Temporal proportionality in the graphical reprentation of age-period-cohort classified demographic rates: (Re)introducing the equilateral Lexis surface

Tim Riffe

December 21, 2011

Abstract

The use of demographic surfaces composed of equilateral APC triangles is encouraged over standard 'Lexis' proportions in order to eliminate disotortion of the cohort perspective. This transform procedure yields age, period and cohort dimensions of comparable scales. Resulting images are highly legible and interpretable in a similar way to more commonly used standard demographic surfaces. While 'Lexis' diagrams and 'Lexis' surfaces are now known to be misnomers, intellectual parentage for the equilateral Lexis surface most likey is owed to Lexis (1875).

1   The standard demographic surface

Any demographic data classified by age, period and cohort are candidate to be plotted as surfaces, with color gradients or contours specifying value intervals for the rate in question. Such surfaces allow for the meaningful summary of large amounts of data and are useful as both diagnostics and didactic tools. Software has been developed in order to convert tables of demographic data into surface figures [Vaupel et al., 1987, Andreev, 1999], as well as a variety of general surface functions from statistical programming languages coercible to 'Lexis' surfaces[1]. Demographic surfaces follow a strict set of guidlines on proportionality, with a unity aspect ratio between age on the y-axis and period on the x-axis[2]. A ninety degree angle between age and period directions forces a 45 degree along the cohort dimension, matching each year of cohort time to a length equal to $sqrt2$ in euclidean space.

Standard demographic surfaces repecting these conventions of proportions are most commonly referred to as 'Lexis' surfaces. We know this name to be a misnomer due to the investigative work of Vandeschrick [2001] and Keiding [2011].

---

[1] such as `levelplot()` in the `lattice` package[Sarkar, 2008] in the R language[Ihaka and Gentleman, 1996], among others.

[2] rearranging the data, a less common rendering of age in the y-axis and cohort in the x-axis with a unity aspect ratio has also been done.

2 transforming the Lexis diagram

References

K. Andreev. Overview of the program lexis 1.0. *S. Heinzel and T. Plesser*, 1999.

R. Ihaka and R. Gentleman. R: a language for data analysis and graphics. *Journal of computational and graphical statistics*, pages 299–314, 1996.

N. Keiding. Age–period–cohort analysis in the 1870s: Diagrams, stereograms, and the basic differential equation. *Canadian Journal of Statistics*, 39(3): 405–420, 2011.

Deepayan Sarkar. *Lattice: Multivariate Data Visualization with R.* Springer, New York, 2008. URL `http://lmdvr.r-forge.r-project.org`. ISBN 978-0-387-75968-5.

C. Vandeschrick. The lexis diagram, a misnomer. *Demographic Research*, 4(3): 97–124, 2001.

J.W. Vaupel, B.A. Gambill, and A.I. Yashin. *Thousands of Data at a Glance: Shaded Contour Maps of Demographic Surfaces.* International Institute for Applied Systems Analysis, 1987.
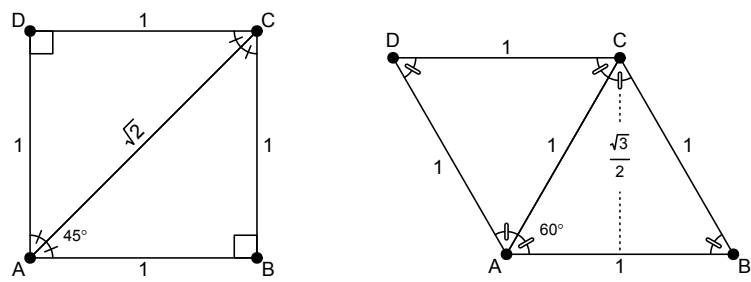
Figure 1: A deceptive scatterplot