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Commentary

What's old is new, and new is old: History and geography's quantitative revolutions

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Abstract
The article provides a critical commentary on papers by Ron Johnston et al. (2014) and Elvin Wyly (2014) about the different forms of geography's quantitative revolution. The paper argues that in both cases the respective authors should have striven for a more robust historical exploration.

Keywords
big data, computerization, George Zipf, quantification, social physics, William Warntz

Over the last couple of months or so I have been trying to make headway with several boxes of archival materials that begin in the 1940s, and which relate to some of the earliest forms of spatial science that subsequently influenced the trajectory of that movement in American geography. I have been especially interested in the social physics movement, out of which spatial interaction models emerged such as gravity and potential models, and which culminated in Tobler's First Law of Geography mentioned by Elvin Wyly – 'everything is related to everything else, but near things are more related than distant things' (Tobler, 1970: 236).

The social physicists were an odd lot, some of them bordering on the barking mad. The Harvard linguist and born-again social physicist, George Zipf, and who has his own eponymous law (Rousseau, 2002), was especially dismissive of social scientists unable or unwilling to practice 'quantitative analysis' in Johnston et al.'s terms. He and his friend, John Q. Stewart, a Princeton professor of astro-physics, labelled any social scientist unfathomably preferring written sentences to strings of numbers, a 'verbalist'. Zipf thought verbalism had no place in contemporary social science. As he bluntly expressed it to Stewart in a November 1949 letter:

> I gather that you too would like to hear lead pipes crunch on verbalistic skills. We have indeed suffered much from the verbalists. But being a peace-loving non-aggressive soul, my only advice is, 'Don't shoot the verbalist with blank cartridges'.[1]

Zipf was really a big data aficionado long before big data, and even before computers were available. Zipf's computers weren't machines but flesh and blood, often his son Robert as well as undergraduate students, dragooned into making massive calculations for him with slide rules, log tables, and if they were lucky, large thudding Monroe and Frieden

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mechanical calculators.[2] Zipf believed in the dictum of the Victorian inventor of regression analysis, Francis Galton, 'Whenever you can, count' (Berry, 2003). And there was not much Zipf thought you couldn't count. There was the easy stuff like populations of cities, words used in English language publications from Beowulf to T.S. Eliot, and the 'length of intervals between repetition' in Mozart's bassoon concerto in B^b major (respectively Zipf, 1949: 420; 123; 337). Only slightly more difficult were 'the death wish', multiple personalities, and 'erotic substitute action' (don't ask) (respectively, Zipf, 1949: 240–241; 269–270; 264–266). As one commentator wrote, 'Zipf was the kind of man who would take roses apart to count their petals' (Miller, 1968: v). Certainly he believed his project was all-encompassing. In 1942, he wrote that social physics 'could be applied to everything . . . down to and including man's [sic] innermost dreams. The soul . . . offers a perfectly legitimate problem' (Zipf, 1942: 62).

Zipf's work through his collaboration with Stewart, and Stewart's work through his collaboration with the geographer William Warntz (1973) (employed between 1956 and 1966 at the American Geographical Society in New York during its 'halcyon days', later Professor at Harvard) who helped to shape geography's quantitative revolution that began unfolding in the discipline from the 1950s. Social physics' emphasis on discerning predictable empirical patterns by applying relatively simple mathematical formulae to increasingly large data sets became a blueprint for the 'new geography'. Further, as those data sets became larger, calculations could no longer be done by hand, by human computers, but necessitated the use of a machine. Geography became a cyborg discipline, its development dependent on the speed, memory and processing capacity of machine circuits, and with which the subject became more and more integrated.

A good illustration was the computations required for population potential maps, Warntz's research specialty, and taken directly from Stewart's earlier work in social physics. Population potential is a measure of the influence of the population of every place within a country on every other place within that same country, and describable by a simple mathematical equation originally taken from Newtonian physics (Rich, 1980). The trouble is that the number and size of those calculations can quickly get out of hand, becoming forbidding. In 1939, when Stewart first tried manually to compute population potentials for the United States, in spite of the 'vigorous assistance of Philip Wilkie . . . for some of the computations', it still took him much of his 'Christmas holidays', and even then it was incomplete, with calculations for only 25 states.[3] It was another decade before Stewart made the first use of a home-made 'computing device', constructed by a Princeton undergraduate electrical engineer, and later in life a litigation-prone Californian inventor, Thomas B. Bissett.[4] Yet, even here there were still problems, and which were not finally resolved until 1958 when Stewart and now Warntz used 'an early IBM electronic computer' to make the first comprehensive set of population potential calculations for all states (Warntz, 1964: 171). This was further refined in 1964 by the use of a still more powerful IBM computer that now took just 'a few seconds short of two hours . . . [to make the] ten billion arithmetic operations . . . required to produce th[e] [population potential] map' for the conterminous US (Warntz, 1964: 177).

What does this story about social physics, and particularly, Warntz, have to do with either the paper by Johnston et al. or the one by Wyly? Following my title, I want to say that Johnston et al. underestimate how much the old is still part of their new curriculum for quantitative analysis in geography, and that Wyly underestimates how much of his new quantitative geography was prefigured by the old quantitative geography.

Johnston et al. believe that the quantitative analysis they do gets them no disciplinary respect; either they are misunderstood or maybe even worse, neglected ('there is only one thing worse in the world than being talked about, and that is not being talked about' said Oscar Wilde). Their strategy in the paper for gaining more respect is to claim that the disciplinary practices that go on under the label of 'quantitative analysis' are not what they used to be (they believe there is a binary divide between the past and present, between what used to be and what is now). While the old kind of quantitative analysis might have had a few

problems, the new kind promises great things and should be pursued. In its new form, quantitative analysis can speak directly to social theoretical concerns (e.g., structuration), non-positivist epistemologies (e.g., critical realism), deal with relevant practical issues (e.g., clusters of leukaemia around nuclear power plants), make an informed citizenry, and shun former quantitative revolutionary *desiderata* like laws, geometry and the rationality postulate. But it seems to me that many of the qualities Johnston et al. are seeking in quantitative analysis were present in the earlier version of the movement, and the binary they recognise is not cleaved as cleanly as they suggest. Warntz's work did not make any assumptions about rationality, and even Zipf's (1949) *Principle of least effort* was couched at the larger system level and not at the individual (*homo economicus*). There was no geometry in Warntz's work on population potential, other than empirically derived isolines. Warntz invoked no laws in his potential studies, only a simple ratio. He believed that knowing numbers was critical to an informed citizenry, and he did all he could to promote them to students and to a wider public whether it was at the American Geographical Society (AGS), or later at Harvard (where he added 'and spatial analysis' to the title of the Laboratory for Computer Graphics that he directed), or in one of his two public television educational series (one in Philadelphia, 44 h, the other in Boston, 13 h; Janelle, 2000). He even spent 200 h of his spare time making a three-dimensional model of the 1960 population potential map of the United States for the 1964–1965 New York World Fair because he believed it would help to inform citizenry about the importance of a mathematical approach to geography.[5] He thought of his approach as immensely practical, he didn't talk about positivism as an epistemological backstop, and he recognised the diversity of geography. With respect to this last point, while he promoted 'macrogeography', which was quantitative and analytical, he recognised still the need for 'microgeography', which was qualitative and descriptive, and embodied in his hero who he celebrated in his last (posthumous) paper, Bernhardus Varenius (1622–1650) (Warntz, 1989). Johnston et al. protest too much in claiming a divide between the old and new quantitative analysis. I think they would have a stronger case if they offered the entire tradition of 'quantitative analysis', holus-bolus, warts and all, rather than a sanitized, ahistoricized, truncated version of only the best bits. Their proposal needs historical ballast.

I also thought there could be some more historical weightiness to Elvin Wyly's otherwise terrific paper. On the surface, Wyly's and Johnston et al.'s contributions are like ships passing in the night. Johnston et al.'s article is narrowly about quantitative geography as an internal disciplinary project, while Wyly's article is about the external project of quantitative geography making the world outside – by big data, by electronic surveillance and by various dastardly deeds perpetrated by Google, Twitter and Facebook that happen only when you are looking. If you stop looking, the dastardly deeds stop too. It is Foucault ratcheted up one more peg: Not only do we passively submit ourselves to discipline and control but we actively join in activities that continue only so long as we allow ourselves to be disciplined and controlled. It made me think of one of Foucault's (1984: 343) responses in an interview he gave, 'My point is not that everything is bad, but everything is dangerous. If everything is dangerous, then we always have something to do. So my position leads not to apathy but to a hyper and pessimistic activity'. Wyly is engaging in precisely that hyper and pessimistic activity, enumerating the dangers of the new quantitative geography, and also in this case judging it bad.

I would have liked Wyly to have considered more the relationship between the external project of the new quantitative revolution and the internal project of the old quantitative revolution that took place within the discipline of geography. I don't mean causally reducing the former to the latter, clearly absurd. But instead trying to think through the common historical intersections and parallel processes producing both, and which on occasion brought the two together at least at moments. For example, Warntz was an important cross-over figure, occupying both worlds, given his early involvement with computers as a researcher, his military funding, his appointment at Harvard in 1966, and 2 years later his directorship of the Harvard Lab, a

key site for the development of geographic information system.

The point is to recognise how seemingly different events are in fact related through larger historical processes. In an 1841 essay, 'History', Emerson wrote, 'There is a relation between the hours of our life, and the centuries of time'.[6] I would have liked both sets of authors in their respective papers to have reflected more on that relation, not only to have greater historical material but to have displayed a greater historical sensibility.

Notes

1. George K. Zipf to John Q. Stewart, 12 November 1949, Box 38, Zipf, George K., John Q. Stewart Papers, Rare Books and Special Collections, Princeton University.
2. Richard S. Wallace, Zipf's law, alicebot.org/articles/wallace/zipf.html; accessed 11 November 2013.
3. John Q. Stewart, The gravity of the Princeton family, *Princeton Alumni Weekly*, 9 February 1940, pp. 409–410, quotations from p. 409, Box 3, folder 9, John Q. Stewart Papers, Rare Books and Special Collections, Princeton University.
4. John Q. Stewart, Memorandum to Research Corporation: Concerning the project, 'The transfer of the social field of the methods and some of the principles of physical science', Progress in Social Physics, September 1948 to May 1949, quotation from p. 5, Box 2, Progress Report, John Q. Stewart Papers, Rare Books and Special Collections, Princeton University.
5. An interview with Warntz and photos of his model are found in The Princeton Packet, 12 February 1964, Box 6, William Warntz Papers, Division of Rare and Manuscript Collections, Cornell University Library.
6. An on-line version of Emerson's 'History' is available at: http://www.age-of-the-sage.org/transcendentalism/emerson/essay_history.html; accessed 11 November 2013.

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