

Visualizing Ryderian Comparative Cohort Careers: Trends in Tolerance for Homosexuality, 1886 to 2001

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Abstract

Sociologists and demographers have long been interested in using population-level data to understand the nature and extent of life-cycle and social change. Examining tolerance for homosexuality using data on more than 116 cohorts born across three centuries in the United States, the author presents a novel visualization of Ryderian comparative cohort careers that parsimoniously summarizes intra- and intercohort trends, or life-cycle and social change. Results indicate dramatically rising levels of tolerance within and across cohorts, with the greatest amount of progress occurring among successive cohorts born before the middle of the twentieth century.

Keywords

social change, cohort analysis, Norman Ryder, LGBTQ, homosexuality

In a widely influential article, the sociologist and demographer Norman Ryder (1965:844) outlined the general contours of what he called “the cohort approach” to analyzing time-series cross-sectional data. Central to Ryder’s framework is the examination of intracohort trends, or “intra-cohort temporal development,” and intercohort trends, or “intercohort temporal differentiation” (p. 861). Because they involve comparisons within cohorts as they age across periods, intracohort trends represent life-cycle change; by contrast, intercohort trends, because they entail comparisons of successive cohorts across periods, represent social change. Combined, intra- and intercohort trends, or life-cycle and social change, constitute Ryderian comparative cohort careers.

Although his 1965 article is highly cited, relatively little work has considered the various ways in which Ryder’s cohort careers can be constructed and visualized using time-series cross-sectional data (for an overview, see Fosse and Winship 2019). As shown in the supplemental materials, following the insights of Ryder (1965, 1968), I outline a general three-step procedure for deriving Ryderian comparative cohort careers: first, specify a model with age, period, and cohort as the inputs; second, reexpress the parameters in terms of age and cohort; lastly, estimate the parameters of interest, calculating the predicted values of the outcome for all observed combinations of age and cohort. These outcome values can then be plotted, in a straightforward way, as a series of cohort-specific line graphs with age as the horizontal axis. Crucially, in contrast to a conventional

age-period-cohort analysis, a Ryderian cohort analysis is based on identifying sets of parameters indexed by age and cohort rather than unique parameters for age, period, and cohort. This has the considerable advantage of relying on a fully identified model that can be estimated from the data at hand rather than an unidentified model that, in absence of information external to the data, cannot be estimated.

Using the three-step procedure outlined above, Figure 1 displays two collections of Ryderian comparative cohort careers using a model with smooth functions for age, period, and cohort, which are treated as continuous.¹ Each panel displays the careers of 116 cohorts born from 1886 to 2001, with selected cohort careers highlighted at 15-year intervals. Note that more recent cohorts appear at the upper left, while older cohorts appear at the lower right. For both panels, the horizontal axes denote age in years, while the vertical axes

¹As outlined in the supplemental materials, I use natural cubic splines with $q = 5$ knots for each temporal variable. The number of knots was determined using information-based fit statistics. Varying the number of knots did not substantively alter the overall conclusions.

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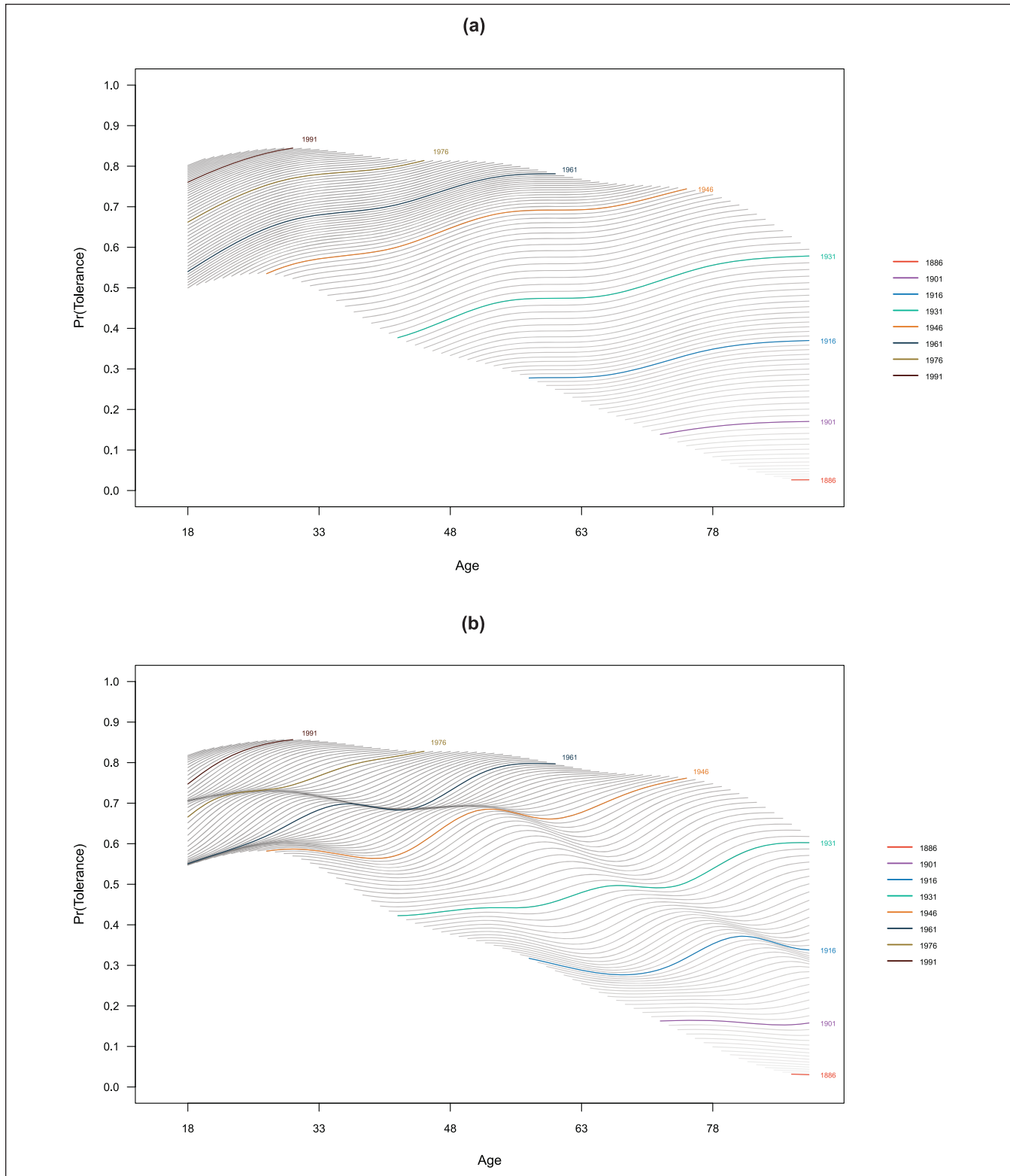


Figure I. Ryderian comparative cohort careers: tolerance for homosexuality, 1886 to 2001.

Note: Panel (a) displays Ryderian comparative cohort careers purged of period fluctuations, while panel (b) displays careers that incorporate these fluctuations. Estimates are based on a logistic regression model parameterized using natural cubic splines for age, period, and cohort with $q = 5$ knots. Cohorts with fewer than three age values (in years) are dropped. Selected cohorts at 15-year intervals are highlighted. Vertical differences across cohorts reflect intercohort trends (i.e., social change), while horizontal differences within cohorts reflect intracohort trends (i.e., life-cycle change). Higher predicted probabilities indicate greater tolerance for homosexuality (see supplemental materials for details). Sampling weights are used to adjust for the complex design of the U.S. General Social Survey. The sample size is 38,512 respondents.

give the predicted probability of having a tolerant attitude toward homosexuality on the basis of three items from the U.S. General Social Survey.² Additional analyses of support for same-sex relationships and gay marriage, which corroborate the findings presented here, are shown in the supplemental materials.

Two variants of Ryderian comparative cohort careers are displayed in Figure 1. While Figure 1a shows the cohort careers purged of the period fluctuations, Figure 1b includes these nonlinearities, which appear as a series of ripples at different ages across the cohorts. The main advantage of the careers in Figure 1a is that they are functions of overall intra- and intercohort trends and can therefore reveal underlying changes across and within cohorts that may otherwise be obscured. In contrast, the careers in Figure 1b are localized, varying across ages and cohorts as a result of the structured heterogeneity introduced by the period nonlinearities.

Consistent with Ryder's (1965, 1968) formulation, in both Figures 1a and 1b, vertical differences across the careers reveal intercohort trends, while horizontal differences within cohorts indicate intracohort trends. If there is very little social change, then the cohort careers will collapse on top of each other; by contrast, if there is a great deal of social change, then there will be increased cross-cohort vertical separation among the careers. Likewise, if there is very little life-cycle change, then the careers will be relatively flat, reflecting stasis within cohorts; conversely, if there is a great deal of life-cycle change, then the careers will be tilted upward or downward, reflecting large intracohort shifts as cohorts age across periods. Note that the period nonlinearities, indexed by age as well as cohort, play a dual role, contributing to both life-cycle and social change. Consider, for example, the "ridge" that runs through the cohorts in Figure 1b. This shift, which reflects a local progressive upswing in the 1990s, appears as an age fluctuation within cohorts that, by appearing at different ages for different cohorts, simultaneously compresses and expands the vertical distances across cohorts.

Three main conclusions follow from the results displayed in Figure 1, clarifying differing accounts on the nature and extent of changes in attitudes toward homosexuality in the United States (e.g., see Hart-Brinson 2018; Schwadel and Gameau 2014). First, as indicated by the overall upward trend within the cohorts visualized in Figure 1a, over the life course cohorts generally became more tolerant toward homosexuality. Take, for example, the career of the 1946 birth cohort. As displayed in Figure 1a, the predicted probability of being tolerant increased from a little over 0.50 in young adulthood to more than 0.70 in old age. Similar patterns hold for the other cohorts, even when incorporating the period fluctuations, as revealed in Figure 1b. Second, as indicated

by the large vertical separation of the careers in Figure 1a, successive cohorts became increasingly more tolerant of homosexuality throughout the twentieth century. However, a careful inspection reveals that most of this social change occurred across earlier cohorts, as indicated by the vertical compression of the careers after the 1946 birth cohort. Finally, as shown in Figure 1b, although the period fluctuations inject some structured heterogeneity in the cohort careers, the fundamental conclusion of increasing tolerance for homosexuality across and within cohorts remains unchanged.

In summary, by displaying the careers of more than 100 cohorts born across three centuries, Figure 1 condenses a remarkable amount of information on population-level temporal variability, revealing the interplay of intra- and intercohort trends, or, equivalently, life-cycle and social change, in a large time-series cross-sectional data set. It is hoped that the example provided herein will encourage other analysts to consider the benefits of formally constructing and visualizing Ryderian comparative cohort careers for their own research.

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Supplemental Material

Supplemental material for this article is available online.

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Author Biography

Ethan Fosse is an Assistant Professor of Sociology and Associate Director of the Data Sciences Institute at the University of Toronto. He received his PhD from Harvard University and previously worked as a postdoctoral research associate at Princeton University. He has published research on social change, quantitative methods, and cohort analysis in a number of journals, including *Demography*, *Sociological Science*, and the *Annual Review of Sociology*. He is currently working on a book with Cambridge University Press on methods for analyzing time-series cross-sectional data.

²Using the General Social Survey labels, these are Spkhomo, Colhomo, and Libhomo (see supplemental materials).