

ADDENDUM

To Dan Sui's Forum in the
Annals of the Association of American Geographers,
94(2): 269-310, June 2004
on:

Tobler's First Law of Geography

“... everything is related to everything else, but near things are more related than distant things”.

(quotation from W. Tobler, 1970, "A Computer Movie Simulating Growth in the Detroit Region", *Economic Geography*, 46, 234-240)

"Erstes Gesetz der Geographie:

Alles hängt mit allem zusammen, aber Benachbartes stärker als Entferntes."

Translation courtesy of W. Kuhn.

The Forum included these discussions:

- | | |
|-------------------------|--|
| #1 Daniel Sui | “Tobler’s First Law of Geography: A Big Idea for a Small World?” |
| #2 Trevor J. Barnes | “A Paper Related to Everything but More Related to Local Things” |
| #3 Harvey J. Miller | “Tobler’s First Law and Spatial Analysis” |
| #4 Jonathan D. Phillips | “Doing Justice to the Law” |
| #5 Jonathan M. Smith | “Unlawful Relations and Verbal Inflation” |
| #6 Michael F. Goodchild | “The Validity & Usefulness of Laws in GIScience & Geography” |
| #7 Waldo Tobler | “On the First Law of Geography: A Reply” |

SUPPLEMENTARY IDEAS

Probably the most important, in my opinion, consequence of "The First Law of Geography" is that: It concentrates attention, and focus, on the exceptions, thus allowing these to be studied, examined, explored, speculatively investigated, and analyzed. See below under ‘context’ how I arrived at the observation. Waldo Tobler

Can the reason for first law of geography be explained?

Here I would like to cite Noble Laureate L. Pauling who, refereeing to some of the laws of nature, wrote that "there is no explanation." ... this is just ... "a part of the world in which we live."

(in explaining the speed of light!). L. Pauling, *General Chemistry*, 3rd ed., Freeman, San Francisco, 1970, page 45

Karl Pearson, 1892, *The Grammar of Science*, Scribner's Sons, London, Pages 37-45, makes the case that scientific laws are inventions of human imagination describing aspects of nature that are helpful in understanding. He goes into more detail in "The Scientific Law" (Chapter III, pp 92-135). Expanded in Chapter X. Given the date, several of his comments throughout the book can be called brilliant, perceptive, and prescient. Chapter V is on "Space & Time", in a very Kantian perspective

Einstein ... claimed that the search for "universal laws from which a picture of the world can be obtained, cannot come by pure logic ... such [laws] can only be reached by intuition"

This according to: Anne Buttner, 1993, *'Geography and the Human Sprit'*, Johns Hopkins University Press, Baltimore, 1993, p. 79, citing Karl Popper, 1976, *'Unended quest: An Intellectual autobiography'*, Open Court, La Salle, IL, page 32.

Richard Feynman, in describing how to invent a new law he points out that the first, and most difficult, step is to guess (Feynman 1967: 156). Then the criterion becomes to "...compute the consequences of the guess to see what would be implied.... Then we compare the result ... with experiment or experience ... [or] observation to see if it works. If it disagrees with experiment it is wrong So guess again." He also points out that laws can only be discovered by doing something radically different. There is no fixed method that can lead to their discovery. Feynman. R., 1967, *'The Character of Physical law'*, MIT Press, Cambridge.

Nobel Laureate Frank Wilczek writes in *"The Lightness of Being"*, Basic Books, 2008, page 122: "... systems can be considered in isolation: their properties don't much depend on the state of the world as a whole⁵." footnote ⁵At least that's a good working hypothesis, and it's justified by its success."

Wilczek also wrote, in his essay "A Piece of Magic", p 129 of G. Farmelo *It Must be beautiful: Great Equations of Modern Science*: "Experimental logic...to validate A, assume it, and show that it leads to fruitful consequences."

"A law of Nature is simply an elegant way of saying, This is the way the world works. We may not know why it works that way, but that's the way things are, like it or not." Robert Wolke, 1997, *What Einstein Didn't Know*, Dell, New York, page 217.

William Warntz, whose work on macrogeography and population potentials might argue that 'The First Law' is a local phenomena and, as such, is microgeography which does not take into account universal, global, macroscopic distance effects.

Homophilia, a term used in sociology, relates to the phrase: "birds of a feather flock together". M. McPherson, Smith-Lovin, L., Cook, J., "...Homophily in Social Networks", *Annual Review of Sociology*, 2001; 27(1):415-444.

The "First Law" is "Spatial Homophilia"!

The "First Law" thus applies to behavior as well as material phenomena.
Behavior should be included under 'near things'

Philip Ball's book, *Critical Mass* (Farrar, Straus, Giroux, New York, 2004) has extremely numerous mentions of phenomena and behavior that depend on local influences, including "Boids" and the Ising model.

According to P. Haggett, (1995, *'The Geographer's Art'*, Blackwell, page 91):
"As John Muir wrote in *My first Summer in the Sierra*", (London, Constable, 1911, page 157)
"When we try to pick out anything by itself, we find it is hitched to everything else in the Universe".

"Laws reflect the existence of patterns in Nature", J. Barrow, on 'Simple Really' page 363 of *"Seeing Further..."*, Harper Press, London, 2010.

"Order and chaos are not part of nature but part of the human mind"

"That there is more order in the world than appears at first sight is not discovered till the order is looked for" (P. Haggett, op cit.,p.16}. The citation is to: N.R.Hanson, '*Patterns of Discovery*', Cambridge U.P., 1958, p.204

On Goethe's thinking: Henri Bortoft, 1966, "*The Wholeness of Nature*", Lindisforne Books, New York

Google becomes social:

"Social Search", a new tool from Google Labs, brings your social circle (and the Web content they create) into your search results "The First Law of Geography according to Waldo Tobler is also a key component in Google's algorithm to determine search ranking. Google looks at how closely search phrases are spaced in the search box, and on the page, as well as how closely linked the searcher is geographically to the search results (among other things). So it should be no surprise that Google can now provide search results based on how closely you are connected to people." Todd Lucier, Oct. 27, 2009.

Proximity counts!

In meteorology – Persistence forecasting.

Context:

How I got to "The First Law of Geography": In my computer simulation (op. cit.), instead of including everything that I could think of that might be influencing the model, I decided to ignore lots of possible variables pertaining to the surrounding world. That's when I invoked the first law of geography as my justification. The specific model used was thus very parochial, and ignored most of the rest of the world, but took into account an empirical reality. W. Tobler.

Empirical tests:

B. Hecht, E. Moxley, 2009 "Terabytes of Tobler: Evaluating the First Law in a Massive, Domain-Neutral Representation of Word Knowledge", "http://www.brenthecht.cm/papers/bhecht_cosit2009_toberslaw.pdf.. in Horsby,K.S., Claramunt, C., Denis, M., Ligozat, G., eds.:Spatial Information Theory, 9th International Conference, COSIT 2009, Aber Wrac'h, France, September 21-25, 2009, Proceedings. Volume 5756 of Lecture Notes in Computer Science, Springer (2009) 88-105

D. Hardy, "Distance Decay in Anonymous Wikipedia Authorship"
<http://www.spatial.ucsb.edu/events/brownbags/docs/2009-2010/hardy-presentation-20100223.pdf>

S. Bjorholm, et al, "To what extent does Tobler's 1st law of geography apply to Macroecology? A case study using American Palms (arecaceae)" <http://www.biomedcentral.com/1472-6785/8/11>

D. Mok, et al, 2010, "Does Distance Matter in the Age of the Internet?", *Urban Studies*, 47(13): 2747-2783.

Implications:

Jowei Chen, Jonathan Rodden, 2009, "Tobler's Law, Urbanization, and Electoral Bias: Why Compact, Contiguous Districts are Bad for the Democrats":

<http://www-personal.umich.edu/~jowei/florida.pdf>

Corollary:

"Things that are near for a long period of time are more related than things that are near for a short period of time".

Sean Gorman <http://blog.fortiusone.com/2009/05/27>

2nd Law of Geography (Tobler)

What the region's neighbors are doing affects what is going on inside of a region, and conversely.

Caveat:

"However, the effect of the first law is not absolute ... Spatial dependence is also affected by natural or artificial barriers. For example, the climate may significantly differ in two neighboring valleys separated by a mountain range, and people's lives in two villages separated by a state border may also differ quite a lot. Similarly, ... Relatedness between things may depend, not only their distance (proximity) but also on direction. Thus, a flood or water pollution spreads downstream along a river.... The notion of proximity is also phenomena-dependent. It may be defined spatially, for example, in terms of distance by roads, rather than straight line distance or distances on the earth's surface."

D. Keim, et al, eds., 2010, *Solving Problems with Visual Analytics*, Eurographics Association, Goslau.

Google (Switzerland) 'First law of geography' 9,510,000 hits.