

EuroVis 2020 Submission Reviews:

Coordinator Review

Paper Type

Application / Design Study

Scope (relevance to the event)

Core topic, fits well

Contribution I (novelty, originality)

The authors propose three interesting bar plot encodings in the manuscript: the slanted perspective chart, the stepped perspective chart, and the circle perspective chart.

Contribution II (novelty, originality)

Reasonable: some valuable contribution

References

Some important references are missing

Utility, Importance (relevance in general)

Case for utility not compelling

Soundness (technical soundness, soundness of approach)

Approach is (technically) correct and well justified

Reproducibility

Many issues discussed, but some important details left out

Presentation Quality

Poor: major structural changes or extensive wordsmithing needed

Argumentation Overall Rating

The manuscript is not ready for publication at EuroVis2020 conference because I have two major concerns:

a) I encourage the authors to focus on the important arguments, and to revise the manuscript to present a structured line argument; I am sorry to say that I strongly feel that the manuscript lacks such a structured line of argument (please see also my detailed comments),

b) I strongly feel that the study does not convincingly demonstrate the benefits and drawbacks of the proposed bar plot encodings; I encourage the authors to consider the detailed comments of the InfoVis reviewer as a guideline to improve the scientific merits of the manuscript.

Expertise

Expert

The Review

The manuscript proposes three interesting bar plot encodings: the slanted perspective chart, the stepped perspective chart, and the circle perspective chart. I consider the proposed encodings as interesting design alternatives to classical bar charts addressing an important challenge in the visualization of quantitative data: bar charts often obscure variations among small quantitative values which poses a challenge for users when trying to compare ratio between two categories.

In reading the manuscript, I strongly felt that the authors do not provide a convincing line of argument to motivate the proposed visual encodings to readers; I strongly feel that the manuscript in its current writing presents a collection of connected ideas and a listing of some loosely connected results which I observed in the following issues:

- a. I argue that the slanted perspective bar chart and the stepped perspective bar charts address two different challenges: the slanted perspective bar chart introduces a special kind of geometric transformation to address the problem that bar charts often obscure variations of small quantities which poses a challenge for users when comparing ratios, and the stepped bar perspective bar chart address the challenge of wasting precious screen space (to improve data-ink ratio). I encourage the authors to center their line of argument along the (distinct) analytical goals of potential users that the proposed visual encodings may support.
- b. I consider the third perspective chart, the circle perspective chart, as infographic or interesting artistic visual encoding for general audiences (perhaps to provide some visual pleasure to readers of a journal). I suggest excluding this visual encoding from the study because of this reason (though I like the artistic encoding but I also think it should not be part of a scientific study).

- c. The authors introduce a special kind of geometric transformation, perspective distortion, to the classical bar chart encoding. I am convinced that this geometric transformation impacts human perception of quantitative information. Unfortunately, the authors do not explore, and discuss this relationship in detail; neither in related work nor in the user study. I encourage the authors to focus on this relationship because it is a unique feature of the proposed visual encodings. I am convinced exploring the question on how perspective distortion impacts the perception of quantitative information and ratios has the potential to report some interesting novel arguments to the visualization community.
- d. I strongly feel that the authors do not relate their ideas to the existing bar plot methods in the related work section. I also think that some methods, such as pixel bar plots, are not strongly connected to the proposed visual encodings. I feel that the related work section in its current writing is a list of some related work without any discussion on how they relate to the proposed visual encodings.
- e. I would like to see a discussion of the decisions the authors made in their design study. Why is it important to compare classical bar charts to circular bar charts? An interesting approach might be to group visual encodings according to some objective criteria together, and then compare different groups; or similar.

In reading the manuscript, I also strongly felt that using classical bar plot and slanted perspective bar chart depends on the user's goal. Table 1 suggest that classical bar charts performs better than the slanted perspective bar chart when reading out quantitative information whereas slanted bar charts perform better when trying to compare ratios. What can we learn here? I encourage the authors to include different analytical goals into the study. Since slanted perspective bar charts and bar charts with logarithmic scale seem to share similar goals, I also suggest a detailed comparison of these methods.

As I stated earlier, my major concern is about the presented user study; though the authors say in their revision report that they revised and re-ran the study, I still need a better motivation and a detailed discussion of the result. Unfortunately, the authors do not draw any scientific conclusions from their study; though I feel that some of the results are interesting.

Committee Member review

Paper Type

Evaluation

Scope (relevance to the event)

Core topic, fits well

Contribution I (novelty, originality)

This is an interesting paper that tests what it sets out to test, but the results and interpretation section needs more development before I can be sure.

Contribution II (novelty, originality)

Reasonable: some valuable contribution

References

At large, all important references are included

Utility, Importance (relevance in general)

Addresses a clear need

Soundness (technical soundness, soundness of approach)

Some concerns on correctness, some choices questionable

Reproducibility

Everything critical is discussed

Presentation Quality

Good: only minor typos and grammar problems

Argumentation Overall Rating

I like this topic, and the paper makes a decent contribution, but the second half (results & discussion) needs more work first.

Expertise

Knowledgeable

The Review

The authors outline multiple styles of bar charts that can use perspective cues to compress the upper end of the axis, to allow a chart that shows both small and large values in a potentially more intuitive way than log-scales. They evaluate these designs in comparison to linear y-axes across a set of standard tasks (find range, read value, etc).

The designs are clever (I don't know this area enough to say how novel they are) and an evaluation of them compared to traditional charts would be a valuable contribution. The first half of the paper is well written and interesting (though see minor comments below), but the main issue is that the presentation and discussion of the results is tough to follow and incomplete.

- (major) Why is all of the data expressed as absolute error? One of the key worries for these perspective charts is that an e.g. ratio judgment would ignore the perspective, and systematically overestimate the ratios of small values to large values, but this issue isn't mentioned.
- Graphs would help for the error values, the tables are tough to browse quickly. The data would be far easier to digest if all results were shown in a single coherent graphic (including the preference data)
- Where is the response time data? The conclusions mentioned 'timing' not being worse for the new design, but I didn't see the data in the paper?
- The reader needs more unpacking of the tasks (there's room in the manuscript page limit), show multiple and show the tasks, so that they can get a sense of what the participant was doing.

Specific issues:

- The results section is confusing to follow because the reader needs to constantly look back within the text to match the jargon for the names (slanted charts, stepped charts, circular charts, circular perspective charts) to the type of chart. Little representative icons for each would be much easier to follow. Similarly, eliminate acronyms like DMD and just spell out the task, there's room.
 - What is a scale-stack chart? It's a core comparison case for the authors' designs, but it's never depicted or even described in the paper, the reader is forced to track down the citation.
 - Why do the sample graphs alternate between orange and blue colors, is that meaningful?
 - The beginning of section 1 + 2 both start with calls to Big Data Rising, but the charts tested all have ~20 values in them at max?
 - I don't understand what Figure 13 is showing. It seems to be collapsing across tasks but I'm not sure what that adds?
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Reviewer 1 review

Paper Type

Algorithm / Technique

Scope (relevance to the event)

Core topic, fits well

Contribution I (novelty, originality)

The paper presents a set of designs for dealing with data with large dynamic range by using perspective warping. A number of related designs are proposed; a simple bar chart with a single-point perspective applied, one where focal "step" areas are rendered normally, but areas of context recede into the foreground, and one with a circular layout. This warping is a natural visual metaphor for large values "receding" (in a way that log scale bar charts are somewhat unnatural) in a way that doesn't elide the remaining context (as is the case for the most usual solution to this problem, broken axes bar charts). It's a common problem that lacks an obviously best solution, so new designs in this space are useful.

Contribution II (novelty, originality)

Reasonable: some valuable contribution

References

At large, all important references are included

Utility, Importance (relevance in general)

Case for utility not compelling

Soundness (technical soundness, soundness of approach)

Some concerns on correctness, some choices questionable

Reproducibility

Everything critical is discussed

Presentation Quality

Fair: some structural changes or some wordsmithing needed

Argumentation Overall Rating

While the designs are interesting and well considered, I was skeptical of the size of the contribution, as well as evaluation's utility. As such my score is slightly negative, but I do appreciate the clarity and thoughtfulness of the submission as it stands.

Expertise

Knowledgeable

The Review

This paper proposes a family of designs for a common problem: what to do when you have a wide dynamic range of values that you want to visualize in a bar chart. Existing solutions involving multi-scale insets or y-axis truncation or logarithmic scales have their drawbacks, so having more options to choose from is beneficial. This is also a class of problem where we don't have a lot of empirical data about our designs, so more information here is valuable. The authors' solution of using perspective drawing makes intuitive sense (this is one of the rare class of papers where you can look at the figures and say "ah, I get how this works," which I always enjoy). The paper itself is straightforward to read, and got me thinking about other places where these sorts of designs could be valuable (Text visualization in particular has a few examples of using "lenses" to create multiple areas of focus, similar to the stepped bars proposed by the authors).

That being said, I had some concerns about the paper as it currently stands that bias me away from acceptance. Namely:

Central Issues:

1. I'm not certain if the size of the contribution warrants a full paper. The proposed design is not precisely novel (for instance using 3D/perspective to deal with focus/context issues in bar charts is discussed in blog posts like Kosara's "3D Bar Charts Considered Not That Harmful"). I also had concerns about the evaluation (see below) which make it hard for me to see the study as a central contribution either. My recommendation is that the authors condense their paper (perhaps by removing the circular charts and some extraneous details about perspective drawing) and submit as a short paper or poster (a poster with a similar design question and contribution size is Yalçın et al. "Piled Bars: Dense Visualization of Numeric Data", for instance).
2. The study design, and the justification for the study design choices, could be improved or made more explicit. In particular:
 - What were the research questions and hypotheses that motivated the experiment? The header of section 4 mentions that the goals were to evaluate the readability and novelty of the charts (I'm not certain how one quantitatively evaluates novelty), but not necessarily what would count as sufficient legibility. To me, the argument here would seem to be that the traditional bar charts with high dynamic range are not legible, or less readily legible, so the authors would

presumably be fishing for:

- a. evidence their designs outperform traditional bar charts on tasks, and perform at the very least no worse than other proposed multi-scale bar chart designs. Failing an unambiguous signal on accuracy (which I wouldn't necessarily expect; these are mostly "either you get it or you don't" affordance questions, and it's not obvious to me that any of the proposed or existing designs lack affordances for these tasks), then the other option would be:
 - b. that participants can perform their tasks faster. So I would expect a design that compares the new proposed designs against traditional bars, and then against one or two other methods. The current pairwise design only looks at a few comparisons rather than all of them. Then, once the task analysis was complete, I would expect an analysis of response times (which is honestly where I'd anticipate the most difference). Section 4 promises that both accuracy and speed were measured, but I'm missing an analysis of RT in the document.
- There should be a figure of what a particular dataset looks like for all of the conditions in the experiment; I had to consult the Scale-Stack Bar Charts paper to figure out what those looked like. Ditto the "radial" charts. The authors include (I think) all of their stimuli in the supplement, so moving this to the main paper would seem to be beneficial.
 - Figure 12 is unnecessary. One can just report that each participant saw two types of graphs, with presentation order blocked. There's no need to graphically show this.
 - Figure 13 aggregates across all tasks. I'm not certain that is appropriate given that the tasks are very different in terms of expected difficulty.
 - There is very little discussion of the results in the paper. What was surprising or unexpected? Do the results match up with the authors' hypotheses? What does the evaluation tell me that I didn't know before? Even some interpretation of the findings would be helpful here.

Minor Issues:

1. In the prior reviews the terminology of "large scale" data is called out as potentially ambiguous and confusing. While the authors have aligned the terminology somewhat, I think "large dynamic range" might be a less confusing term than "scale" or "large scaling factor."
2. I agree with the prior reviewers that the circular perspective charts stick out here. The problems raised in legibility and label placement don't seem addressable in the current design. As such, it was very difficult for me to extract values from any of the circular examples in the paper. Figure 4 in particular is kind of fun, but shows some of the drawbacks of the circular technique (especially since the perspective drawing is not applied to the interior details of the buildings as accurately as to the building exterior). I know that e.g. Milwaukee is the most popular city in Wisconsin, but I have no idea how much more populous it is than, say, Madison. And it takes me quite a while to figure it out even with the

unstylized version (I pretty much have to just count bars, which was difficult to do in the printed version of the paper due to aliasing).

3. I'd be curious how interaction would be employed in these charts (for instance choosing the degree of "tilt" or selecting where the "steps" occur), especially in light of e.g., Ritchie et al. "A Lie Reveals the Truth: Quasimodes for Task-Aligned Data Presentation", where it seems like people really struggle with interpreting changes of scale or starting point without interactivity.
4. One of my pet peeves is sentences and paragraphs that attempt to justify vis papers in light of the increasing size and complexity of data, especially for techniques like these that could be as easily used in 1720 as 2020. Both the intro and background of the paper begin with these sort of generalities. There are other ways to motivate this paper beyond appeals to the data deluge.

Reviewer 2 review

Paper Type

Algorithm / Technique

Scope (relevance to the event)

Core topic, fits well

Contribution I (novelty, originality)

The contribution is what is also claimed by the authors a variant of bar charts, called perspective charts, and variants (stepped and circular, respectively, perspective charts) for large range quantitative data.

The idea of perspective charts is nice and potentially useful.

Contribution II (novelty, originality)

Reasonable: some valuable contribution

References

At large, all important references are included

Utility, Importance (relevance in general)

Addresses a clear need

Soundness (technical soundness, soundness of approach)

Approach is (technically) correct and well justified

Reproducibility

Everything critical is discussed

Presentation Quality

Poor: major structural changes or extensive wordsmithing needed

Argumentation Overall Rating

The contribution of the paper justifies its publication, but not at its current length. The contribution is easily explained and the paper provides all necessary details to understand the need that is addressed and the technical details of the solution within the first few pages. The exposition can easily be shortened to fit within four pages.

If the authors want a full paper they should add more content. Adding content is easily possible since there are some issues that are not addressed:

1. Clarify the relation to log-plots. I might be totally wrong here, but are perspective charts not variants of log-plots (with a small basis for the logarithm)?
2. What happens if you take the bars in your perspective plots and draw them non-slanted as in normal bar charts while keeping their length. The deeper question is, does the slanting help humans to interpret the compressed scale that is used for perspective charts. Your arguments for Section 2.3 on human perception point in this direction but could be extended.
3. Large scale could be defined formally, for instance by the ratio of the largest and the smallest data value.

A weak point of the paper is the discussion of related work. The discussion should be more thorough. For instance in Section 2.1, stacked bar charts are not an alternative to bar charts, but display an additional categorical dimension that is not covered by ordinary bar charts. Also, starting the related work section with a statement about the increasing size and complexity of data sets is not to the point. The data sets addressed by the presented technique are neither large nor complex. Here, the reader (or at least me) would be more interested in alternative techniques besides log-plots and broken bar charts that address exactly the same problem, namely visualizing large range quantitative data. The discussion in Section 2.2 is more about extensions of bar charts that could also be used together with perspective charts. So it is more like an outlook.

The paper is sloppily formatted. Figures are not well placed.

I cannot really comment on the evaluation. Perspective charts seem reasonable and useful to me. The evaluation seems to find that they are superior to standard bar charts on some common tasks, but I am not sure of the significance of the results.

To summarize my review, this submission could make a great short paper if properly shortened since it introduces a neat and potentially useful idea. For a full paper it needs much more substance.

Expertise

Knowledgeable

The Review

There is nothing that I want to add to my arguments for the overall rating.