Reviewer 1

The premise of this paper is interesting and useful. It was a pleasure to review it.

The narrative examples, figures, and tables are crucial to communicating the ideas, so I have commented in detail on them.

Abstract:
Line 3. Suggest changing “understanding” to “portrayal”

Page 4
Line 10. “[T]emperature” should be “elevation.”

Page 5
Line 13. I don’t understand the example from Chrisman (2002). Explain further or create a different example.
14-15-16. Delete because this sentence gives a different opinion than the next.

Page 7
Line 6. “When measurements are added…. "[M]easurements” is a convenient word to the argument but “observations” is more accurate. Use the latter.

Figure 1. Re-label the light key item as “other counties in Ohio.” Use county names instead of A, B, C, D; the discussion in the text supports that. Figure 1 then becomes the reference map enabling simplification on the thematic maps that follow.

Line 14. This works because of nesting of units. Add that point.

Figures 2 and 3. These are about categories, not accuracy of areal or distance representation. Take off reference information—north arrow, scale, Lake Erie, OHIO.

Figure 2(a). Use different hues to reinforce that these are non-ordered categories. Then use the same color scheme on Figure 3(a). Take off the current, lone key item and, in the space cleared by removing north arrow and scale bar, add a key. A key wouldn’t be necessary except that the map needs an “other land use” category to explain the background areas.

Figure 2(b). Use a graduated color scheme in one hue to reinforce that these are ordered categories. Then use the same color scheme in Figure 3(b).

Figure 2(c). The example is strained. Four geographic areas, four data points, are not enough to generalize into classes for a choropleth map, which is what would be expected here for a population density map.

19-20. This sentence is important, but does not follow from the one before it.

Page 8
Figure 3(a). Good that there is a key but simplify—take off the key box and the key title “Urban Settlement Types.” Instead of “study area” as a key item, label it “other land use.” Take Lake Erie off the map to eliminate confusion about whether it’s part of the study area.

Figure 3(b). Same changes as suggested for 3(a).

Figure 3(c). Remove county labels. Use graduated color scheme in same hue as in 2(c). Color spots will coalesce and make the point nicely.

Line 18+. Page 6 lines 21-22 properly acknowledged the space-time literature but also that “we will deliberately limit this paper to deal with fixed time representations” so drop time and concentrate on space hereafter.

21. “Empirically assigning” is unclear. Does this mean values are assigned rather than numbers used simply as labels?

Page 9
Figure 4. Too simple. The better figure to place here already is used as Figure 8(a). So drop Figure 4. The narrative explains well enough without illustration.

Page 11
Lines 1-4. Similar-or-different is not a good example of contextual scale. It’s still categorical. Or else the argument isn’t clear yet.

Page 13
Line 20. “Census units.” Specify. Tracts?

Page 14
Line 6. Change “downtown” to “urban.” “Downtown” is not on Figure 6 and would need to be added. Instinctively it would be nested within the red line for urban, but it might not fit there if defined in the terms from page 13 line 21. Zero distance to city center is easy to imagine but "downtown" may have a low residential population density.

8. Spatial space—is this a generally accepted term? The redundancy is a bit of a show stopper. Does the literature yield any alternative phrase?

15+. From the point of view of the target audience (the attentive but non-expert reader), this paragraph “feels” the same as page 12 line 5+. That deals with category semantics, this with cognitive theory of conceptual spaces. Don’t rewrite the section but do help the reader explicitly know why this paragraph is different and necessary.

Page 15
Line 15-16. “[A]nd it can be derived…” Non sequitur. Leave the phrase out. The next sentence implies it.

Table 3. Compact the table.

Page 16
Lines 1-3. The explanation of zero to one scale is different on Table 3 than here. This is more accurate. Copy on to Table 3 or delete the explanatory line there.

Figure 7. Clustering is the message but a couple of places that really matter to your argument, e.g., deciduous forest and evergreen forest, have dots that overlap so closely that they might not be noticed. Perhaps adding a thin black or white line around the circles would differentiate the circles and draw the eye to the tight clusters. Also, these colors give the impression that they correlate with colors used on Table 1. If so, make that more overt. If not, try to find an example for Table 1 that would enable use of a noticeably different color scheme.

21. “Forest categories” and “Residential/Commercial/Industrial” refer too casually to the components of Figure 7. Replace these phrases with the actual lists of categories from the map referred to.

Page 17
Line 5. “Temporal” was set aside early in the paper. You might finally include it here, but make it more obvious how it would work with “measurement of distances, clusters and other possible quantitative spatial analyses.”

Figure 8 (b). Figure 3(c) has high density at the top of the key and low at the bottom—the reverse of this key. For consistency, flip this one so that urbanized is at the top.

Page 19
Lines 2-4. “Scalar” is a new term. Previously the term used was “interval” so use it here.

Actually, this sentence is an unsatisfactory summary statement and can be left off.

7-8-9. Again, the space-time measurement concept is uneasily inserted.

12. “Topologically structured”—don’t introduce a new term in the conclusion.

Reviewer 2

This paper deals with a number of issues when mapping and analysing categorical data. In particular, it argues that it is possible for categorical data to have some kind of 'ordering' although it may not be an ordinal measure in Stevens (1946) original sense. Generally the paper is clearly written, and the examples used do a good job of illustrating the arguments put forward. athere are one or two points that I would like to make, however:

Initially there is discussion about representation of space and time, but there is little analysis of temporal aspects of this issue - and the example is purely spatial. I feel that consideration of spatial aspects at this stage stands well in its own right, and that the temporal discussion does little to help an already solid argument. Although it may be useful to acknowledge that this issue clearly has a temporal aspect, the current discussion dwells too much on this area without reaching a conclusion and detracts from the momentum of the paper.

Also, the paper considers the notion of constructing a feature space between categories - as a means of providing ordering to categorical data. This is an interesting and useful idea, but as well as the approaches they quote - as one example semantic similarity measurements - a fair amount of statistical work has been done in this area. For example correspondence analysis attempts to
represent the rows and columns of a contingency table (whose labels are categorical) geometrically - see
Greenacre, Michael J. (1984) Theory and Applications of Correspondence Analysis. London: Academic Press.
for example -
and similarly Homogeneity Analysis (HomAls) deals with multivariate categorical data - see
Gifi, A. (1990), Nonlinear Multivariate Analysis, Chichester: Wiley for example.

I feel that some discussion of these kinds of approach would add depth to the paper - particularly as the current argument relies strongly on the idea that feature spaces are derived using a semantic separation measure - however I wonder whether such a measure can be unambiguously derived in all situations.

Thus, I feel this is a good paper, although I would like to see some of the above issues addressed before final publication.