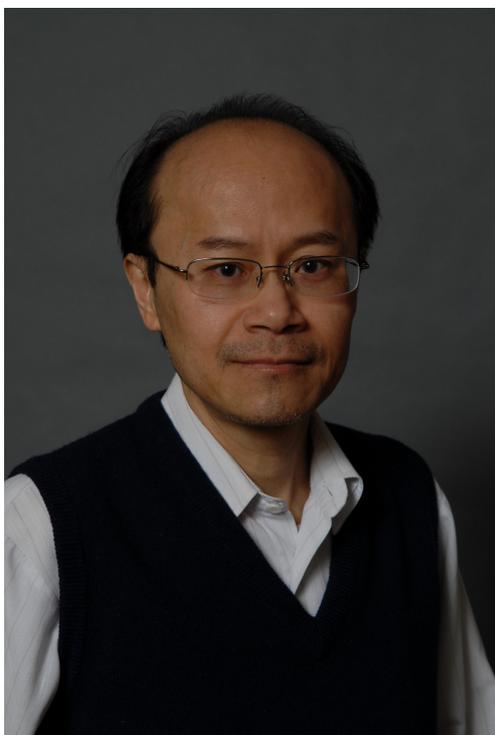


Conversation with David W.S. Wong¹

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The disciplines of geography and statistics cross paths in many research areas, and this trend will undoubtedly continue in the future as scholars in both fields explore common interests using shared approaches, methods, and technologies. In this Conversation conducted April 18, 2017 between David Wong,

Professor, Department of Geography and Geoinformation Science, George Mason University, and Nancy Torrieri, Interview Editor, we learn of a multidisciplinary career path grounded in geography, but taking flight in many directions involving statistics. David's research in the spatial dimensions of segregation and ethnic diversity; the geo- and statistical visualization of spatial data quality; spatial epidemiology and public health; and other areas has resulted in over 70 refereed articles for professional journals and working relationships with many geographers and scholars in other disciplines in the U.S. and abroad, and in various universities and federal agencies. He is co-author (with J. Lee) of *Spatial Analysis with ArcView* (Wiley & Sons, 2001) and *Statistical Analysis and Modeling* (Wiley & Sons, 2008). He is also co-editor (with C. Yang, Q. Miao, and R. Yang) of *Advanced Geoinformation Science* (CRC Press, 2010) and co-editor (with C. D. Lloyd and I. G. Shuttleworth) of *Social-spatial Segregation: Concepts, Processes and Outcomes* (Bristol, UK: Policy Press, 2014). David is currently working on a National Institutes of Health Grant (NIH R01) on spatial data quality. In addition to teaching at George Mason University, David serves as Adjunct Professor, Department of Health Services Policy and Management, Arnold School of Public Health, University of South Carolina.

Interviewer: David, tell us about your background, education, and research interests

I grew up in Hong Kong and completed my undergraduate training in traditional geography with little emphasis on tools and techniques, but more on concepts and to some extent theories and models, then completed my Ph.D. in Geography at the University

¹The views and opinions expressed in the conversation are those of the interviewee and do not necessarily reflect the policy or position of the Statistical Journal of the International Association for Official Statistics nor IOS Press.

of Buffalo. At that time, the University of Buffalo had one of the earliest programs in Geographic Information Systems – more widely known today in academia as Geographic Information Science (and abbreviated as GIS in either case). I was exposed to technical areas of geography, GIS and spatial statistics, there, but I was trained as a human geographer with an interest (especially) in population and urban geography. I have published in many fields in Geography, both human and physical geography, including remote sensing and atmospheric dispersion, both of which are quite different from human geography. Over the course of my career, I have written most frequently on the measurement of spatial segregation. In the future, I would not be surprised if I started publishing in fields that are new for me, about a topic I have never previously had much interest in as far as my research is concerned.

Interviewer: How have the disciplines of geography and cartography evolved since the time when you were an undergraduate or graduate student?

Twenty years ago, GIS gradually emerged as a major subfield within geography, while cartography has been around for a long time – centuries. At that time, GIS and cartography were a relatively small part of geography – just getting popular and a little more accessible. Geographers were still talking about geographical concepts related to space, scale, dynamics, and interaction, and cartographers focused on human perception of maps and cognition of maps but there were not a whole lot of connections to GIS or computers before that time. So, the major differences between geography practiced today as compared to geography practiced more than twenty years ago is attributable to technology. Today, geography is dominated by computers and information technology – it would be rare to find a geographer practicing geography today without GIS or computers. That's a good thing, as long as the respect for traditional geography is not lost. Another difference between the practice of geography today and in the past is the relationship between cartography and GIS. In the past, these were separate subdisciplines of geography. But the boundaries between those subdisciplines have blurred since then. In fact, one of the major cartographic journals has changed its name to include "GIS" (to be more accurate, Geographic Information Science) in the journal's title. It would be highly unusual to find a geographer making a map without GIS today.

Interviewer: You seemed to suggest earlier in our interview that in the rush to embrace GIS, some geographers have not paid as close attention to traditional geography as they should.

Yes – it's an issue now. Traditional geography, which dominated geographic research until at least the 1960s, and dates back centuries before then, is associated with two distinct subdisciplines, human and physical geography, and is dominated by area studies and spatial analyses of natural and human relationships with land. Geography is a multidisciplinary subject by itself as it shares the domains of study with other physical and social sciences disciplines. Subfields in geography such as climatology share interest with meteorology and atmospheric science; geomorphology with hydrology and geology; political geography with political science; and health geography with public health, as in many geography subfields. The quantitative revolution, computers, new technologies, and new methodologies changed the discipline in many ways, for example, spawning new technical subfields such as remote sensing, GIS, and spatial statistics. To some extent, the embrace of effective new tools is a healthy thing for the discipline, but losing traditions and concepts that once were central to the practice of geography is not a good thing. Some of my colleagues would disagree, and it's a highly debatable issue, but I do know a significant number of geographers have been concerned about the over-emphasis of GIS at the expense of the field of geography. Geographic concepts – such as space, place, regionalization, mobility and migration, diffusion, spatial interaction, and environmental perception – are the foundation on which geography, even as it is practiced today, must stand. On the other hand, today, it is ironic we see that a lot of GIS users, including GIS faculty at many universities, know very little about geography. Some of these non-geographer GIS users are engineers or information scientists, or have computer science in their backgrounds. The National Science Foundation has adopted the term spatial sciences to embrace research that uses GIS. They recognize the role of GIS well beyond the practice of geography.

Interviewer: Could you comment on the broad structure of professional organizations, academic institutions, and governments that support and help shape the field of geography today?

In the U.S., the American Association of Geographers (AAG) is the leading professional organiza-

tion supporting geography. Other organizations in the U.S. supporting geography are the National Geographical Association and the American Geographical Society. The University Consortium for Geographic Information Science promotes GIS research and education across many disciplines.

Geography as an academic discipline practiced in the U.S. is for the most part hosted by state universities. Of the eight Ivy League Colleges, only one, Dartmouth University, has a formal geography program.

All major federal government agencies support geography at least to the extent that they have in-house GIS operations because they use GIS as a production tool or to do some analysis. State governments also support and use GIS. The National States Geographic Information Council supports coordination of geospatial activities among the states. Local and tribal governments use GIS for planning activities related to public safety, economic development, and other goals.

Internationally, the geographers of at least a dozen of countries are represented by national organizations. These include, for example, the Royal Geographic Society, the Canadian Association of Geographers, the Geographical Society of Finland, and the Society of South African Geographers, to name a few.

The International Geographical Union and the International Cartographic Association support GIS science and cartography worldwide. The American Society for Photogrammetry and Remote Sensing supports imaging and geospatial science and technology internationally.

Interviewer: Can you tell us about a relatively new subfield of geography, geovisualization?

I would not call it a subfield yet. To some extent, I would treat geovisualization as the intersection of cartography, GIS, and spatial statistics. In fact, I found I did some form of geovisualization when I was first trying to visualize segregation at the local level and how it varied across space. We used maps and a combination of statistical graphics and techniques in spatial data handling. An example or application of geovisualization for the environmental sciences might include the study of sea ice changes, atmospheric dispersion, and moving trajectories of objects in space, such as aircraft. Therefore, the process involves 4Ds – x, y, z (elevation), and t (time). This is really what is meant by geovisualization, yet, interestingly, a lot of the work of geovisualization in geography is concerned

with visualizing the data. Today, visualization is moving us beyond two-dimensional and three-dimensional representation, to include four-dimensional dynamics with the fourth dimension being time, or, the temporal dimension. Many spatial statisticians and experts in geoinformatics look at data, analyze it, and show the results of analysis, not just a visualization of the data.

Interviewer: Could you comment on geovisualization as it might pertain to immersion in an artificial or virtual world?

There is some research conducted in virtual geographic environments, and to some extent those are geovisualizations. This research is especially concerned with looking at complex data concurrently, and may be most applicable for planning or training with some analyses. It's interesting, but it is not clear how much this will advance our knowledge. In support of the study of virtual geographic environments and many other geographic applications, there has been lots of interest and discussion, especially at the last AAG meeting, around the topic of Big Data – a somewhat new topic for geography and for other disciplines as well. Currently, aside from providing improvements in handling and managing large and heterogeneous data sets, it is not clear how the Big Data movement will benefit geography – i.e., advancing our fundamental understanding of geography. Big Data may prove more useful for other disciplines. The exception may be applications of Big Data to the subdisciplines of geography focusing on environmental science. In most cases, many geographers draw on large data sets, but only use a small portion of the Big Data. They extract what they need, and that makes the research manageable.

Interviewer: Are internship programs keeping up with the growth in geography as a discipline? Could you speak about your own experience with internships?

I am still running an internship program with the USGS and have put twenty to thirty students through that program. We took advantage of our proximity to the sponsor(s). However, it is still challenging and difficult. To be effective, internships need funding and good coordination and administration. That is, unfortunately, the exception, not the rule. Funding is always an issue. Most agencies don't have a pool of money for in-

ternships. So, in many cases, the students hired for internships become a cheap source of student labor. That does not mean the internship experience is not useful. But it could mean the student misses out on learning other skills, such as teamwork, leadership, project management, and critical thinking. Yes, agencies like the USGS still need students with backgrounds in earth science, for example, but what is most needed is the GIS experience in many occasions.

Interviewer: What companies and software provide the tools for geographers?

The Environmental Systems Research Institute (ESRI) is the GIS leader – essentially, the Microsoft of the GIS industry – and their GIS software, ArcGIS, is quite popular. Government agencies have invested extensively in ESRI products, so that helps ESRI dominate the GIS industry. I'm not aware of data or studies comparing ESRI products with GIS products for other companies, such as Caliper, developer of Maptitude, Manifold, and QGIS, an open source product that is popular in Europe. All are very good in my view, but ESRI clearly has the largest number of users.

Interviewer: What would you wish for the future of geography?

Skepticism would be a healthy development. We are too much enamored with technology and have lost some of the instincts and capabilities to question what we find. We see a map, lots of color, and dynamic things moving around and get excited. But we need to ask questions. We need students to think more deeply about what they see, find, and produce. When I demonstrate to students that some algorithms or procedures in their software do not produce what they expect or do not make sense, they are shocked. They trust the computer and the software too much. We have to teach the concepts behind the tools, and a healthy respect for testing and verification. A solution to this problem is not easy to find. I am considering revising an introductory course I teach to include more training to address this shortcoming, and in an advanced class I teach, I am trying to spend more time on this issue and include a lot of challenging questions for the students to consider. Unfortunately, many students are simply not as interested in learning concepts as learning how to use GIS technology.

Interviewer: David – thank you for taking the time to talk about the field of geography, your career interests, and the importance of critical thinking skills as core values that must drive the learning experience, whatever the discipline.