

A Network Approach to Pattern Discovery in Spell Data

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Motivation

The goal is to identify population-level patterns using a network framework for representing actors' participation in multiple, simultaneous spells. This framework relies on Butts and Pixley's (2004) structural representation of life history data and simple life history graphs.¹

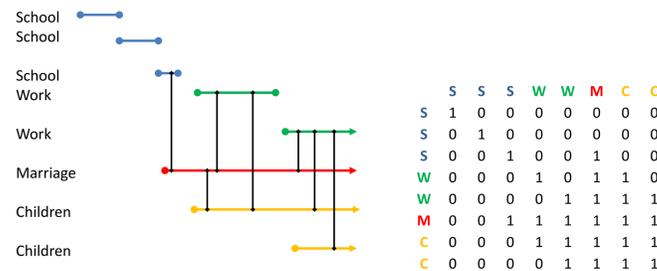
How can we use spell data and a handful of covariates to discover activity patterns in a population?

Data

I use retrospective life history data from Charles Hirschman and his colleagues' 1991 Vietnam Life History Survey.² Respondents listed the start and end dates of several spells, including schooling, working, marriage, childcare, and military participation.

How Does the Method Work?

Use spell overlaps to construct interval graphs and convert them into networks. Find the distance between all these interval graphs. Perform a cluster analysis and look for patterns (actors close together have similar life histories). More spell types allows for greater differentiation and consequently more precise results, an improvement over a limitation of sequence analysis methods.⁴

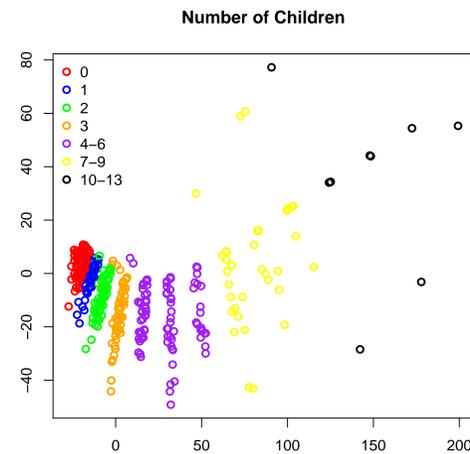


Why Interval Graphs?

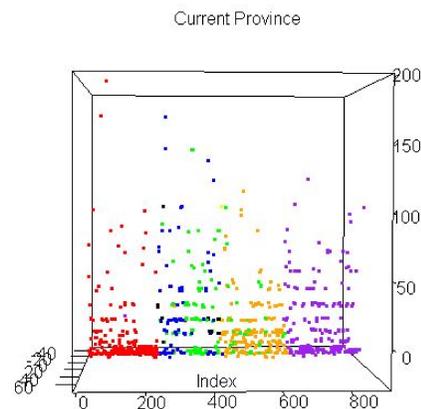
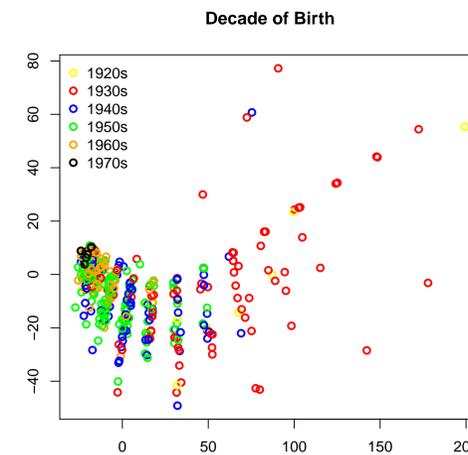
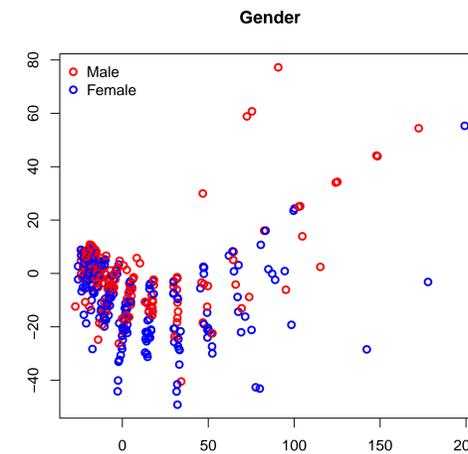
The life course approach studies spells which are extensive in time.³ The context in which these events takes place is meaningful—spell overlaps provide a useful representation of this context.¹

Exploring the Data

Factors that Differentiate Life Histories



Factors that Do Not Substantially Differentiate Life Histories



Can Tho, Tien Tien, Hai Hung, Hai Duong, Long Hoa

Initial Findings

- Lives are most differentiated by childcare spells.
- Location differentiates individuals' life histories throughout their entire lives. Location is also associated with differences in job industry, religion, and ethnicity.
- Gender, education level, and decade of birth are less important in differentiating life histories.

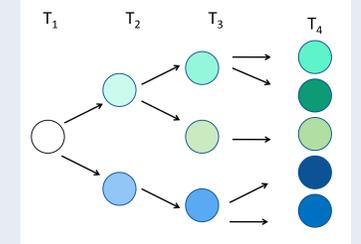
Further Applications

Using after action reports such as the Oklahoma City Bombing Final Report⁵, we can examine:

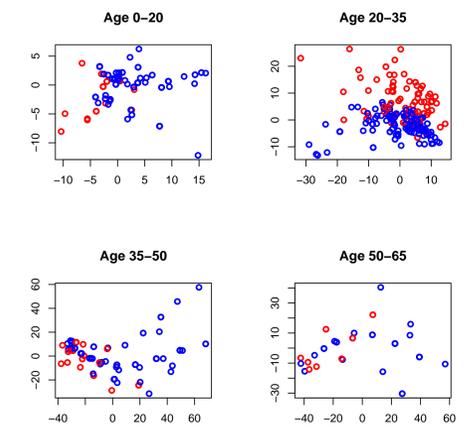
- Co-participation in activities (evacuation, search and rescue, triage) to anticipate tie-formation and future collaboration among organizations.
- Activity patterns of organizations involved or uninvolved with tasks on the critical path, as identified by Program Evaluation Review Technique (PERT).

Path Dependency

We can examine whether these clusters converge or diverge over time and trace the paths actors follow en route to their final position.



Path Dependency Example



Military Participation vs. No Military Participation

References

- [1] Butts, Carter T. and Pixley, Joy E. (2004). 'A Structural Approach to the Representation of Life History Data.' *Journal of Mathematical Sociology*, 28(2), 81-124.
- [2] Hirschman, et al. (1991). *Vietnam Life History Survey*
- [3] Elder, Jr., G. H. (1995). The Life Course Paradigm: Social Change and Individual Development. In Moen, P. and Luscher, K., (eds.) *Examining Lives in Context: Perspectives on the Ecology of Human Development*, (pp. 101-139). Washington, DC: American Psychological Association.
- [4] Abbot, Andrew and Forrest, John. (1986). 'Optimal Matching Methods for Historical Sequences' *Journal of Interdisciplinary History*, Vol. 16, No. 3, 471-494
- [5] Final Report: Alfred P. Murrah Federal Building Bombing April 19, 1995. (1996). Stillwater, OK: Department of Central Services Central Printing Division.

