In *CP 94*, you will find two PEER-REVIEWED ARTICLES. In the first, Georgianna Strode and colleagues revisit Bruce Trumbo's ideas from the 1980s on bivariate choropleth map design. They offer a set of focal models that illustrate how bivariate choropleth maps can be designed to answer one of three types of questions. In the second article, Chelsea Nestel combines insights from cartographic semiotics and experiential graphic design to analyze the maps and signage at the ancient site of Troy. Her work underscores the importance of good design in enhancing the user experience at cultural heritage sites, especially those at which maps can help visitors to imagine landscape features that are now present only as remnants of their former structure.

At a time when many of us might like to escape planet Earth (or maybe only your house-mates!), you can travel to the Moon with Eleanor Lutz's piece in PRACTICAL CARTOGRAPHER'S CORNER. It describes how she created the *Geologic Map of the Moon* that she displayed in the 2019 NACIS Annual Meeting's Map Gallery.

In VISUAL FIELDS, Darin Jensen shows it is possible for people from all over the world to quickly collaborate to create something together in his piece on Guerrilla Cartography's Atlas in A Day project, which took place in October 2019.

Four book REVIEWS complete CP *94*. Michelle Church reviews *Wild Migrations: Atlas of Wyoming's Ungulates*, a thematic atlas produced through a collaboration between several Wyoming-based scientists and science communicators, and cartographers at the University of Oregon's Infographics Lab. Allan Mustard, the banquet speaker at the 2019 NACIS Annual Meeting, draws on his past experience as diplomat posted to the USSR to ably provide a perspective on John Davies and Alexander Kent's *The Red Atlas: How the Soviet Union Secretly Mapped the World*. Daniel Cole summarizes the strengths and weaknesses of *GIS for Science: Applying Mapping and Spatial Analytics*, a recent Esri Press book edited by Esri's Chief Scientist, Dawn Wright, and Christian Harder, which profiles interesting scientific projects that make use of mapping technologies. Finally, Jenny Marie Johnson compares the contents of three recent volumes penned by Edward Brooke-Hitching, an English writer and map collector, that tell the story behind a selection of historic maps. Each volume uses a different lens through which to view its selection of maps.

Please take care of yourself and each other. I hope *CP 94*'s contents provide you with a few hours of mappiness in these uncertain times.

Amy L. Griffin (she/hers)
Editor, *Cartographic Perspectives*

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Operationalizing Trumbo's Principles of Bivariate Choropleth Map Design

Georgianna Strode
Florida State University
gstrode@fsu.edu

John Derek Morgan
University of West Florida
jmorgan3@uwf.edu

Benjamin Thornton
Florida State University
bwt13b@my.fsu.edu

Victor Mesev
Florida State University
vmesev@fsu.edu

Evan Rau
Florida State University
evanrau@gmail.com

Sean Shortes
Florida State University
seanshortes@gmail.com

Nathan Johnson
Florida State University
mrchocoborider@gmail.com

Trumbo's (1981) ideas on bivariate choropleth design have been underexplored and underutilized. He noted that effective map design (including color selection) is directly informed by the intended goal or use of the map (i.e., what questions might the map answer), and he identified three common spatial relationships that can be displayed by a bivariate choropleth map: inverse relationships, a range of one variable within another, and direct relationships. Each is best suited to answering different map readers' questions. Trumbo also suggested sample color palettes to focus the map reader's attention on pertinent data. In consultation with Trumbo, we extended his ideas, first by creating focal models that illustrate his three spatial relationships. We then constructed sample maps to examine each of the focal models, and finally compared each model by mapping the same two data sets (of obesity and inactivity). We investigated the visual differences in each of the resulting maps, and asked spatial questions regarding the relationships between obesity and inactivity. Our work validates Trumbo's ideas on bivariate choropleth map design, and we hope our focal models guide cartographers towards making color choices by linking their map purpose to the appropriate focal model.

KEYWORDS: Bivariate choropleth map; sequential color scheme; diverging color scheme; color selection

"Confusion and clutter are failures of design, not attributes of information. And so the point is to find design strategies that reveal detail and complexity — rather than to fault the data for an excess of complication. Or, worse, to fault viewers for a lack of understanding."

Edward Tufte, Envisioning Information, 1990

BIVARIATE CHOROPLETH MAPPING

WHILE UNIVARIATE MAPS, which represent one thematic variable at a time, are both standard and widespread (Jin and Guo 2009; Brewer 1994), bivariate maps have the potential to reveal spatial relationships and patterns between two variables on a single map more effectively than by using two side-by-side univariate maps (Carstensen 1986). Bivariate maps can make use of a variety of symbol strategies, such as color combinations (as we explore in this paper), shaded proportional symbols, shaded cartograms, split symbols, shaded isolines, or star plots (Friendly 2008; Kimball and Kostelnick 2017). Though they can represent any pairing of thematic variables, they are typically employed to examine the relationships between socioeconomic variables, such as elderly populations and ethnic minorities, or levels of educational attainment and household income. A well-constructed bivariate map displays both the distributions of its individual datasets and their degree of interaction, and—at least for some visual variable combinations— variation in one thematic variable does not impair the ability to read the other (Ware 2009).

The alternative to bivariate mapping is to compare two univariate maps side-by-side; often inconvenient and inefficient (Leonowicz 2006; Wainer and Francolini 1980;