of how common brightness changes are with modern screens. There have been many studies on brightness done, but we felt that this specific type had not been fully explored yet.

Author

Chevalier, Fanny and Dragicevic, Pierre and Franconeri, Steven

Title

The not-so-staggering effect of staggered animated transitions on visual tracking

Venue

IEEE transactions on visualization and computer graphics

Citation Count

Year

2014

Aim

The goal of this paper was to discuss the different types of animations used to transition from one display to another and how these differences can affect the perception of the data being displayed. They evaluated two staggering effects and their effect on tracking tasks.

Conclusion

The conclusion was that staggering effects have a negative effect on the tracking tasks performed so the benefits need to significantly outweigh this issue in order to be used. The ability for animation to grab the attention of users is very useful, so the staggering animations can still have their place in the visualization community.

How it Informs Us

After reading this paper we realized that we would need to choose a specific part of animation to test, as all "animation" is too broad of a channel to accurately acquire data for. We ended up choosing the velocity of an animation, because this paper discussed pacing so thoroughly.

Author

Matthew L. Bolton

Title

Modeling Human Perception

Venue

IEEE International Conference on Systems

Citation Count

4

Year

2008

Aim

This paper again looks at Stevens's Power Law and argues that the results are more of a product of the experimental procedure than they are true perceptive measurements. The paper goes in depth on exploring how changing the way to gather data can drastically affect the overall outcomes, and how this affects the Power Law's usefulness in the real world.

Conclusion

This paper informed many aspects of our project, including why it's important to be consistent with the method of gathering the data. This involved the 1-100 scale, keeping the given value on the left, an ensuring that each repetition of the trials were similar in nature to the previous ones.

Author

Jeffrey Heer and Michael Bostock

Title

Crowdsourcing Graphical Perception

Venue

Proceedings of the SIGCHI Conference on Human Factors in Computing Systems

Citation Count

598

Year

2010

Aim

This paper was well-studied in class, but we used it again to inform our analysis of the results, and to make sure that what we saw was consistent with the research already done here concerning line length perception and area perception. The paper explores many different graph types and how good or bad humans are at seeing the differences between two data points on those charts.

Conclusion

As mentioned, it was important that we saw line length outperform area perception in our results, and we did indeed see this. This also gave us inspiration to try brightness and velocity perception, since those were not studied in this very thorough paper which is widely used in this domain.

Author

Resnik, Ronald A

Title

Seeing, Sensing, Scrutinizing

Venue

Vision Research

Citation Count

Year

2000

Aim

Large changes in a scene become difficult to notice while the eye is moving, so the paper was intended to understand the different aspects that go into the process of seeing change. They tested changes being focused on and changes that were out of the main focus area.

Conclusion

The outcome of this paper was to quantify and discuss the limits to human attention in regard to transitions in their visual environment. They were able to map out the attentional mechanisms involved in this process.

How it informs Us

Reading this paper assured to us that animation in visualizations can be used to code data and further inform the viewer. This gave us a reason to test the perception of different velocities.

Author

Rink Hoekstra, Addie Johnson, and Henk A. L. Kiers

Title

Confidence Intervals Make a Difference

Venue

Sage Journals

Citation Count

17

Year

2012

Aim

This paper explores in depth the reasons why confidence intervals are critical to understanding the uncertainties in data, and how to apply them. The paper also discusses whether a person's ability to perceive whether an effect is present in the data is affected by presenting the data with confidence intervals. They go on to show that there is not a significant change in this phenomenon.

Conclusion

We used this paper when analyzing our data to decide how best to present it. We ultimately decided to use 95% confidence intervals to summarize our results for each of the 4 visualization types, and we believe this was useful in showing the distribution of the data in addition to the uncertainty that comes with it.

Author

Stevens, SS

Title

Concerning the psychophysical power law

Venue

Quarterly Journal of Experimental Psychology

Citation Count

Year

1964

Aim

This paper is the original experiment that Stevens ran to develop his power law. His goal was to quantify the way that human perception worked with different stimuli. He also developed the process to repeat this experiment for new stimuli as needed.

Conclusion

This was a seminal work in the space, as it gave a quantification to how perception could be measured. As a novel idea, there were not any other papers out at the time that could argue these results. Many experiments since this paper have been pursued because of the work Stevens did.

How it Informs Us

Stevens' original experiment has been questioned and criticized thoroughly since its release, yet it is still used as a guideline for the perception channels. We planned to use the most common visual channels, length and area, along with two unexplored channels to both confirm the conclusions Stevens had come up with and apply this approach to new channels.

Author

Ronold A. Rensink

Title

Change Detection

Venue

Annual Review of Psychology

Citation Count

1260

Year

2002

Aim

Five aspects of visual change detection are reviewed. The first concerns the concept of change itself. The second involves the various methodological approaches that have been developed to study change detection; it is shown that under a variety of conditions observers are often unable to see large changes directly in their field of view. Next, it is argued that this "change blindness" indicates that focused attention is needed to detect change, and that this can help map out the nature of visual attention. The fourth aspect concerns how these results affect our understanding of visual perception. Finally, a brief discussion is presented concerning the limits to our current understanding of change detection.

Conclusion

We used this paper to get a sense of what is and is not appropriate when designing an experiment to measure the perception of changes. This paper has a ton of information on this topic, hence the 1260 citations. We wanted to make sure we could reduce the likelihood of change blindness in our experiments, and we believe we did this well.

Author

George Robertson, Roland Fernandez, Danyel Fisher, Bongshin Lee, and John Stasko

Title

Effectiveness of Animation in Trend Visualization

Venue

IEEE TRANSACTIONS ON VISUALIZATION AND COMPUTER GRAPHICS

Citation Count

321

Year

2008

Aim

The paper evaluates the three visualizations for both analysis and presentation. Results indicate that trend animation can be challenging to use even for presentations; while it is the fastest technique for presentation and participants find it enjoyable and exciting, it does lead to many participant errors. Animation is the least effective form for analysis; both static depictions of trends are significantly faster than animation, and the small multiples display is more accurate.

Conclusion

This paper concludes that animation is not a great way for humans to perceive information about data. We saw from this that our velocity experiment should have the lowest accuracy of the 4 types, and we were right about that. While our experiment does not necessarily measure someone's ability to see a *trend*, this does inform that overall, humans are poor are being able to see the details of animation visualizations.

Author

S. S. Stevens

Title

The Direct Estimation of Sensory Magnitudes

Venue

The American Journal of Psychology

Citation Count

830

Year

1956

Aim

This paper by Stevens is part of the basis for this entire experiment. He goes in detail on how measuring the ratio of a perceived magnitude to a given magnitude can be done, which is called the method of magnitude estimation. This is widely studied, but Stevens was one of the pioneers of this field. He does note that it's hard to ensure credibility with the results, because we don't (or didn't at this time) know how the actual range of stimuli might affect these results.

Conclusion

We used this paper as a foundation for how to conduct the experiments and actually go about measuring the results. While somewhat old, it has been built upon by many other papers and still holds a lot of weight when exploring related works. This work has been criticized because of the uncertainty of the results, but we still felt it was a valuable resource if we wished to improve upon the methods presented here.

Author

Teghtsoonian, Robert

Title

On the exponents in Stevens' law and the constant in Ekman's law.

Venue

American Psychological Association

Citation Count

Year

1971

Aim

The goal of this paper was to argue that there is a constant that affects all the perception stimuli that can be used to show a correlation between them all. The hypothesis is that there is just one scale of sensory magnitude suggests and that there maybe just one value for subjective resolving power.

Conclusion

The result from this paper is that if Weber fractions are transformed to their subjective counterparts by the psychophysical power law, the result for nine different continua is nearly constant at about .03.

How it Informs Us

This paper was used mainly for us to fully understand all the mathematical basis behind estimating Stevens' Power Law. This was a very mathematic-heavy paper so it was helpful for us to read through and understand what we were truly calculating.