COLUMN

**Conversation with
Stephen A. Matthews**

*Associate Professor of Sociology, Anthropology & Demography
(Courtesy Geography) at Penn State University*

*Paul R. Voss
Editor, Teaching & Learning*

Paul R. Voss (PRV): Stephen, let's start by finding out a little more about you and your origins in spatial demography.

Stephen A. Matthews (SAM): I was dropped on my head at birth and ever since have been fascinated by people and places, history and geography, data and maps. One of my cherished possessions is an atlas given to me by my brother and sister for Christmas when I was perhaps 10. I do believe context and location matter though it could be genes too. In regard to genes my father earned a dual undergraduate degree in English and Geography at University of Leeds in the late 1950s. I don't remember being pushed by him into geography but he did become a university professor in English, and I certainly knew that he and my mother expected me to go to university. As regards context, by aged 12 I knew I would be taking geography as a core subject in high school for my O-Levels (taken when aged 16) and later as an A-Level (taken when aged 18). In the UK the choice of A-level can restrict what you will be competitive in when you apply to university. Luckily, my choices when aged 12 didn't waiver and I always I knew I would be applying to universities to study Geography. My focus in geography has been on the 'human' (social science) side and throughout my O and A-levels we covered many 'population' topics – demographic transition, population pyramids, human migration, settlement patterns, urban structure and composition. Some readers may

find this odd but my high school instruction in geography and in demography-related topics was very strong indeed. Some people tell me I am not trained in demography which must be true, but I have also been studying demography since creating a population pyramid of my home town when I was about 12.

In terms of formal interests in spatial thinking and the study of human spatial behavior I was reading Peter Haggett's *Modern Synthesis in Geography* during high school. Like all of Peter's books, *Modern Synthesis* is quite simply a wonderful text. If I wasn't hooked on geography before this text cemented my interests, it certainly worked. Because of this fact I regard this as the most influential book I ever read. Peter was at the University of Bristol and I knew I wanted to study there. During the summer before applying to university (aged 17) my parents took a detour on the return leg of a family vacation to spend a day in Bristol. Again after visiting Bristol I was even more convinced that this was where I wanted to go to university. I save the gory details but I ended up at Bristol and have never looked back.

PRV: From your perspective, how has the scope of spatial demography and the special role of GIS changed since you first became involved with the field?

SAM: So, while spatial analysis, spatial modeling and quantitative analysis in geography have a long history, the emergence of GIS in academic geography occurred in the mid-1980s, and even later in demography-related social sciences (mid-1990s). I entered graduate school in 1986 at the University of Wales in Cardiff, the year my department became one of the national centers for GIS in the UK. The Department of Town Planning was one of eight Regional Research Laboratories (RRLs) and it became a vibrant, resource-rich environment that afforded opportunities to work alongside well known GIS luminaries such as Michael Batty, Ian Bracken, Paul Longley, and Chris Webster (all have authored GIS/spatial analysis textbooks). The faculty also included well known quantitative geographers and planners such as Neil Wrigley (my advisor), Richard Davies and Huw Williams and there were always distinguished visitors. Stewart Fotheringham (a developer of GWR) spent a year in Cardiff while on sabbatical. One of my contemporaries in graduate school was David Martin, author of one of the first books with a socioeconomic and demographic perspective on GIS and spatial analysis. It was truly a very exciting time to be in graduate school. I know the environment and my experience in Cardiff and the connections I made in the GIS field helped me secure a visiting appointment in Geography at UCLA in 1989.

I am not sure I ever thought of myself as spatial demographer (though I am happy to wear the label). I was recruited to the Population Research Institute at Penn State to help set up an in-house, let's call it GIS capacity. In 1995 the Geographic Information Analysis (GIA) Core – the name is no accident – was launched as part of a 5-year infrastructure grant in support of demographic research at Penn State. The GIA Core started off at fledgling levels of funding (and it remains that way) but unquestionably the impact and local multiplier effect of the GIA Core at Penn State, specifically in helping make proposals more competitive and contributing to innovative science, justified the investment. Many who used our services were not really interested in spatial analysis *per se*. Rather they wanted a derived variable (e.g., distance), or for us to use geocodes

to create a multilevel database, and very occasionally they wanted a map. The promotion of spatial analysis at Penn State has been a more personal enterprise and without the support of several excellent graduate students, most of whom cut their first teeth in the GIA Core, our analytical work would have remained under the radar. Note to others: it is the graduate students that can help sell the new concepts, data, and methods. I must have realized this early on because I was highly motivated to invest time in developing training infrastructure for spatial methods in demography. And, as you and many others know, the training programs – first 1-day workshops at PAA and then 5- and 10-day summer workshops – have been successful and have generated a cadre of demographers who have been exposed to GIS/spatial analysis. I'm sure my citation count will never be very high but I do know that 500+ people – many early-career – have attended the GIS and spatial analysis workshops I have coordinated.

PRV: *Indeed, I have witnessed several of the workshops you've had a strong hand in organizing. I would rate every one of them a huge success. You've mentioned several influential individuals in the development of your career. Who have been some of the other key influences in your professional life? Any former teachers or colleagues who have helped focus your interest in spatial demography?*

SAM: Many of the key influences in my professional life I am lucky enough to call friends. They span a variety of fields which will come as no surprise to those who know me. In terms of the biggest influences in the area of spatial demography many have also been close collaborators and in this group I include Don Janelle, John Weeks, and a certain gentleman named Paul Voss. I also have to say that my most recent collaborators – Tse-Chuan Yang, Carla Shoff, Daniel Parker and Claudia Nau – are wonderful and the field seems to be in good hands. As regards others who either have influenced and often helped me directly or indirectly is a very long list. I am in danger of omitting names here but among the geographers from my days at Bristol I would include: Peter

Haggett, Andy Cliff, Alan Frey, Tony Gatrell, Tony Hoare, Keith Bassett, Ed Thomas, Les Hepple and Neil Wrigley. Other geographers/planners who have been supportive and influential include Sara McLafferty, Don Janelle, Mike Batty, Bill Clark, Ellen Cromley, Mark Ellis, Stewart Fotheringham, Art Getis, Kelvyn Jones, Paul Longley, David O'Sullivan, David Rigby, Gerry Ruston, and David Unwin. The Sociologists and Demographers on my list include certainly include Bill Axinn, Gordon DeJong, Mark Hayward, Leif Jensen, Barry Lee and Sean Reardon. And it would be remiss of me not to mention Dennis Hogan who gave me my start at Penn State, and the late Clifford Clogg who was always available to discuss ideas and offer assistance. Others who also are instrumental to who I am today and have shaped me in so many ways include Linda Burton, David Takeuchi and Susan Kemp and a new set of physical activity/health researchers whose work I am excited to read and/or collaborate with including Basile Chaix, Jacqueline Kerr, Kevin Patrick, Steven Cummins and Shannon Zenk. Many of these names might not be known to spatial demographers and that is just fine. I certainly admire the work of many spatial demographers and in this list I would include Deborah Balk, Marcia Castro, Katherine Curtis, Barbara Entwisle, John Logan, Seth Spielman, and John Weeks to name a small group but there are many others; and a spritely young fellow named Paul Voss.

PRV: I'm inclined to cease the interview and commence a social network chart! That would be a fun task. In terms of teaching, what are some of the central concepts you feel absolutely must be included in a comprehensive semester-long course in spatial demography?

SAM: I may be a bit of a purist as I don't like to teach GIS or spatial analysis courses without providing a solid grounding in the history of quantitative spatial analysis and a discussion of core spatial concepts. To me this means the student will be exposed to fundamental concepts such as scale, units of analysis, representations of place, definitions of neighborhood, location (absolute/relative), distance, adjacency, and

proximity, the modifiable areal unit problem (MAUP), spatial dependence and autocorrelation, nonstationarity and spatial heterogeneity.

I also want spatial demographers to know about cartography and map design. To me this is an essential skill that should not be blown off or dismissed (but it I recognize that it competes with other topics in the limited time available in a 15-week semester). I try to teach cartography by example and use every opportunity (map) as a teachable moment. I will also often say to those who are engaged in a traditional ecological analysis "Why don't you map the dependent variable? This is after all the pattern you are trying to explain in your models." Or, I'll say, "Given that you have geospatial data why don't you calculate the Moran's I?" Following the example of Kathy Brasier (2005)* I encourage students using geospatial data to calculate the Moran's I and include it in their "Table 1 Descriptive Statistics." I also want students to be aware of different forms of geospatial data that exist and the different forms of analysis this might entail. This requires a focus on geographic objects such as points, lines, areas, and surfaces. In this regard it is hard to beat the structure of David Unwin's (1981) *Spatial Analysis*.

* Brasier, K. 2005. Spatial analysis of changes in the number of farms during the farm crisis. *Rural Sociology* 70 (4), 540-560.

PRV: Is there a strong role for spatial demography in an undergraduate curriculum? Graduate curriculum?

*SAM: Demography, and spatial demography, should be introduced as soon as possible into the curricula. If undergraduate courses adopt books like John Weeks *Population*, they might get slightly more exposure to spatial thinking and descriptive analysis as related to demographic research questions quite early on in their career (John firmly believes that demography is inherently a spatial discipline). But more to the point, in my experience undergraduates are very keen to learn about and use geospatial data (whether that be looking a census data, crime statistics, political voting patterns, or changing*

land use and environmental change) and they are even more interested in geospatial technologies such as global positioning systems. So, I believe spatial thinking can and should be introduced early and often at every level of education and this will generate a new generation of spatially informed social scientists and demographers.

My 7 year old used Google Earth on her first day of First Grade and my 12-year old downloads data off the web to produce graphs, maps and reports. We are in an age of ubiquitous computing and huge amounts of geospatial data. The next generations of students are both the users and generators of new types of information and they are also naturally keen to find out how others use and think about these new data. Courses that help to describe, define, and understand the social and physical world can all embrace spatial concepts and technologies, and we can use these as vehicles to get undergraduates interested in demographic questions that they can pursue in specialized courses or later in graduate school.

At the graduate level spatial demography is seen as a 'methods' course that is competing against other methods courses such as demographic techniques, event history analysis, causal analysis, and multilevel modeling – at least it is at Penn State. Most graduate students will take something like 24 course-credits in the dual degree program in demography; a total of 24 credits to cover the core, survey and demographic processes courses. The methods requirement is 6 credits or two courses. The good news for me is that every time I offer Spatial Demography it is a fully enrolled class. Our dual-degree demography program has approximately 70 students from across seven departments and so my courses draw in a diverse set of students, backgrounds and experiences. I try to harness this diversity throughout the course. For example, I provide a wide range of resources spanning many fields and I rarely assign canned projects (except when teaching fundamental concepts). I shy away from canned exercises as I want individuals to invest time and energy creating *their* geospatial data sets and analyzing *their* data. That is, for me, the substantive questions should drive the curiosity in the contribution that a spatial perspective

might add. I want students to feel passionate about *their* research and hopefully they will then invest more time leaning about spatial data analysis.

PRV: Do you use a textbook when teaching spatial demography? Are there certain textbooks of which you are particularly fond?

SAM: I don't often use textbooks but I will refer to them; indeed I swamp students with readings, resources and tips. If they are keen they will pursue the 'classics' themselves.

In class I have referred to online materials such as the GeoSpatial Analysis text by de Smith, Goodchild and Longley (www.spatialanalysisonline.com) and, of course, the GeoDa workbooks from Luc Anselin (<http://www.geodacenter.asu.edu>)

There is, as yet, no spatial demography text book (though of course there are multiregional demography texts (Rogers, A. 1975; 1985), several quantitative population geography texts (Rees, P.H. & Wilson, A.G., 1977; Woods, R. & Rees, P.H., 1986), and a more applied text (Plane, D. & Rogerson, P.A., 1994). My favorite textbooks, ones that can help ground the early-career graduate students in spatial thinking and analysis, include Cromley E. and McLafferty S. (2011) and O'Sullivan, D. and Unwin, D. (2009). The blend of these two books would make a great text.

My favorite spatial analysis-related books seem to originate in or connected to Bristol – funny that – and on my list would be Haggett, Cliff and Frey (1977) *Location Analysis in Human Geography*; Cliff, Haggett, Ord, Bassett and Davies (1975) *Elements of Spatial Structure*; Cliff and Ord (1973) *Spatial Autocorrelation*; Cliff and Ord (1981) *Spatial Processes*; and Cliff, Haggett, Ord and Versey (1975) *Spatial Diffusion: An Historical Geography of Epidemics in an Island Community*. And at various points in time I have used for personal use Bailey and Gatrell (1995) *Interactive Spatial Data Analysis* and Haining's (1990) *Spatial Data Analysis in the Social and Environmental Sciences*.

PRV: I completely agree with the last two books you mention – especially the Bailey and Gatrell text. I return to it frequently, and often recommend it (despite its age) to students who ask me what I would recommend to a beginner in this field. Since that textbook came bundled with an old (non-)floppy disk and mapping software, I'm inclined to ask about the latter. Are there specific software packages or tools you feel are especially helpful in your teaching?

SAM: I typically focus on the specialized software not ArcGIS per se; though as the spatial analysis tools are expanded in ArcGIS it is more appealing. However, I am still loyal to GeoDa (now OpenGeoDa), and frequently use GWR and CrimeStat. I have been slower to R and other analytical packages like WinBUGS (the downside – if there really is one - of having invested in TC Yang is that he does much of the analysis).

Don't get me wrong on ArcGIS. I require students to learn ArcGIS for data handling, cleaning, manipulation, linking, mapping, etc. ArcGIS is useful for lots of stuff and these skills are essential for a spatially informed demography project, but the analysis that I focus on tends to be ESDA, spatial econometrics, and GWR, with a splash of geostatistics. If students want to learn ArcGIS they can do so in other 15-week classes on campus they don't need to do so in a spatial demography class.

PRV: What about resources on the internet? Any favorite websites you use when you teach?

SAM: The internet is a wonderful resource and yes there are several key sites I tend to promote (I hope you will forgive some self-promotion)*

* GIS and Advanced Spatial Analysis workshops – <http://csiss.ncgia.ucsb.edu/GISPopSci/>

* Future Directions in Spatial Demography – <http://ncgia.ucsb.edu/projects/spatial-demography>

Teach Spatial – <http://www.teachspatial.org>
The Geoda Center, Arizona State University – <http://www.geodacenter.asu.edu>
Geospatial Analysis Online –

<http://www.spatialanalysisonline.com/>
Color Brewer – <http://colorbrewer2.org/>
Geostatistics website – <http://www.ai-geostats.org/>

Then there are plenty of good online journals in the field (very generally defined) – one being the *International Journal of Health Geographics* (<http://www.ij-healthgeographics.com/>) and I think every academic should bookmark Google Scholar (<http://scholar.google.com/>).

PRV: That list will be helpful to readers of this journal. What preparatory skills or basic knowledge should graduate students bring to a course in spatial demography to ensure they get the most out of the course?

SAM: I want students to come to class eager to learn and apply skills they have acquired in earlier courses – substantive as well as methodological – and I want students to raise questions as much as possible. This means questioning the operationalization of the unit of analysis, being receptive to looking at the problem at a different scale, to think about what a spatial weights matrix is and how it is working, to question the measurement of specific variables, etc. Critical thinking before running models always seems to help. The thing that surprises me most is that far too many students just want to run models in GeoDa and GWR and seem unwilling to first step back to examine the variables they have and the models they are proposing. So, I guess I like students to remember their quantitative methods skills and ideally I like students who know something about cartography. Of course, skills in file management and data manipulations skills are a plus too.

PRV: What's the proper balance between spatial theory, spatial concepts, GIS skills and formal spatial modeling methodologies in a graduate-level spatial demography course?

*SAM: Taking off on a comment made by Ken Jennings (in his book *Maphead*) I've written about how many PhDs have gone from kindergarten to graduate school and never cracked a geography/spatial analysis text and*

certainly never taken a university level course. For me the training many demographers seem to receive in fundamental spatial concepts, geospatial data and analytical methods is either limited, patchwork or nonexistent. But many important demographic questions deserve to be studied and framed using spatial approaches and this will become even more evident as changes in the volume, source, and form of available demographic data – much of it geocoded – further changes the data landscape and thus the methods demographers need to utilize. Ultimately, changes in the data demographers collect, how they collect data, how they link data, and how they analyze data suggest the need to begin to train next-generation population scientists in spatial thinking, concepts and methods of analysis. A 15-week single course has to pick and choose its battles. I try for a general understanding of fundamental concepts and I cover issue that I think ought to be included in every spatial demography class (IRB and data privacy). When we get to spatial modeling I focus almost exclusively on ESDA, spatial regression and GWR. It is a very specific focus and, for many students, it suits their needs. While students are working on projects (last 3-4 weeks) I provide lectures and demos on topics such as GPS and remote sensing and I provide a superficial coverage to topics such as geostatistics though I do try to cover future directions (e.g., emergent data and volunteered geographic information as well as Bayesian methods, and agent-based models). 15 weeks is not a long time and I'd rather do a focused job well than rush through every method – or 15 methods – under the sun.

PRV: What preparation do you feel teachers of spatial demography need in order to offer a strong, well-grounded course?

SAM: This is too personal a decision. I suspect many instructors of spatial demography can draw on many personal experiences in their own training and research that can help them. I like to ground the course in high-quality substantive readings on topics such as residential segregation, health inequalities and population and environment research. These, for the most part, are substantive areas where the collection

and analysis of spatial data can add to a researcher's understanding. On a more practical level I feel fortunate that my training is in geography and planning. I have solid training in cartography (manual as well as what was first called computer cartography), data visualization and quantitative statistics, and a well-rounded familiarity with many of the US and some of the international data sets students want to use. This is experience gained over many years, and some of it learned in the classroom from participating students.

PRV: You mentioned "future directions" in an earlier answer. How do you view the direction of our field? What should teachers of spatial demography be doing now to remain current and prepared for the future?

SAM: The projection request? Aaargh! This is a huge topic and I cannot do it justice in a few sentences but some things that I believe are important would include trying to get spatial thinking into the undergraduate curriculum across the social sciences (including demography and related disciplines) as early and as often as possible. More generally I believe academia needs to encourage and reward team science and collaboration. It is frankly impossible to keep up with everything happening in geospatial data, technologies and methods and also to be motivated by the important substantive questions of the day. A network of scholars and friends can help, but fundamentally we often need to collaborate – and why not? It is often fun. Unfortunately, academia in the social sciences, as currently structured, does not actively encourage collaboration. People increasingly tell me this is not true, but all evaluations I know of focus on sole-authored and first-authored papers in own discipline journals. This is a model that increasingly is out of date.

PRV: Do you have any specific advice for someone planning to teach spatial demography for the first time?

SAM: Keep it simple; focus on core concepts (see above); use a user-friendly package like OpenGeoDa; encourage the students to get their

hands dirty with assembling their data and importantly do this early and often throughout the semester (if you don't, the students will delay and delay and then complain about the time it takes to assemble their data leaving little or no time for applying the spatial analysis tools they wanted to learn). To help with the latter, hold open forum sessions to get people to discuss their data and problems they are encountering, and to share and exchange ideas and tips. Other things to think about might be to remind the students that theory and conceptual development and measurement are as important as analysis. I love spatial analysis but I don't think I try to oversell it either. If the data and analytical plan do not fit a spatial framework say so don't try to force students to do a something that is half-baked or worse irrelevant.

PRV: As one of the associate editors of this journal, how would you like to see the journal serve as a vehicle to effectively assist those involved in spatial demography instruction?

SAM: To my mind the journal and its website have many responsibilities to the field. I very much like the idea of a specialist journal and I like the proposed structure with area editors responsible for disseminating news and information on geospatial data, teaching, software and methods. These components can help make the journal a go to place for everyone from the novice to an advanced user. If the journal can be both high-caliber in its review process and at the same time offer expedited review this would be a huge plus. Too many

journals have too long a delay from submission to review (and that is just the first step), and to me this is a problem. The fact that the journal is open access and online also is appealing to me. I like the idea of a blog and news forum though... full disclosure, to date, I have tended to be blog-shy. I increasingly appreciate the contribution a blog can make in building a community of scholars but please don't ask me to join Facebook.

PRV: What do you do when you're not involved in intellectual pursuits? Do you have any hobbies or recreations you'd like to share with readers?

SAM: The answer here is quite simple. I try to spend as much time with my wife, Valarie King (Professor of Sociology, HDFS & Demography at Penn State), and our two beautiful daughters, Kayleigh and Celine. The girls are regular PAA attendees – Kayleigh was at one time 7-7 in attendance and is now batting 10-12; not bad! I believe travel is the best form of education and I hope both girls develop the same kind of fascination with people and places as have I. However, Valarie and I don't expect them to be 'demographers' but they could end up being population scientists, especially the kind that studies marine biology (Kayleigh) and animal science (Celine).

PRV: We'll look for you all at the next PAA meeting, although I recognize it frequently conflicts with the annual geography meetings. We need to work on that. Thanks, Stephen!