

Comparing Choropleth Maps

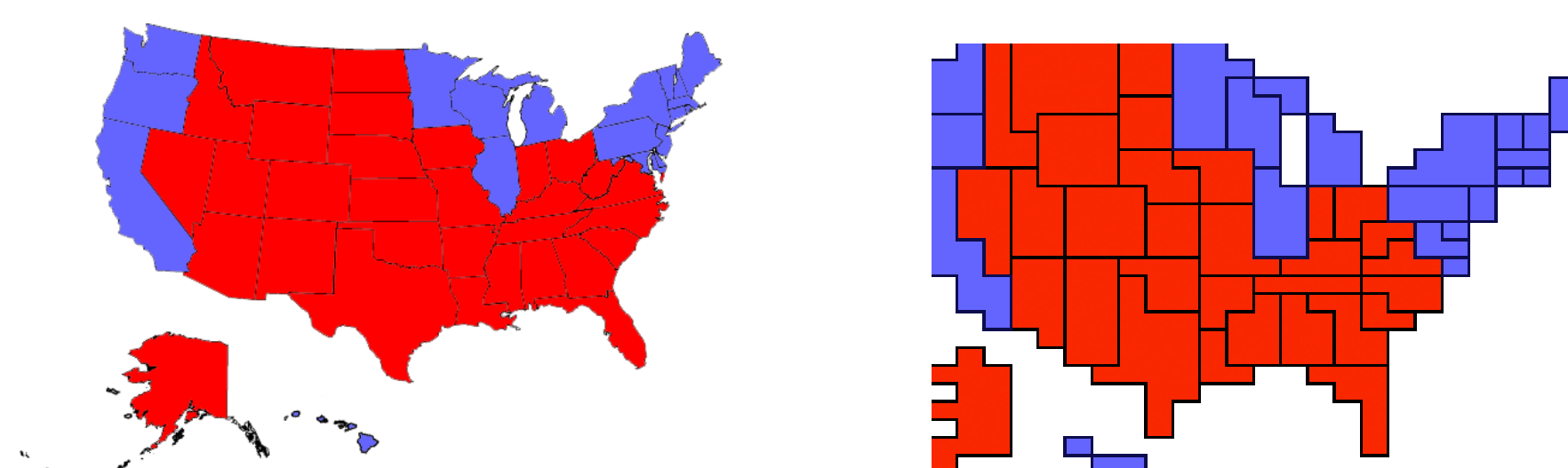
A pilot study on the usability of Multiple Small Maps



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What are Choropleth Maps?

“Choropleth” is the name of the kind of maps we commonly use for showing statistical information as it varies from one predefined region to another by using colors. Perhaps the most famous of these is the electoral map, which shows which states voted for which presidential candidate. The map on the left is a standard choropleth map showing the results of the 2004 presidential election. The map on the right shows the same information, but has been distorted to make it easier to see the colors of the smaller states such as Maryland. One goal of this project is to determine whether there is an optimal level of distortion to make the map legible for all states.



Experimental Conditions

Our 64 participants were shown screens with one map at the top and four maps at the bottom, one of which matched the map at the top in the way the states were colored. Accuracy and response time were measured. Many factors were varied to find out which ones affected performance.

Within-Subject factors

Overall Size - 6 sizes were used, from 144 x 144 pixels to 36 x 36 pixels.

Distortion Level - 6 Levels were used, from 72 x 72 (low distortion) to 12 x 12 (high distortion). Note that not all combinations of Overall Size and Distortion Level were possible.

Difficulty - 3 Levels of difficulty were used. More difficult items had answer choices that were more similar, and what differences there were occurred in the smaller states.

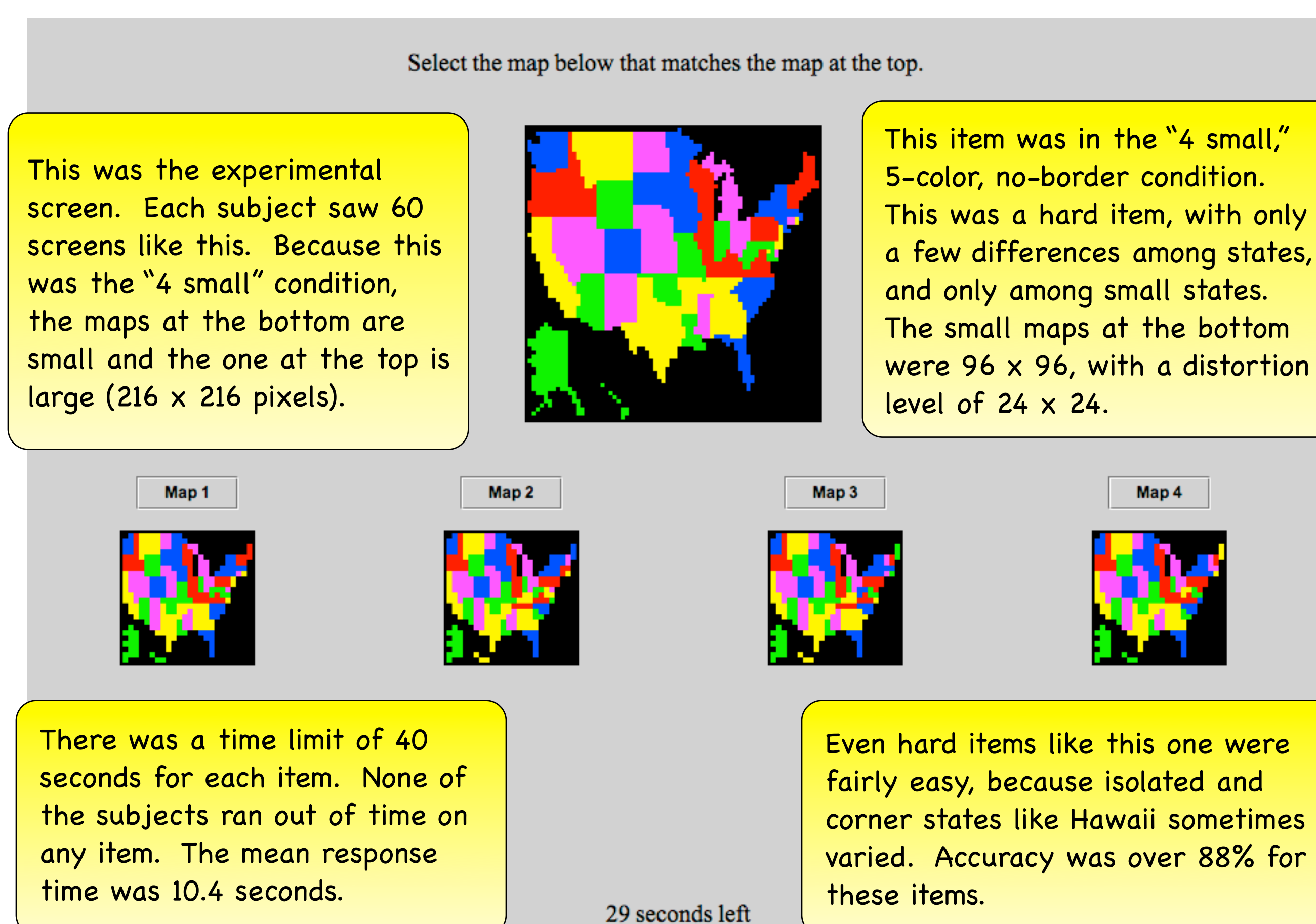
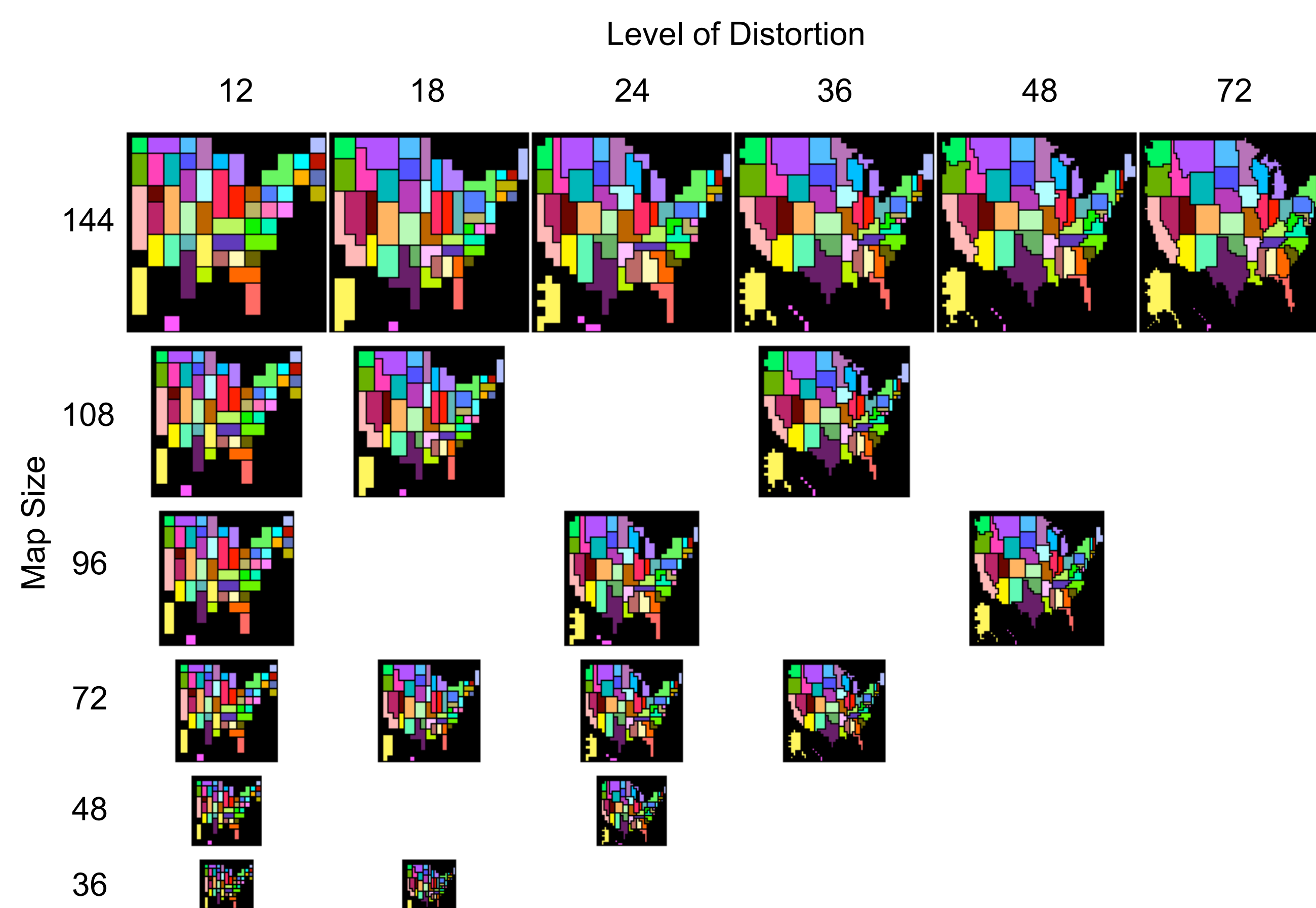
Between-Subjects Factors

Color - Either every state was a different color, or only 5 colors were used.

Border - Some maps had a thin black border between states. This border did not affect the overall size of the map.

Question Type - Either the top map was large and the answer choice maps were small (4 small) or the top map was small and the answer choice maps were large (4 large). Only the small maps varied in size from one item to another.

Map Sizes and Distortions



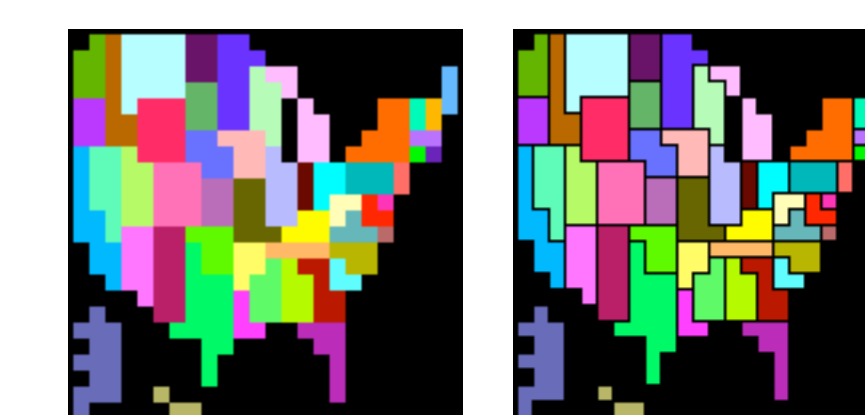
Results and Future Research

Overall accuracy was high (over 93%) and response time was generally low (the median was 8.5 s.), and the differences between conditions were fairly small. The items that were supposed to be more difficult generally were, although performance was good on these items, too. Performance was generally better for large maps than for small maps, although this was not uniform. We did not find differences among color or border conditions, although there might not have been enough power because the items were too easy. We did find that under some conditions, moderate levels of distortion resulted in faster response times than high or low distortion. We plan to continue this research with a broader design.

Total Screen Size	Distortion						Total Screen Size	Distortion					
	12	18	24	36	48	72		12	18	24	36	48	72
144	95	93	95	95	97	95	144	10.2	9.8	10.2	9.2	10.6	10.9
108	96	97		93			108	10.1	9.7		10.2		
96	93		96		92		96	10.9		9.8		9.9	
72	91	93	95	93			72	10.9	9.8	10.2	10.7		
48	92		92				48	11.0		10.8			
36	90	89					36	11.5	10.8				
	Accuracy %							Time (sec.)					

Border

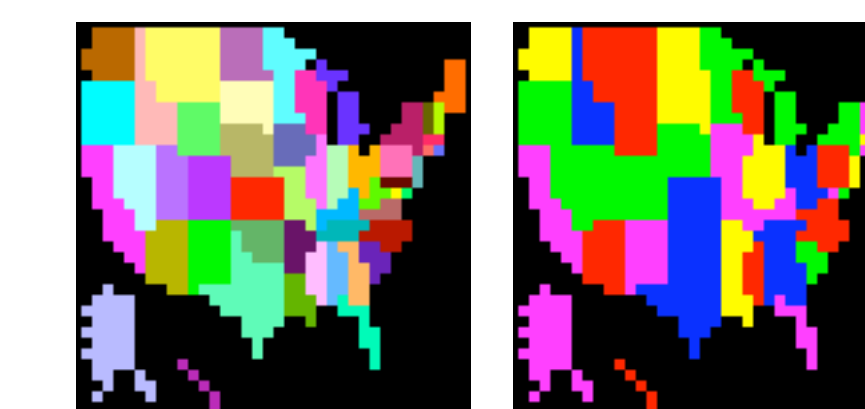
No Border
93.0%
8200 ms



Border
94.2%
8764 ms

Color

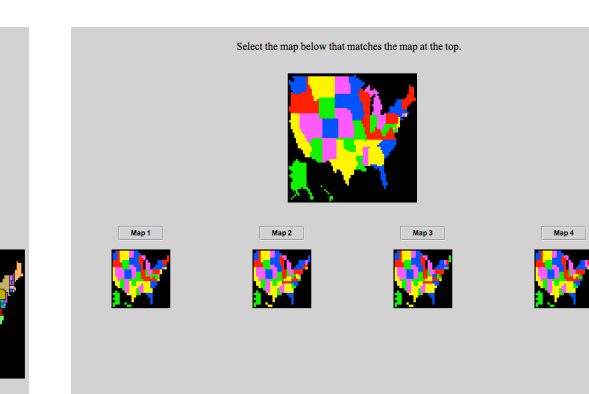
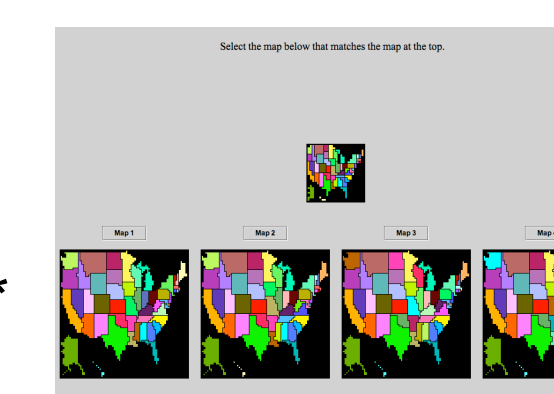
51 Colors
93.7%
9027 ms



5 Colors
93.7%
7936 ms

Question Type

4 Large
94.5%
9229 ms *



4 Small
92.7%
7734 ms *