

An Interval Graph Method for Cross-Cultural Comparison of Life Histories*

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MURI AHM

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Outline

- Introduction to interval graphs
- Exploratory results
- Future directions

MURI

- Several MURI projects advance methods in analysis of a single, large graph
- Focus here is analysis and comparison of *large numbers* (i.e. thousands) of graphs

Introduction: Life History Concepts

- Lives are composed of a series of subintervals (spells) and life history is the collection of these spells
- Start and end dates of spells (school, work, marriages, etc) allow for surprisingly deep insight into one's life
 - Timing of spells has lasting impact on timing (or even existence) of subsequent spells (Elder 1998)

Introduction: Why Networks?

- We need a method for analyzing life history which preserves maximal information on context and timing of spells
- Butts and Pixley (2004): Structural approach to representing life history data
 - Understand life history as a series of intervals and their temporal overlap

Introduction: Why Networks?

- Interval graph: takes a set of spells as the vertex set and coterminousness as the edge set (Butts and Pixley 2004)
- Why are we interested in spell simultaneity?
 - When activities are coterminous, they are linked together in a meaningful way

Introduction: Why Networks?

- Example: Four lives

Introduction: Why Networks?

- Example: Four lives
 - School

Introduction: Why Networks?

- Example: Four lives
 - School
 - School + Work

Introduction: Why Networks?

- Example: Four lives
 - School
 - School + Work
 - School + Work + Marriage

Introduction: Why Networks?

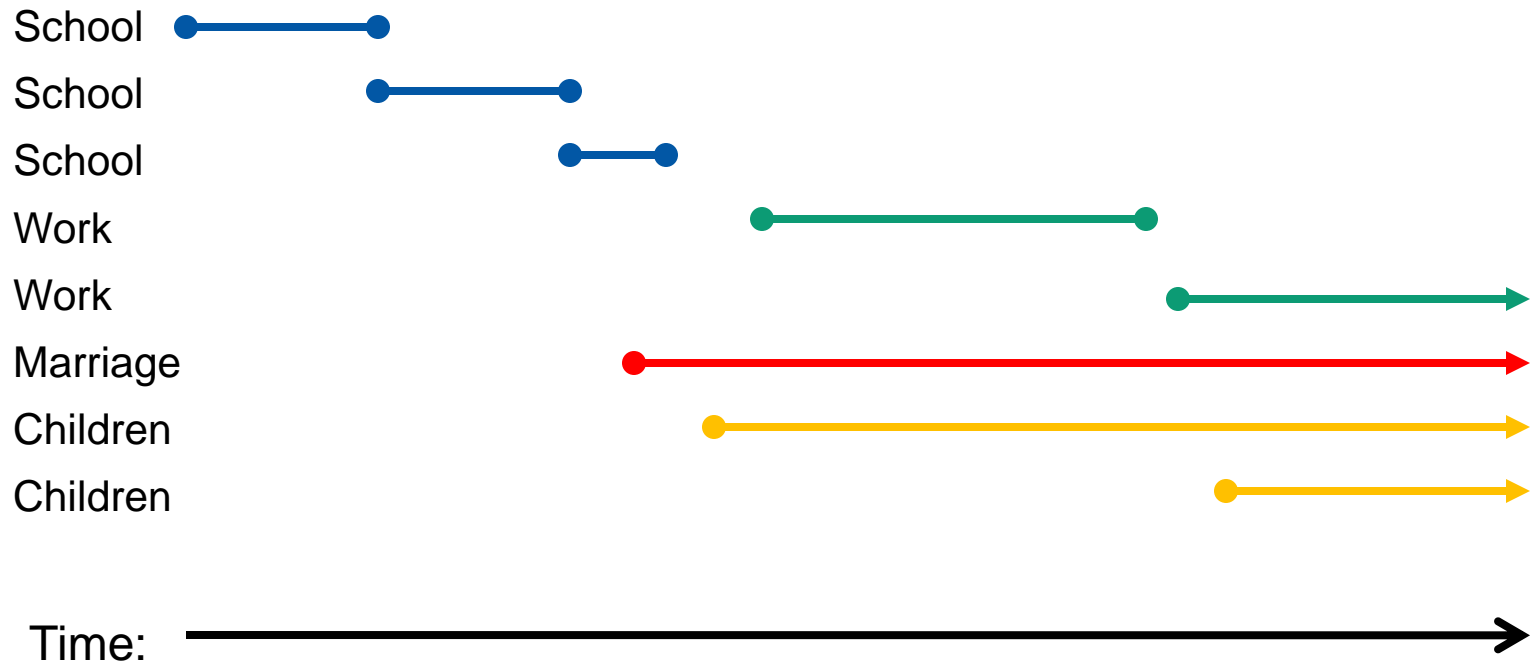
- Example: Four lives
 - School
 - School + Work
 - School + Work + Marriage
 - School + Work + Marriage + Children

Introduction: Why Networks?

- Example: Four lives
 - School
 - School + Work
 - School + Work + Marriage
 - School + Work + Marriage + Children
- Context is important!

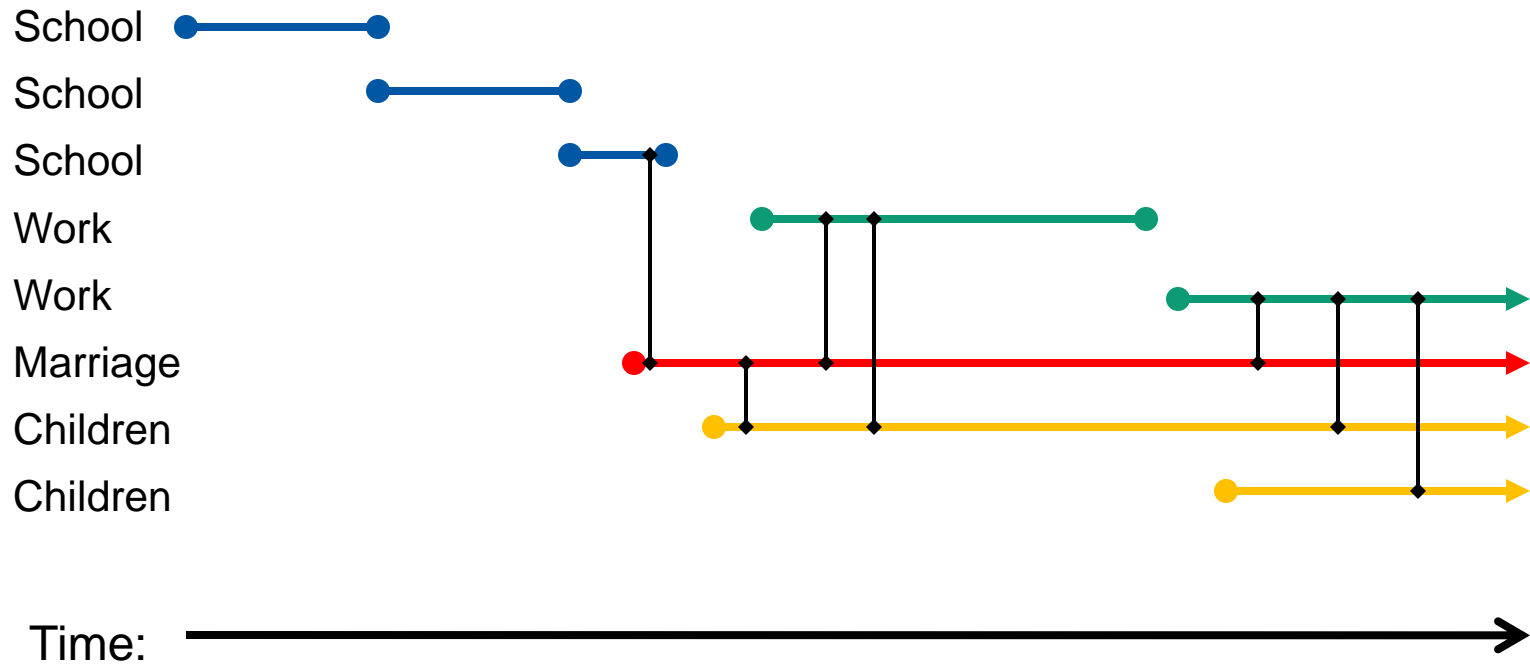
Methods: Interval Graphs

- How do we construct an interval graph?



Methods: Interval Graphs

- How do we construct an interval graph?



Methods: Interval Graphs

- Interval graph: tie indicates coterminousness

	School 1	School 2	School 3	Work 1	Work 2	Marriage	Child 1	Child 2
School 1	1	0	0	0	0	0	0	0
School 2	0	1	0	0	0	0	0	0
School 3	0	0	1	0	0	1	0	0
Work 1	0	0	0	1	0	1	1	0
Work 2	0	0	0	0	1	1	1	1
Marriage	0	0	1	1	1	1	1	1
Child 1	0	0	0	1	1	1	1	1
Child 2	0	0	0	0	1	1	1	1

Methods: Interval Graph Comparison

- Comparison across multiple lives:
 - Construct an interval graph for each actor
 - Find the graph distances between all actors
- Direct comparison is inappropriate here: spells are not comparable across domains
 - We must use a partial labeling function to identify which sets of vertices (spells) are equivalent in our comparison (Butts and Carley, 2005)

Methods: Interval Graphs

- Exchangeability list: we treat spells within domains as comparable and allow permutation within domains

	School 1	School 2	School 3	Work 1	Work 2	Marriage	Child 1	Child 2
School 1	1	0	0	0	0	0	0	0
School 2	0	1	0	0	0	0	0	0
School 3	0	0	1	0	0	1	0	0
Work 1	0	0	0	1	0	1	1	0
Work 2	0	0	0	0	1	1	1	1
Marriage	0	0	1	1	1	1	1	1
Child 1	0	0	0	1	1	1	1	1
Child 2	0	0	0	0	1	1	1	1

Methods: Interval Graph Comparison

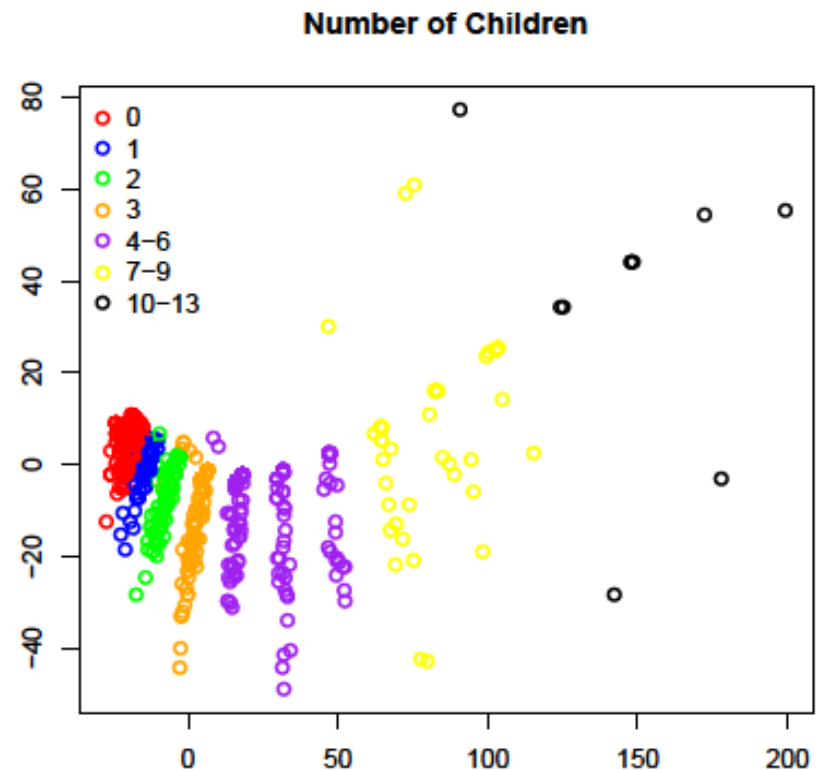
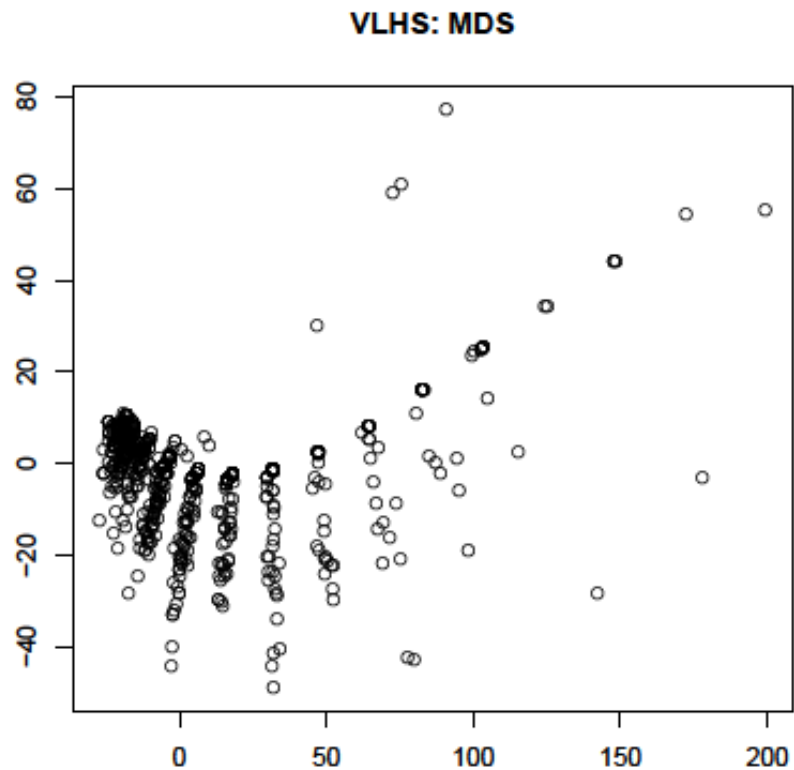
- Distance matrix: $n \times n$ matrix where the (i,j) cell is the distance between i and j
 - In this context, graph distance corresponds to differences in life histories
- Use multidimensional scaling (MDS) to visualize the distances
 - MDS represents similarities and differences among a set of items as Euclidean distances in k -dimensional space (Kruskal and Wish 1978)
 - Actors grouped together in MDS space have similar life histories

Data

- Retrospective life history data: individuals provide start and end dates for a variety of spells
- Vietnam Life History Survey (Hirschman et al., 1991)
- Wisconsin Longitudinal Study (Hauser and Sewell, 2010)
- Life Histories and Social Change in Contemporary China (Treiman and Walder, 1998)
- Domains of interest: education, work, marriage, children, military participation

Results: Vietnam

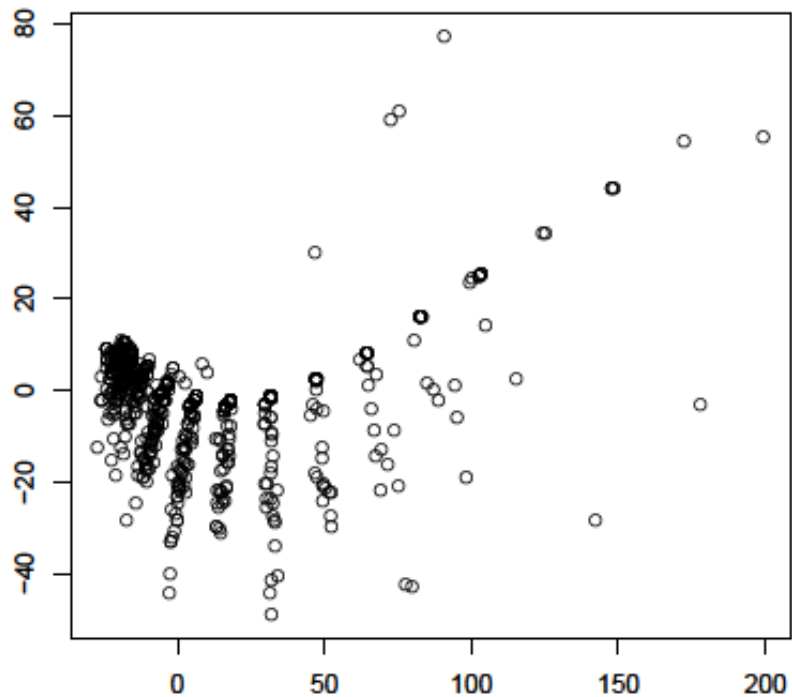
- MDS: Banding is explained by number of children



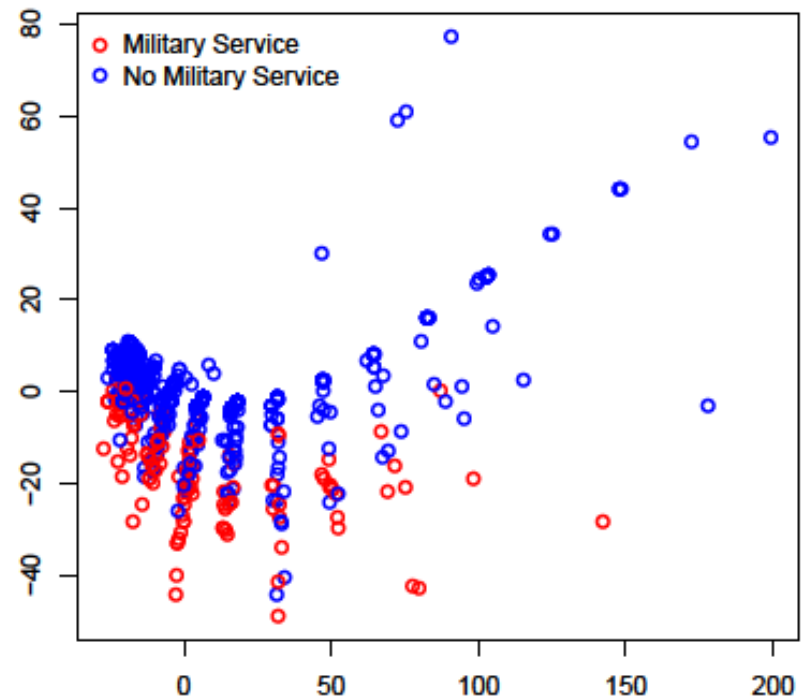
Results: Vietnam

- MDS: Within bands, actors are primarily differentiated by military participation

VLHS: MDS

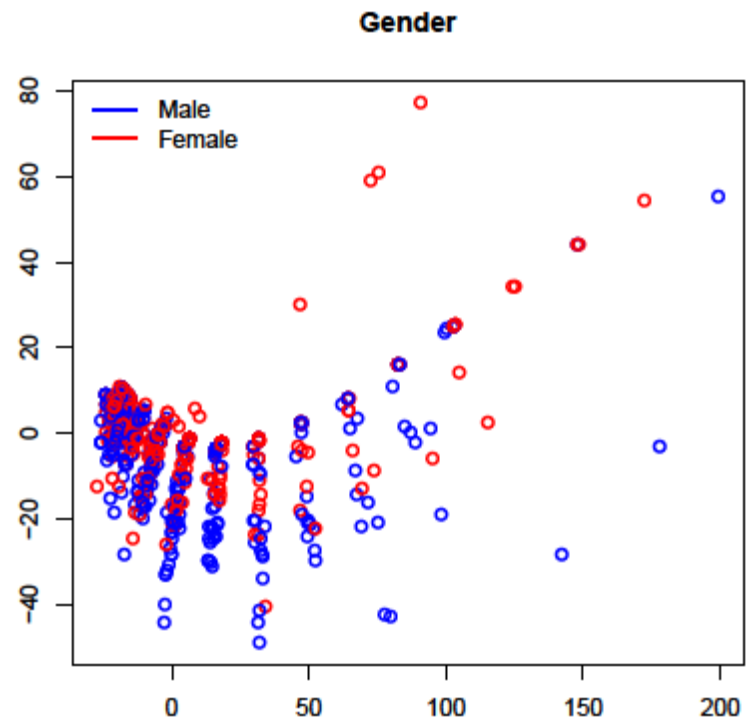
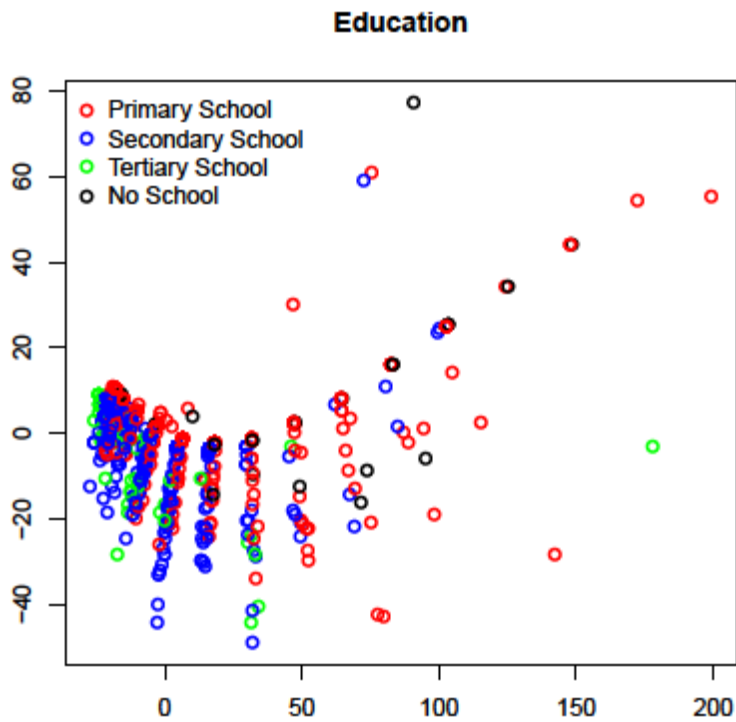


Military Service



Results: Vietnam

- Which covariates explain patterning?



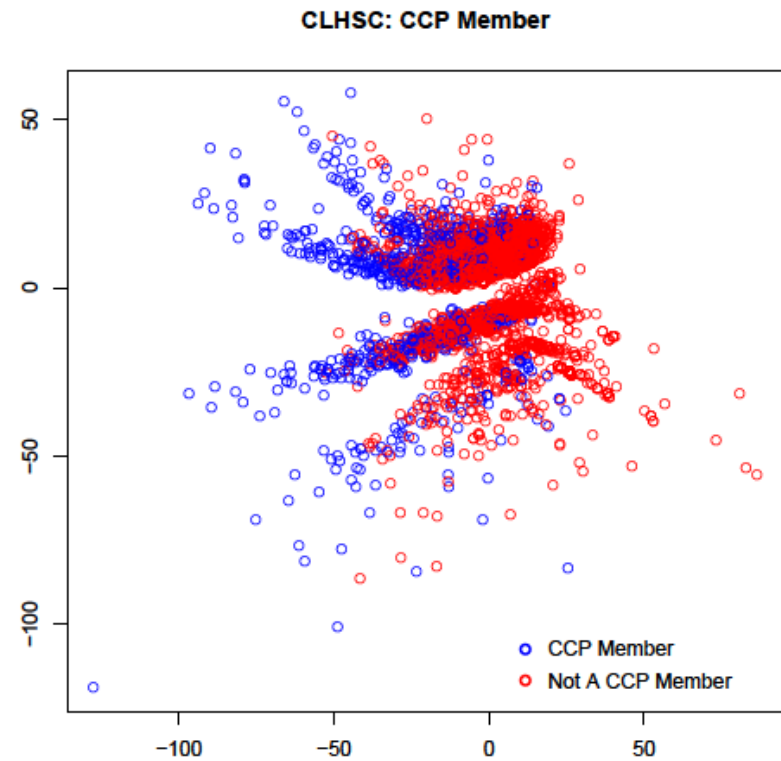
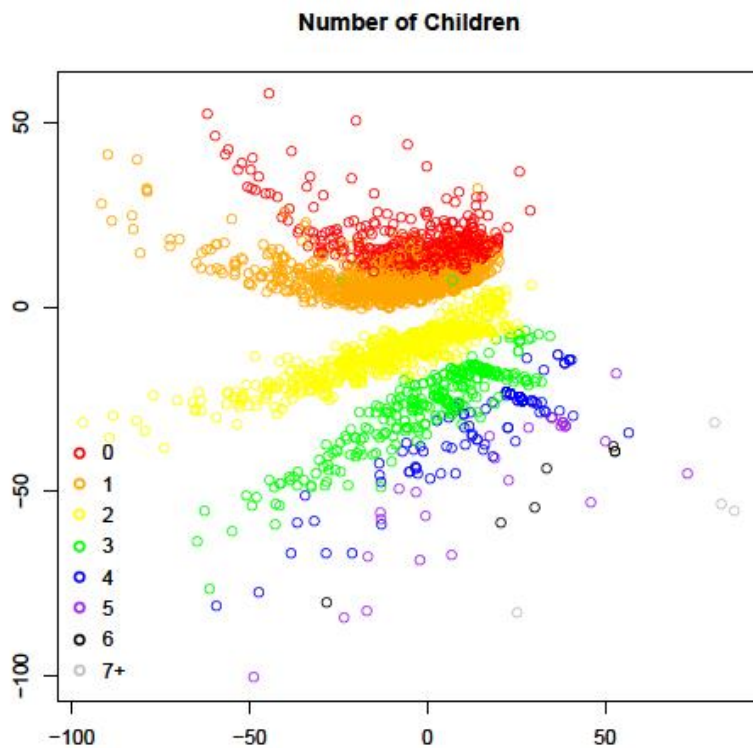
Results: Vietnam

- What is associated with differences in lives?
 - Family size
 - Military

- Might we see differences in China?

Results: China

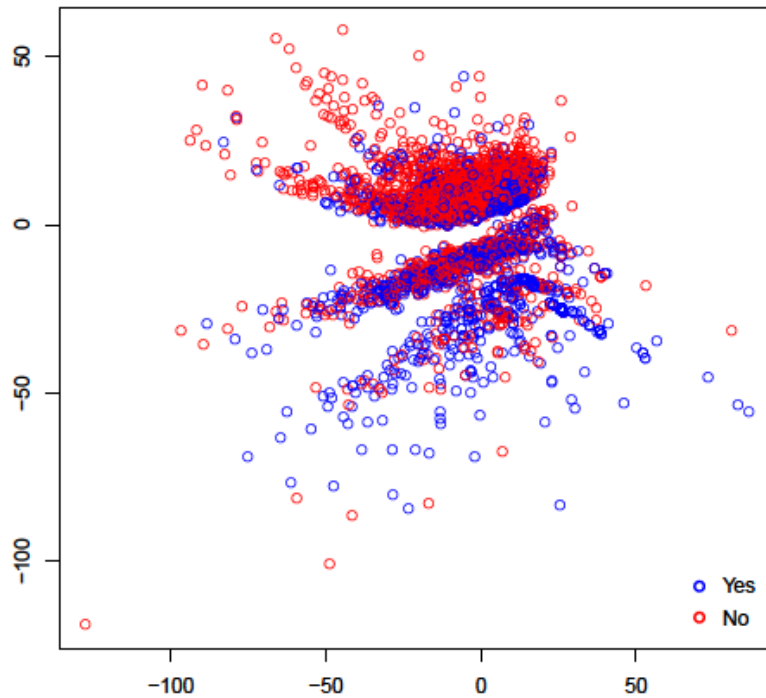
- Number of children and CCP membership explain much of the differences among lives



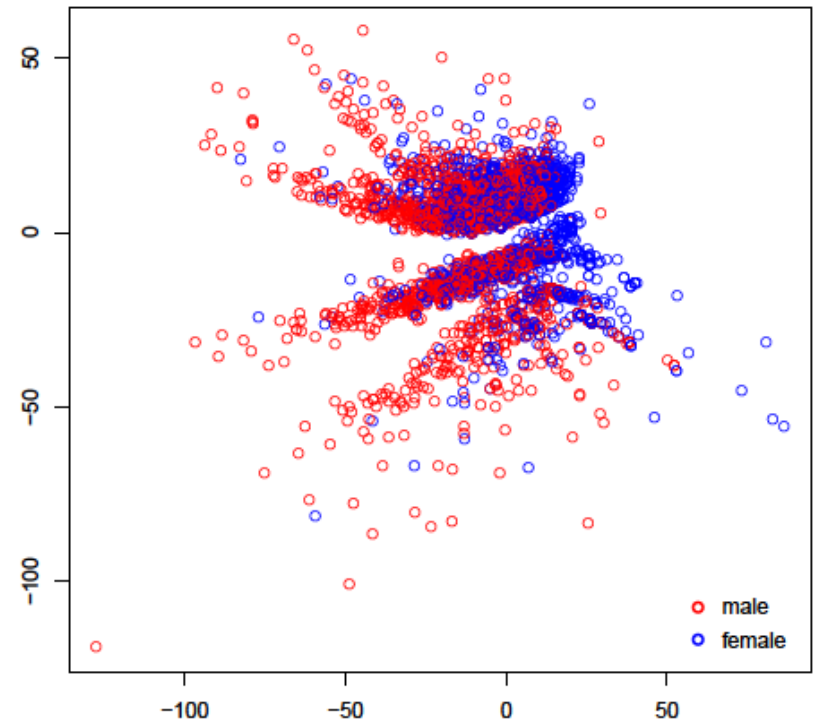
Results: China

- Gender and farming are associated with differences

CLHSC: Grow Crops

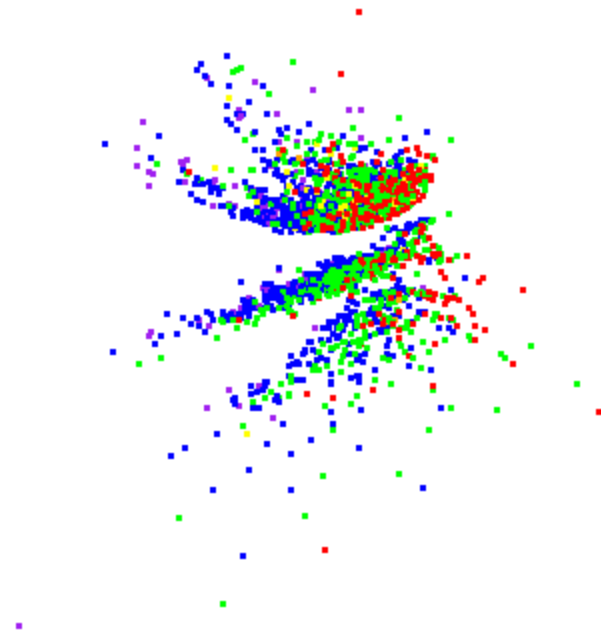
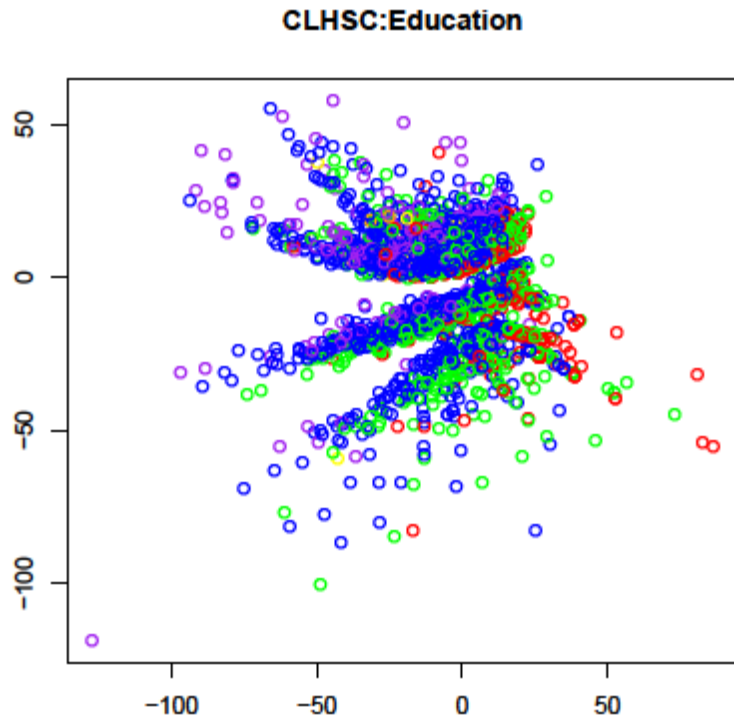


Gender



Results: China

- 3D plots allow us to explore further



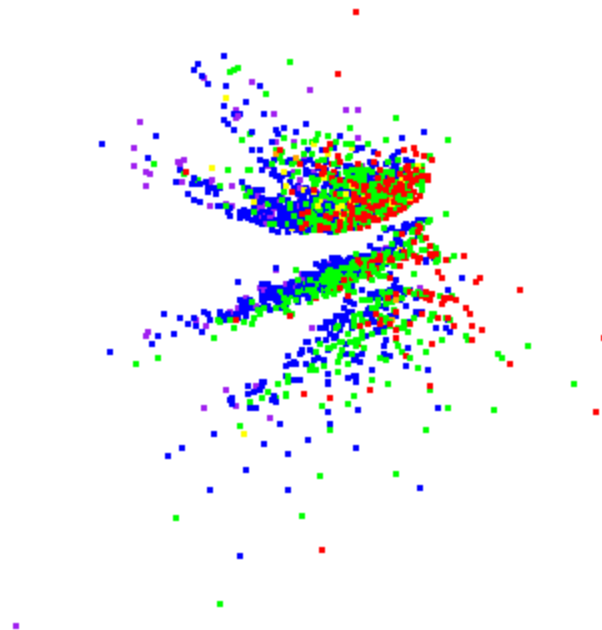
Results: China

No schooling/illiterate

Primary school

Middle school

University



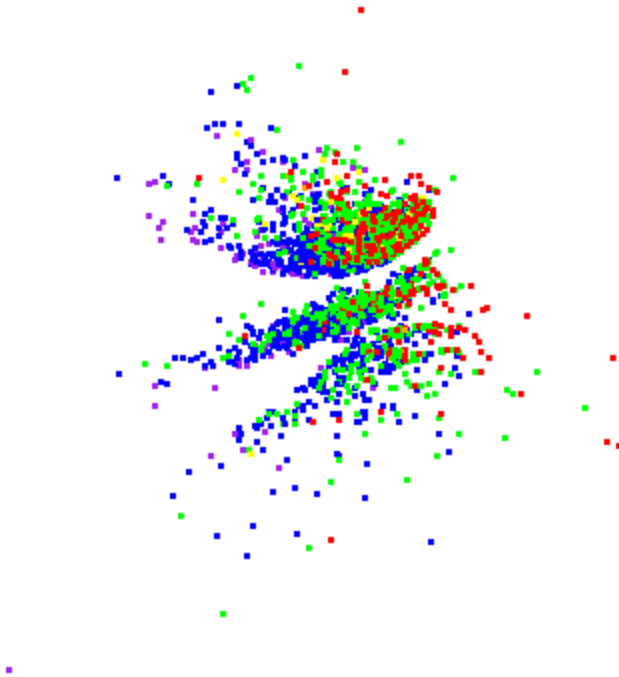
Results: China

No schooling/illiterate

Primary school

Middle school

University



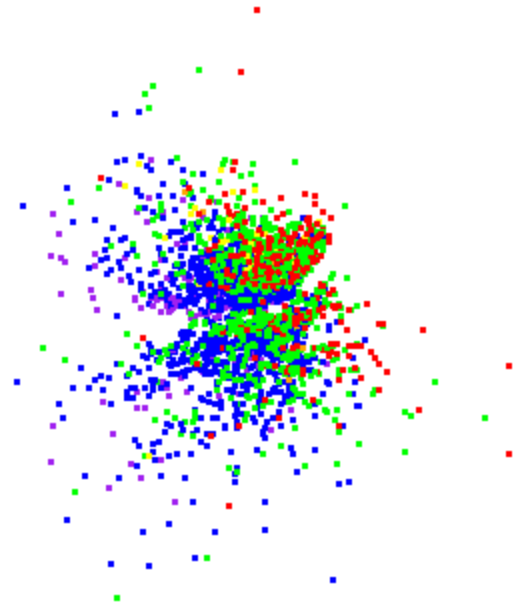
Results: China

No schooling/illiterate

Primary school

Middle school

University



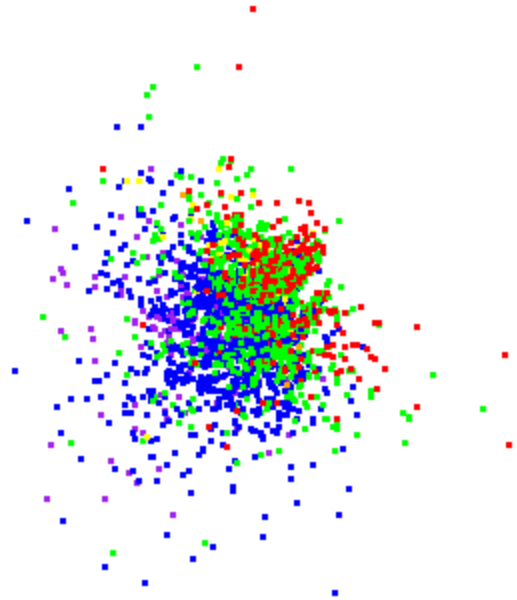
Results: China

No schooling/illiterate

Primary school

Middle school

University



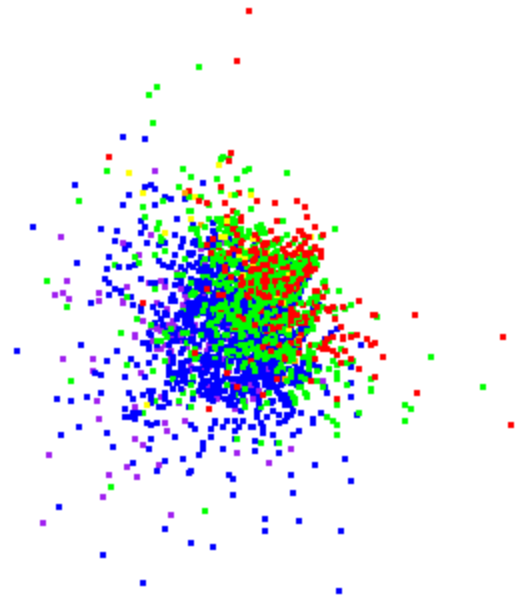
Results: China

No schooling/illiterate

Primary school

Middle school

University



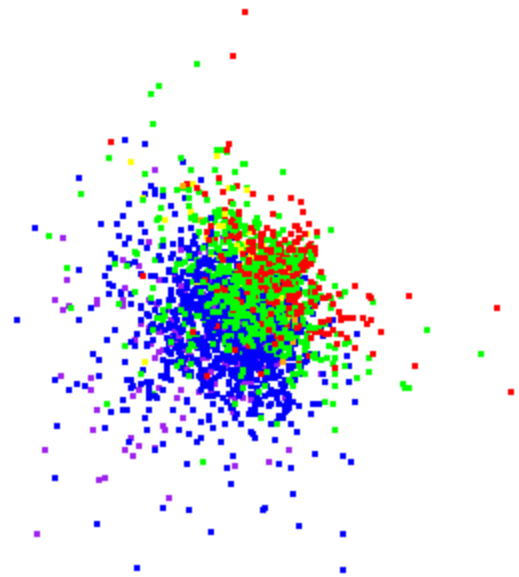
Results: China

No schooling/illiterate

Primary school

Middle school

University



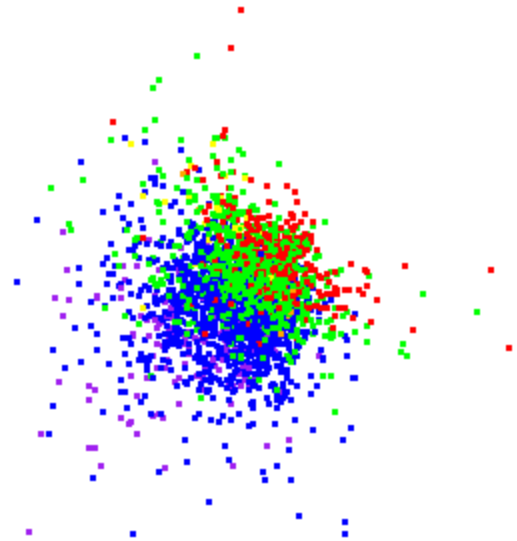
Results: China

No schooling/illiterate

Primary school

Middle school

University



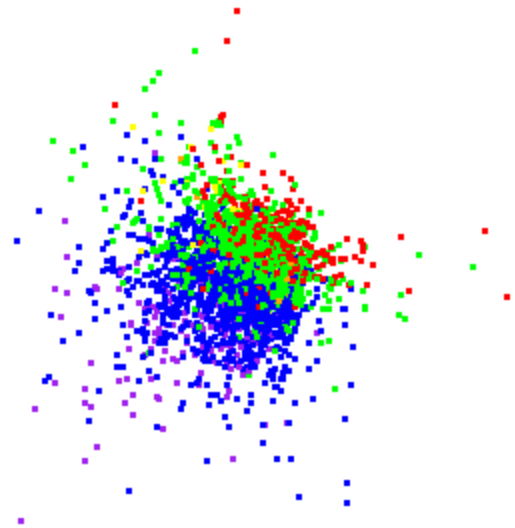
Results: China

No schooling/illiterate

Primary school

Middle school

University



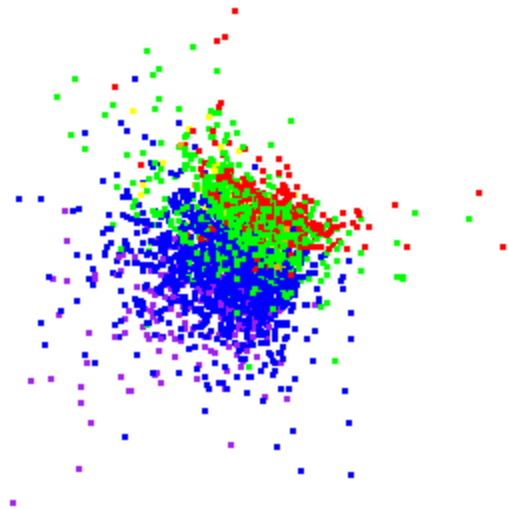
Results: China

No schooling/illiterate

Primary school

Middle school

University



Results: China

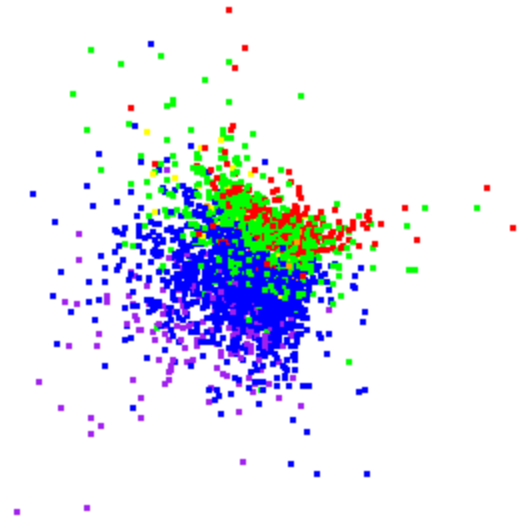
- We can see a spectrum of education levels here

No schooling/illiterate

Primary school

Middle school

University



Results: China

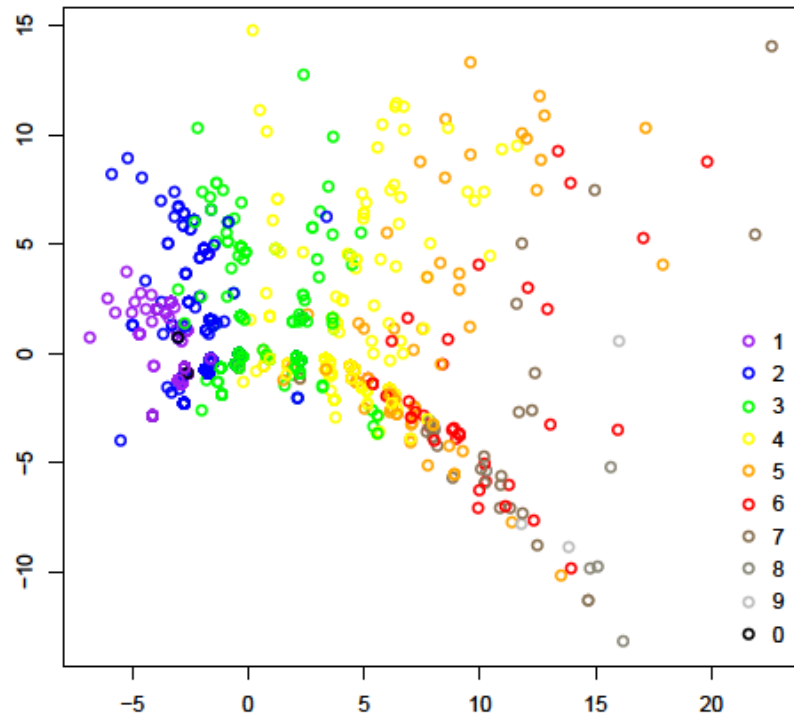
- What is associated with differences in lives?
 - Family size
 - Education
 - Party membership
 - Gender
 - Involvement in agriculture

- What patterns might we see in the United States?

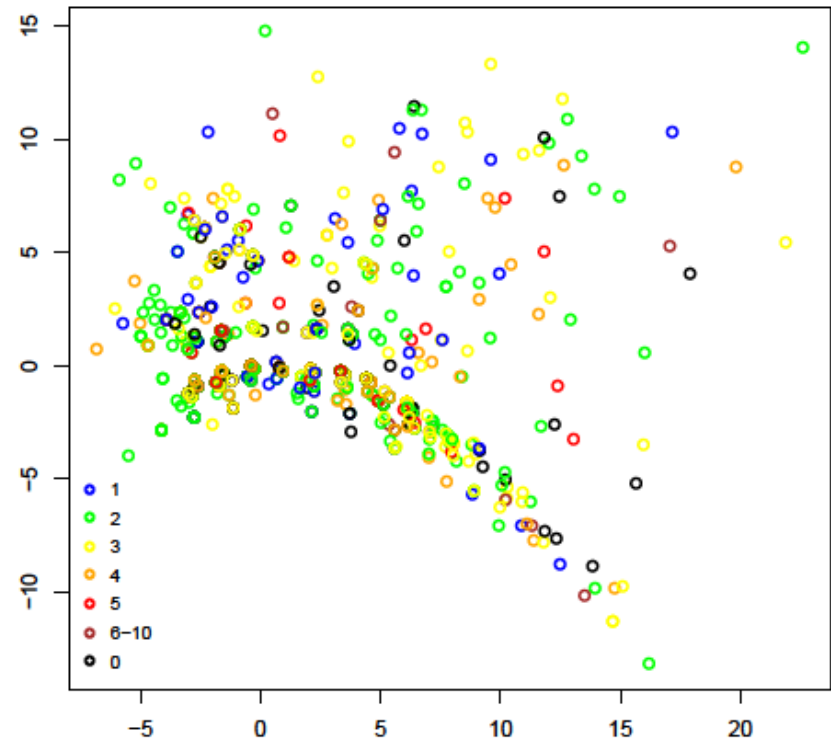
Results: United States

- Jobs instead of children!

WLS: Number of Jobs

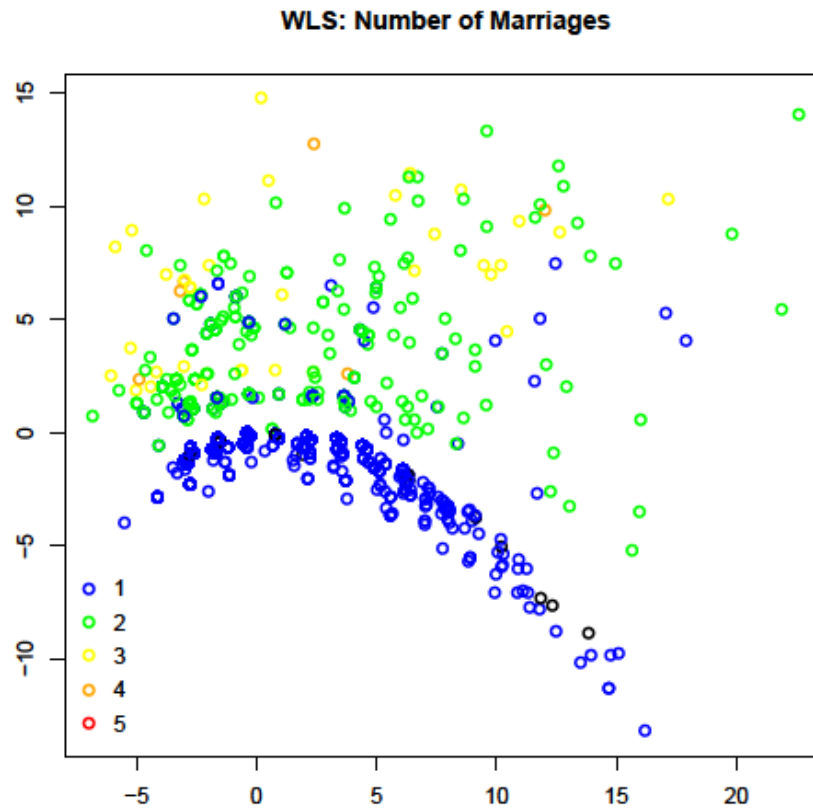


WLS: Number of Children



Results: United States

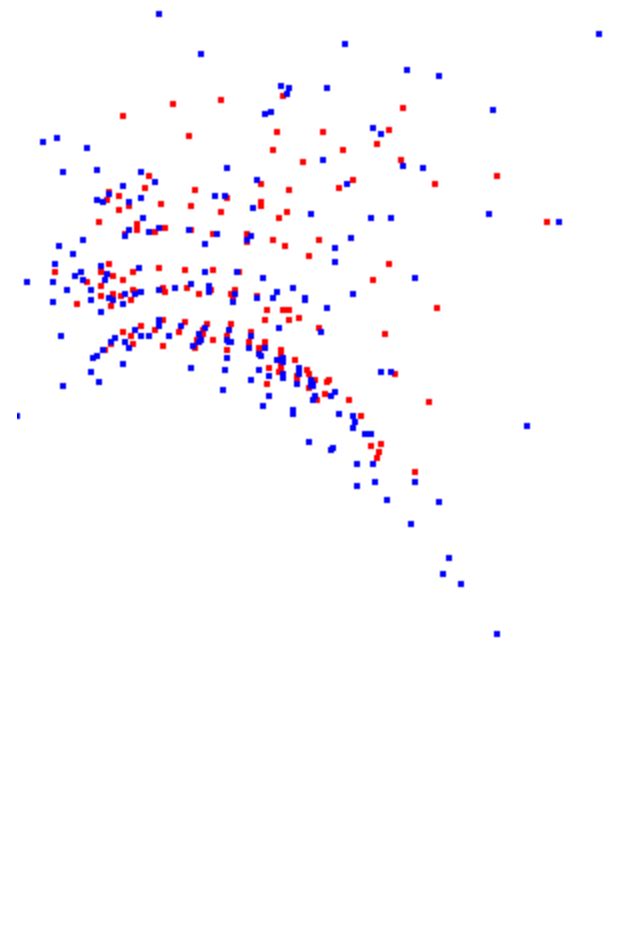
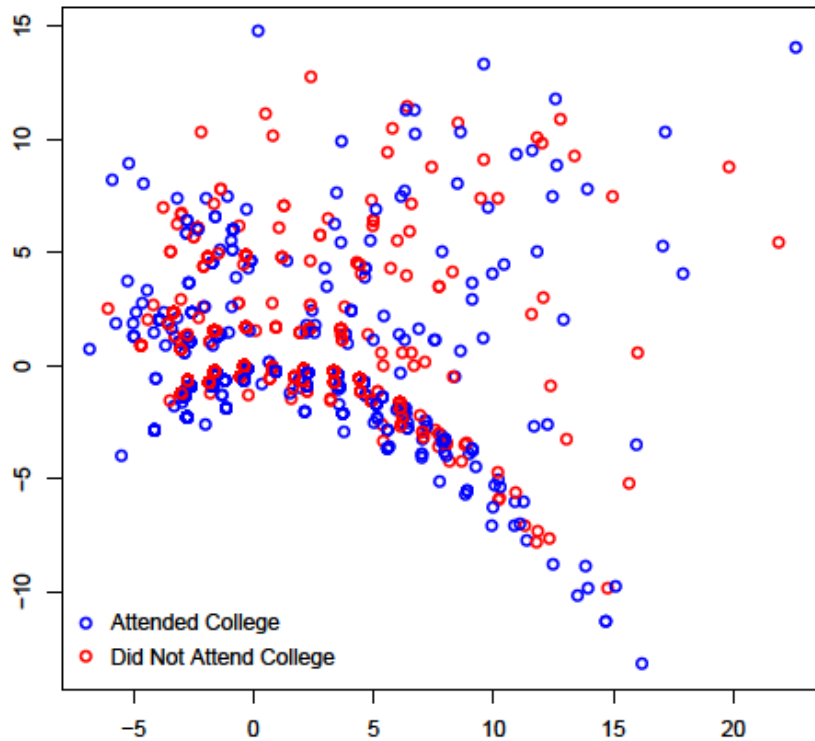
- Some differences between those with 0/1 and 2+ marriages...



Results: United States

- Back to the 3D plots

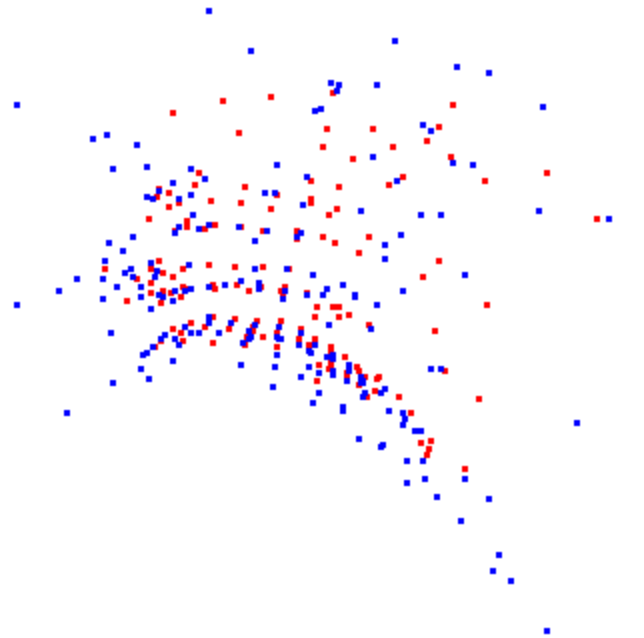
WLS: Attend College



Results: United States

Attended college

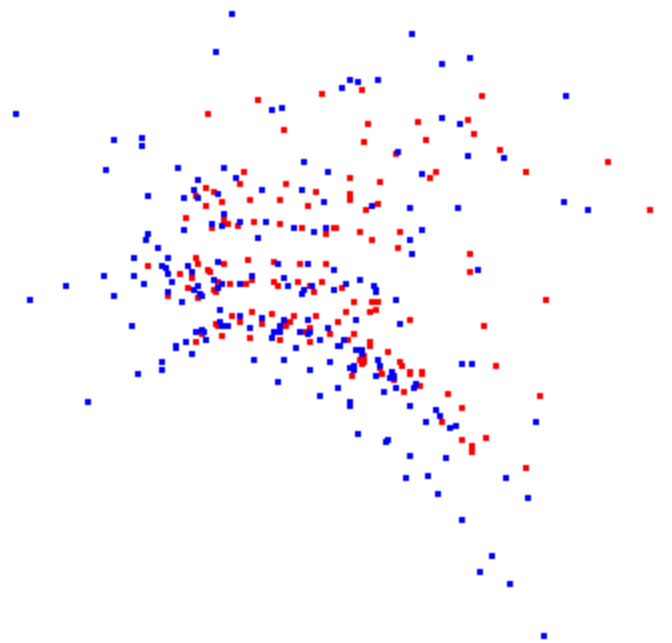
Did not attend college



Results: United States

Attended college

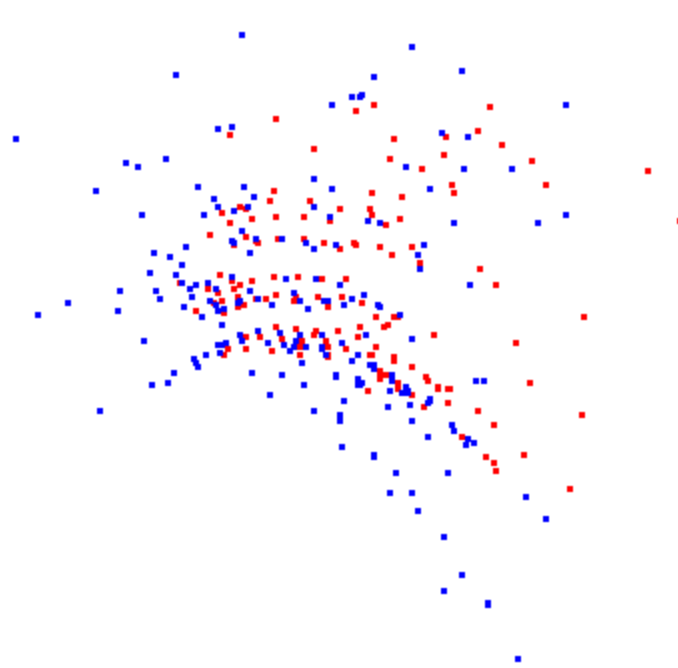
Did not attend college



Results: United States

Attended college

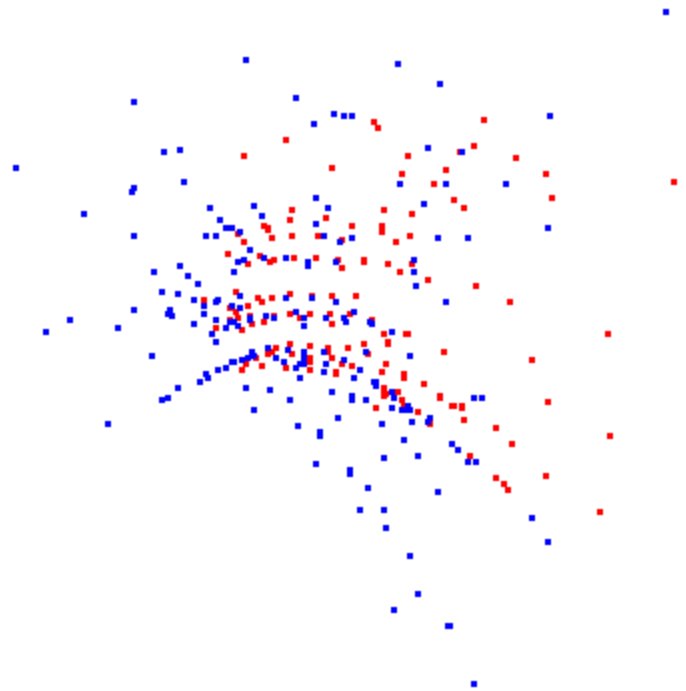
Did not attend college



Results: United States

Attended college

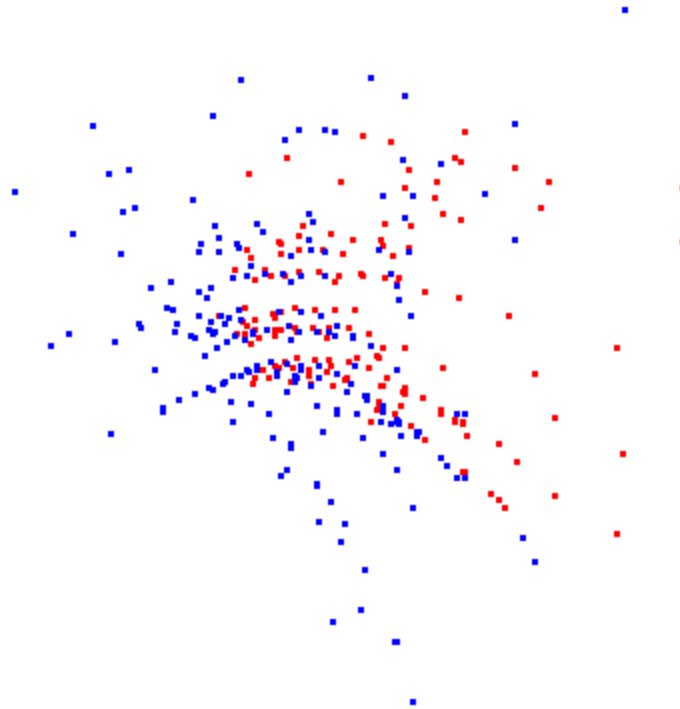
Did not attend college



Results: United States

Attended college

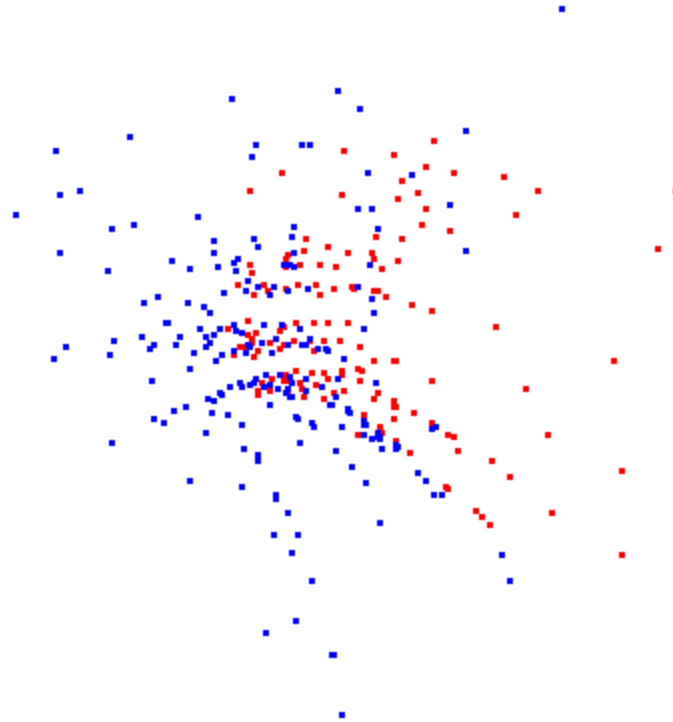
Did not attend college



Results: United States

Attended college

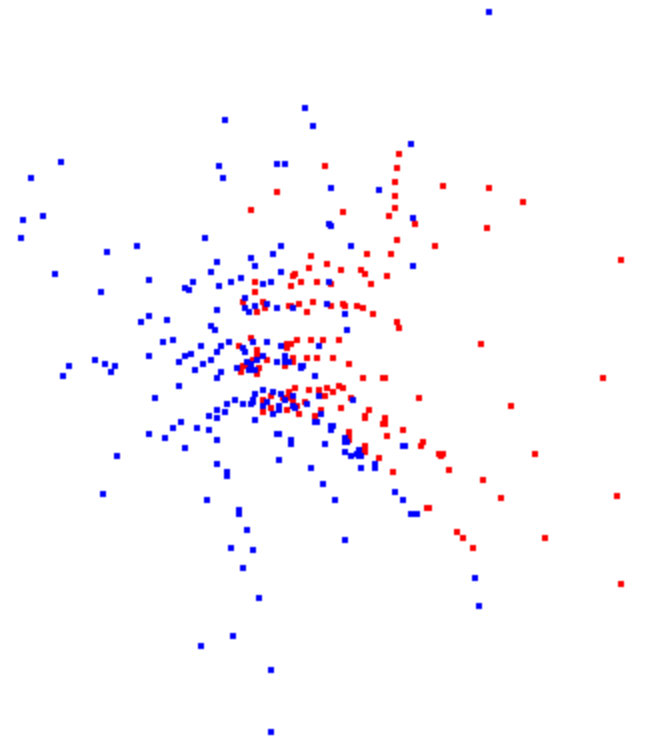
Did not attend college



Results: United States

Attended college

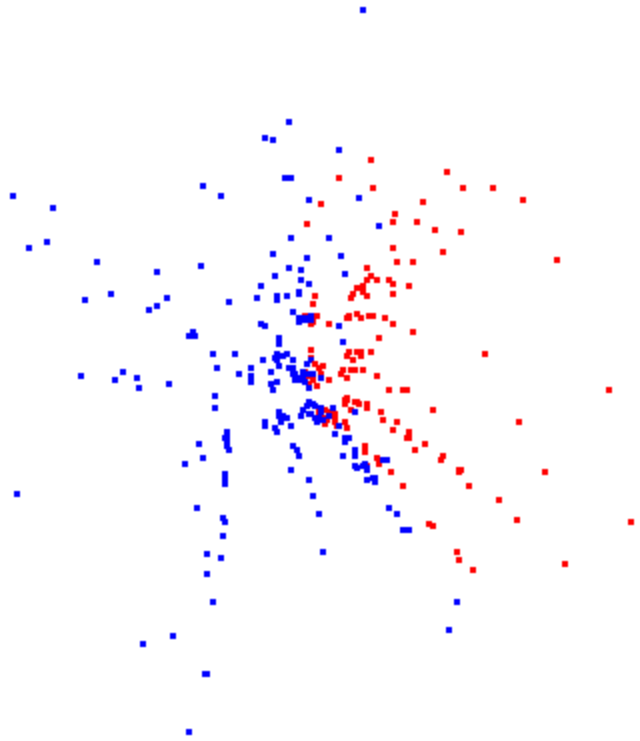
Did not attend college



Results: United States

Attended college

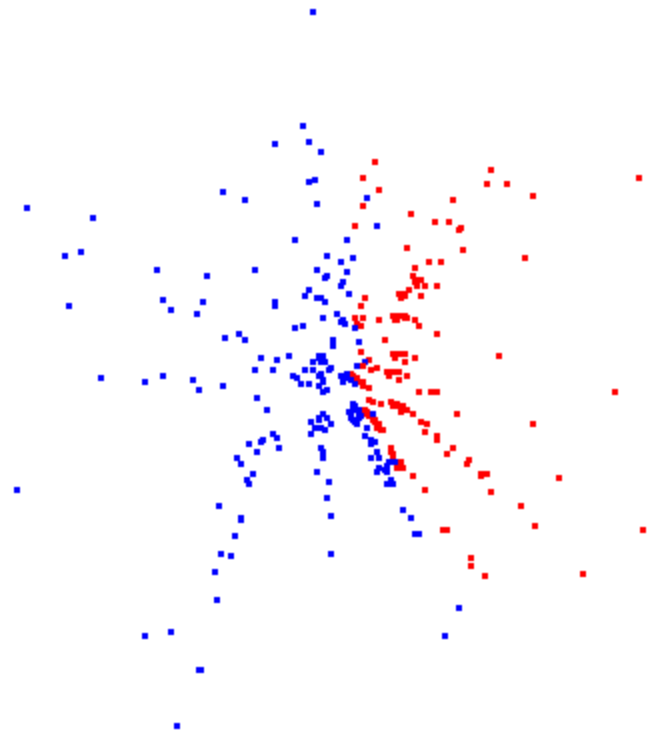
Did not attend college



Results: United States

Attended college

Did not attend college

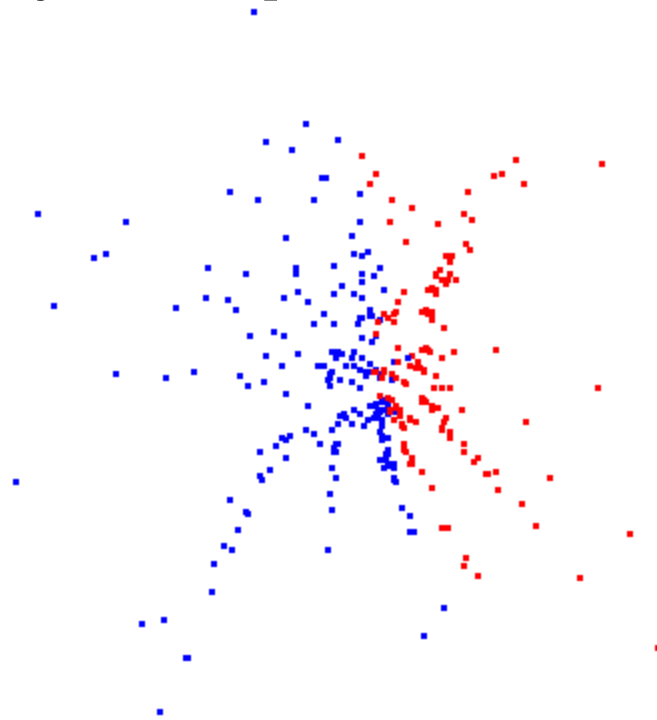


Results: United States

- College education plays an important role in differentiating lives

Attended college

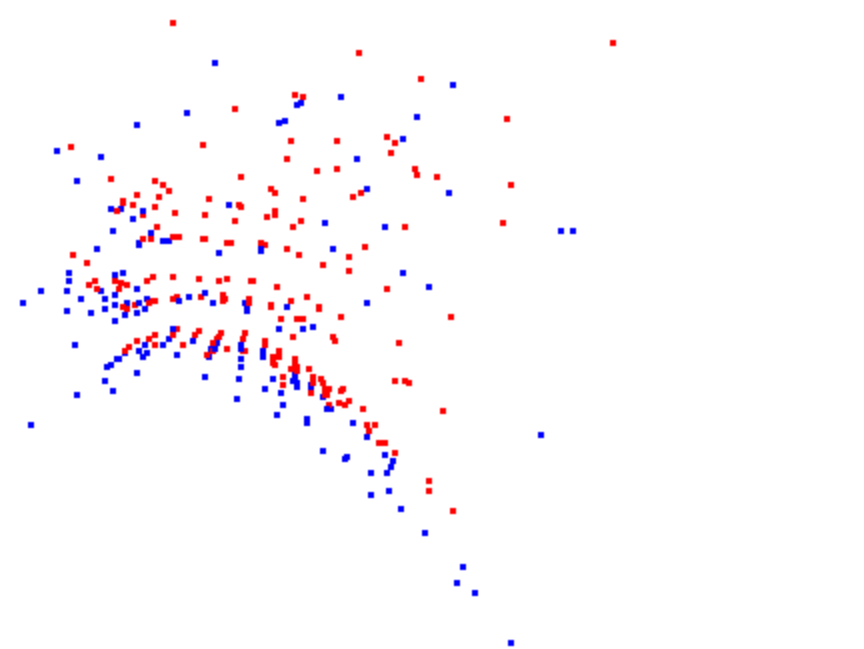
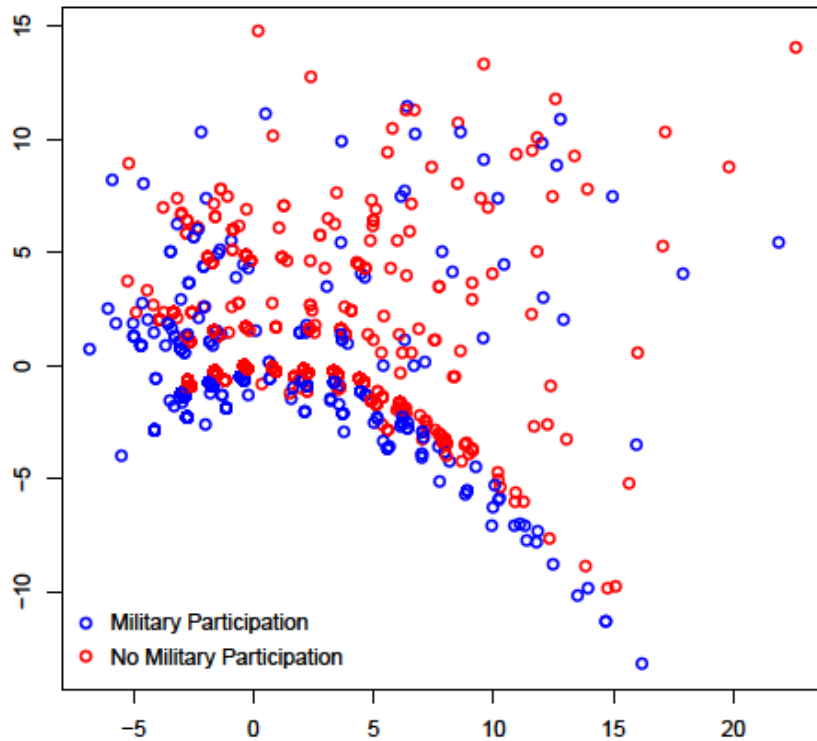
Did not attend college



Results: United States

- More 3D plots

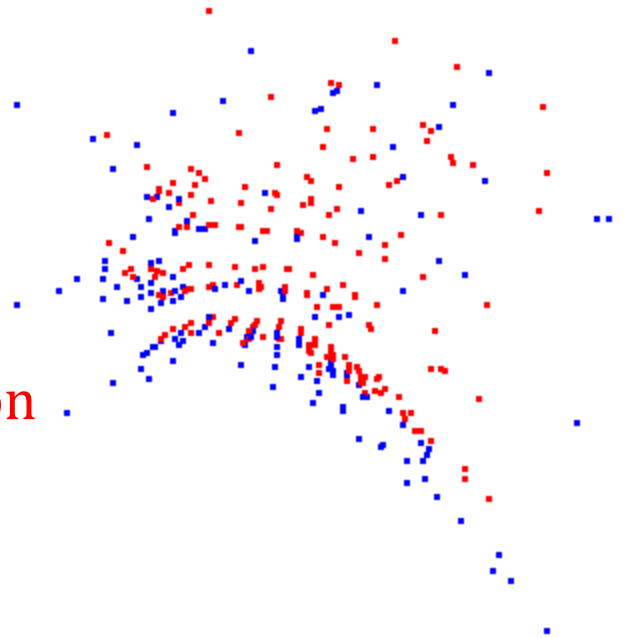
WLS: Military



Results: United States

Military participation

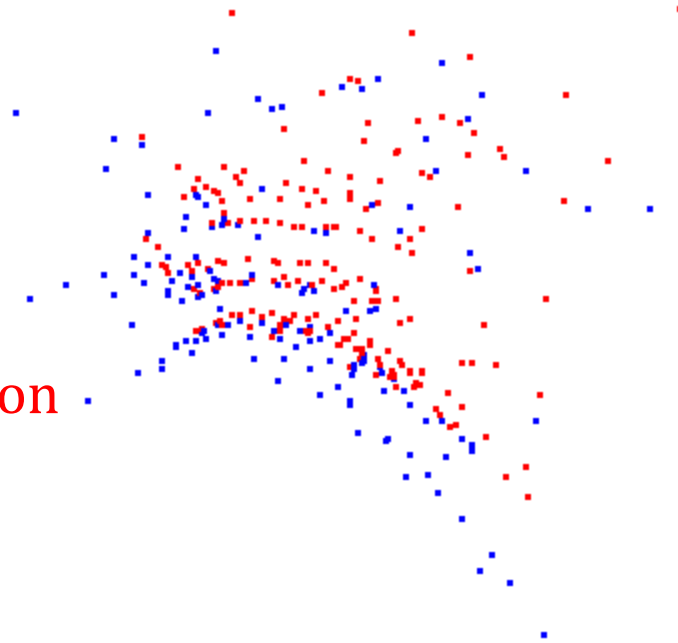
No military participation



Results: United States

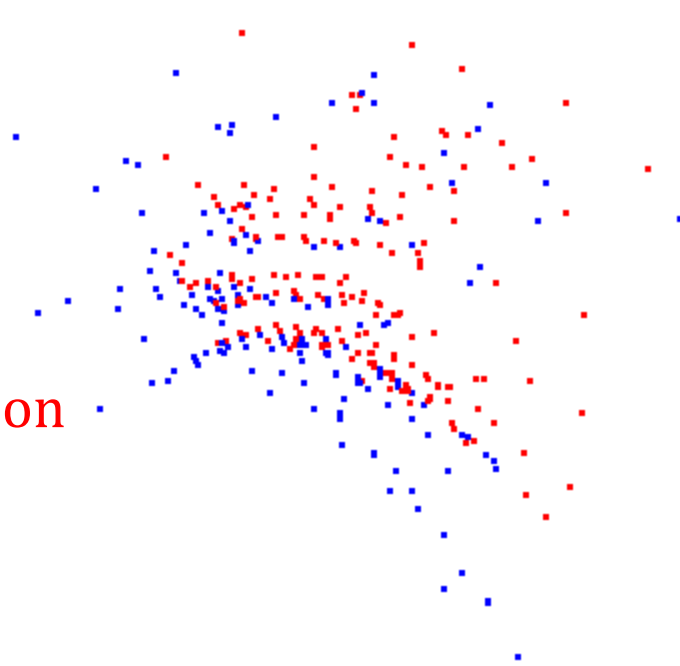
Military participation

No military participation



Results: United States

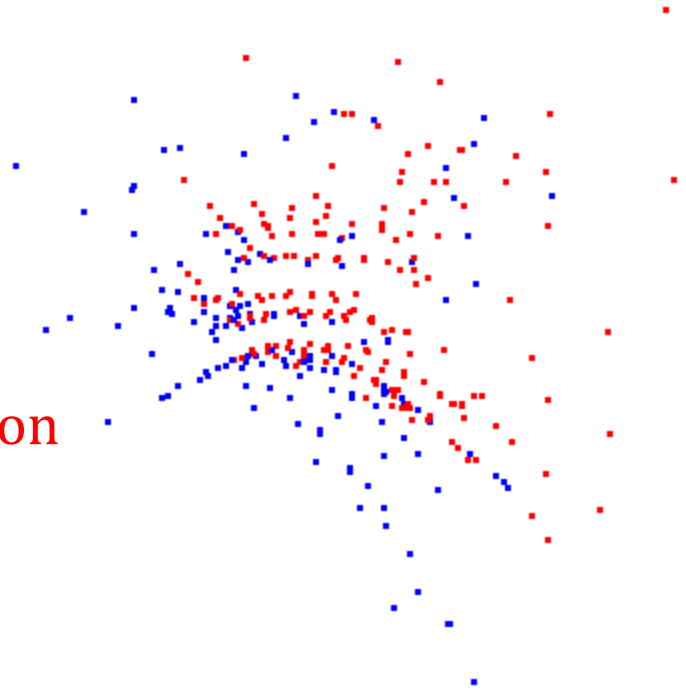
Military participation
No military participation



Results: United States

Military participation

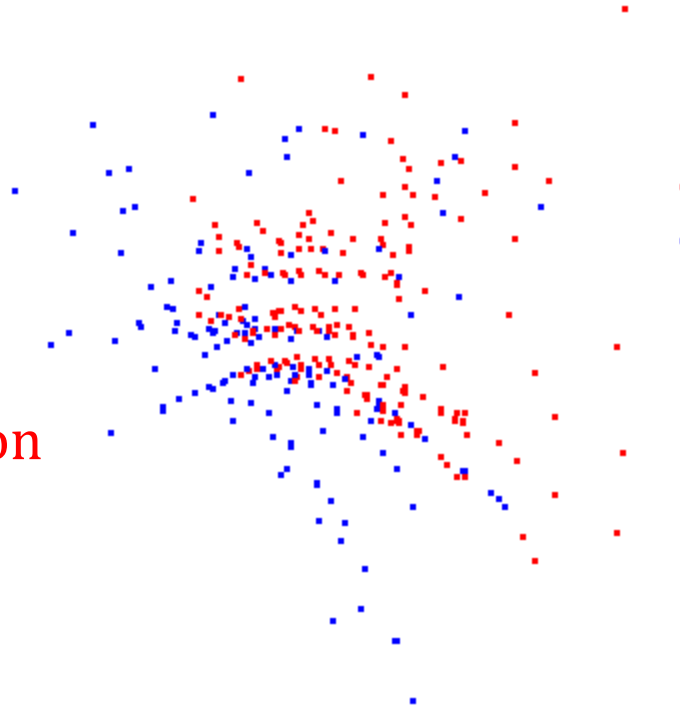
No military participation



Results: United States

Military participation

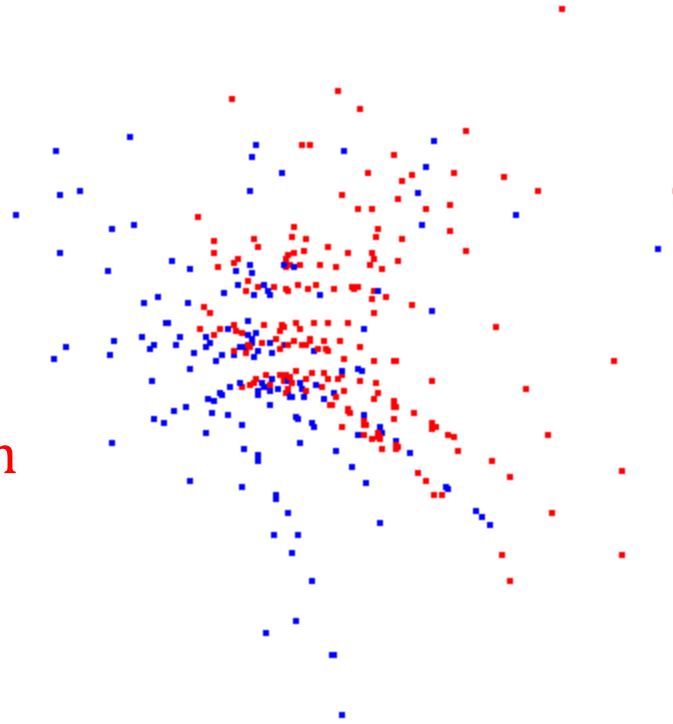
No military participation



Results: United States

Military participation

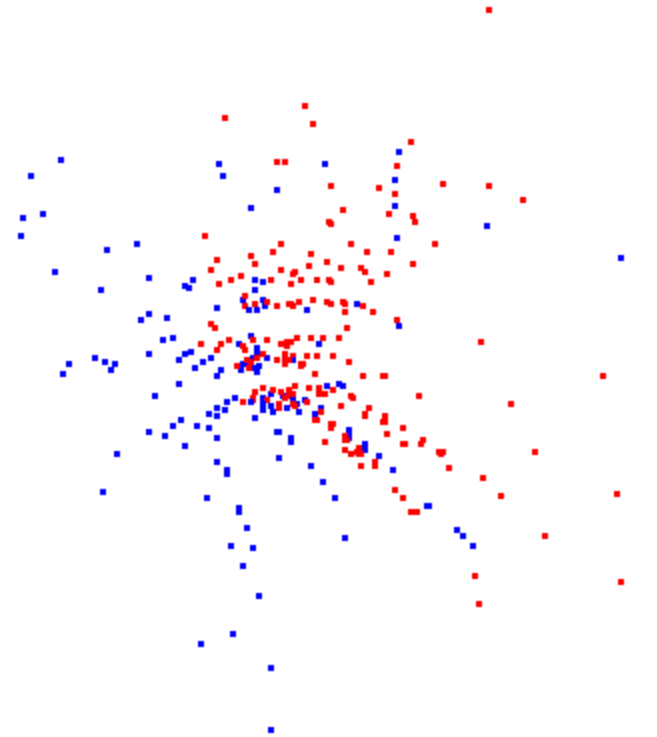
No military participation



Results: United States

Military participation

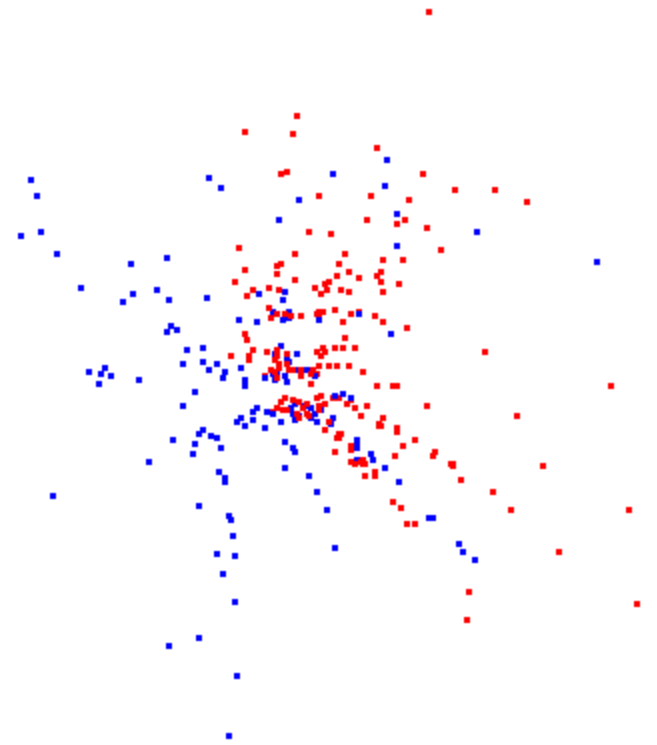
No military participation



Results: United States

Military participation

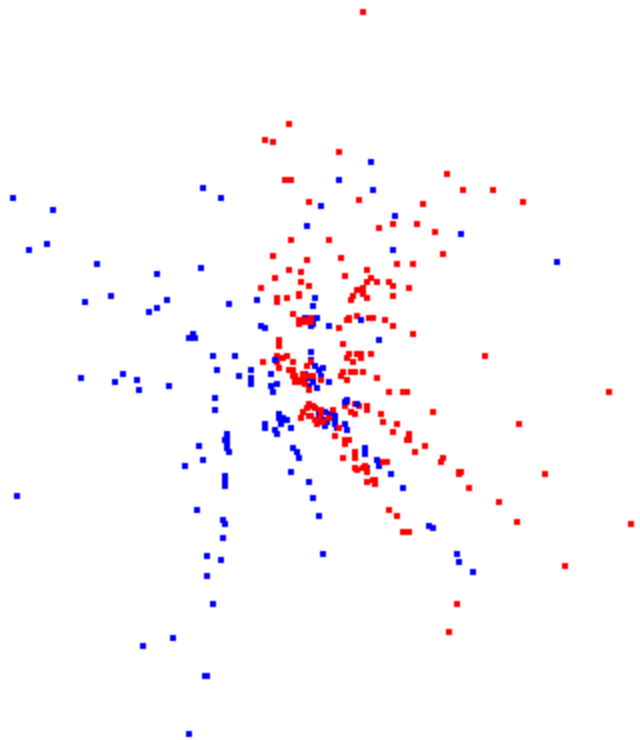
No military participation



Results: United States

Military participation

No military participation

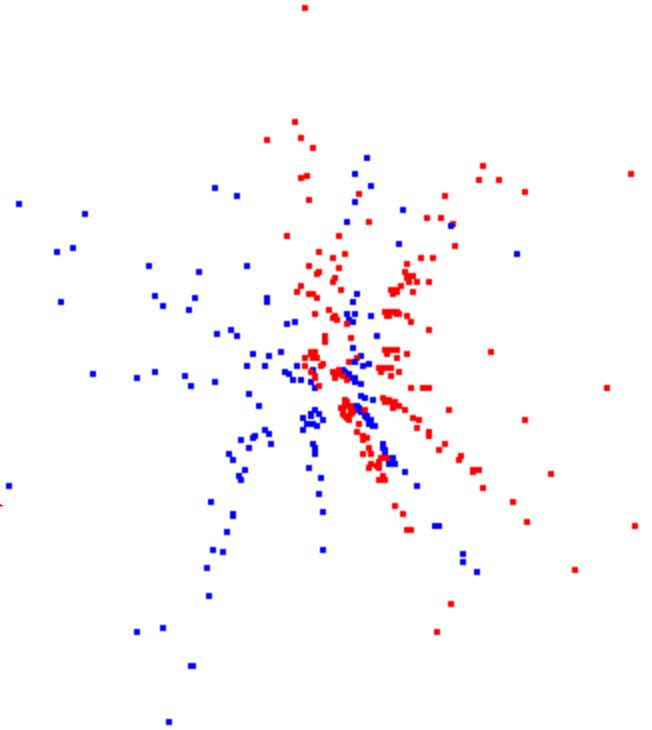


Results: United States

- Military participation also differentiates American lives

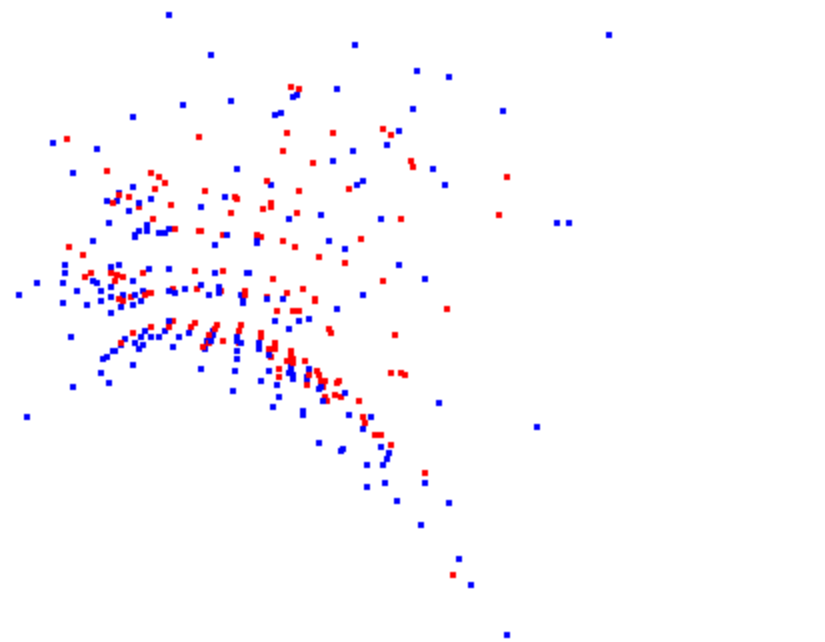
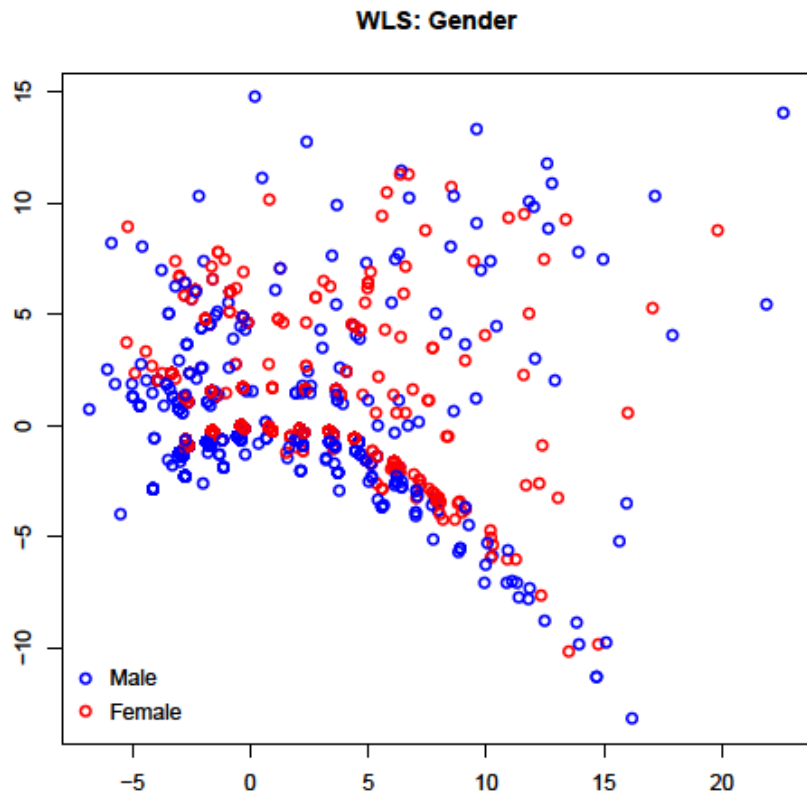
Military participation

No military participation



Results: United States

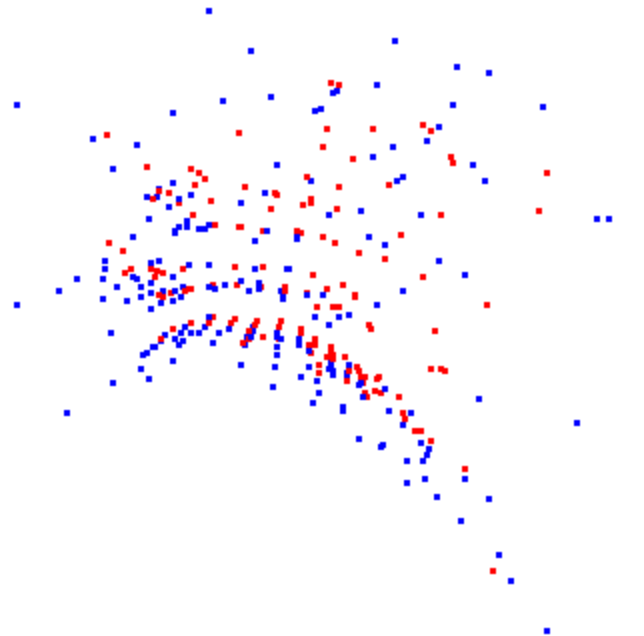
- One more plot



Results: United States

Male

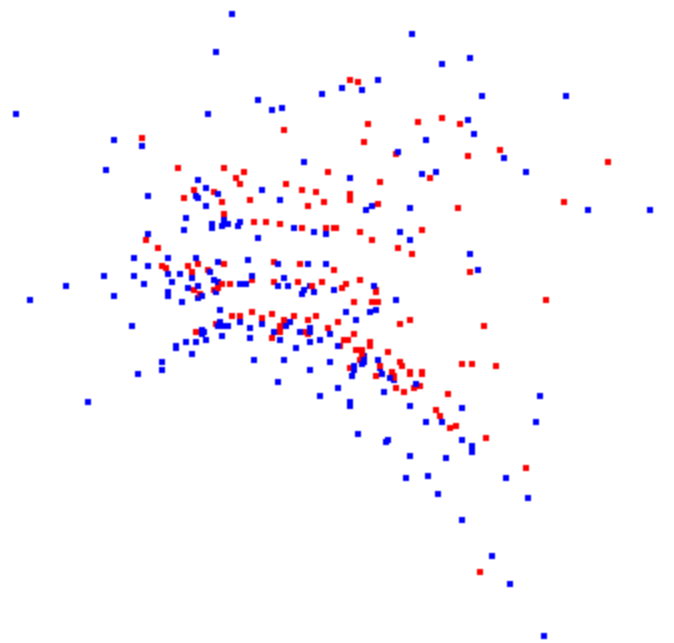
Female



Results: United States

Male

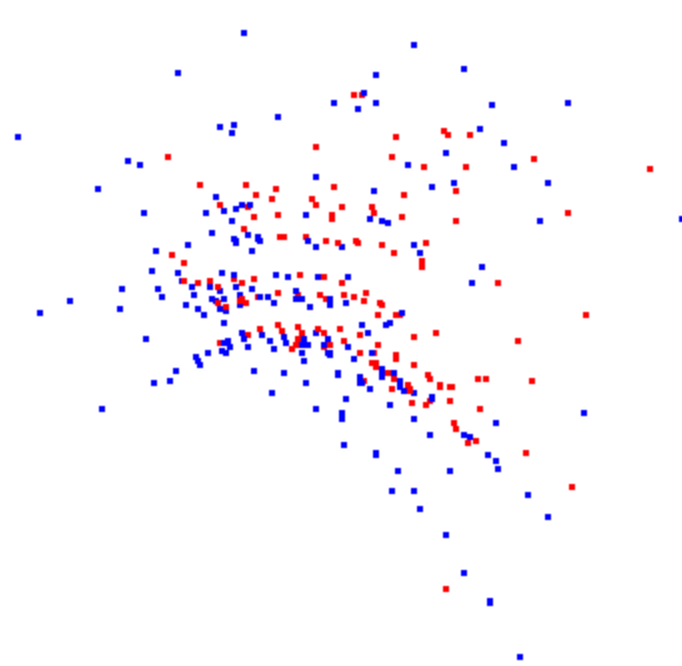
Female



Results: United States

Male

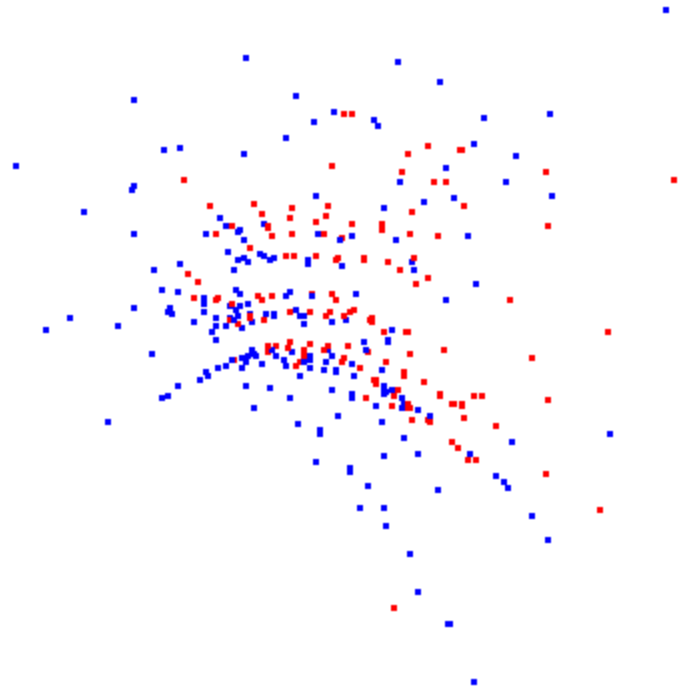
Female



Results: United States

Male

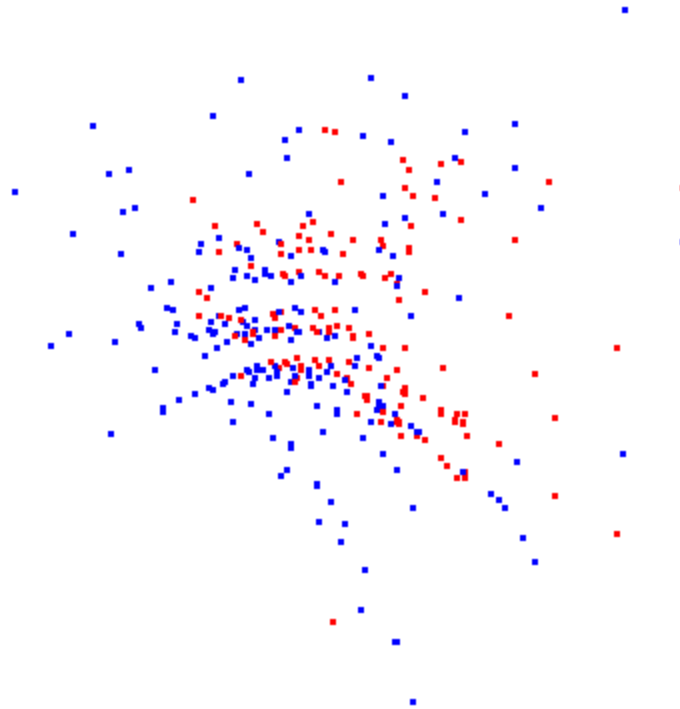
Female



Results: United States

Male

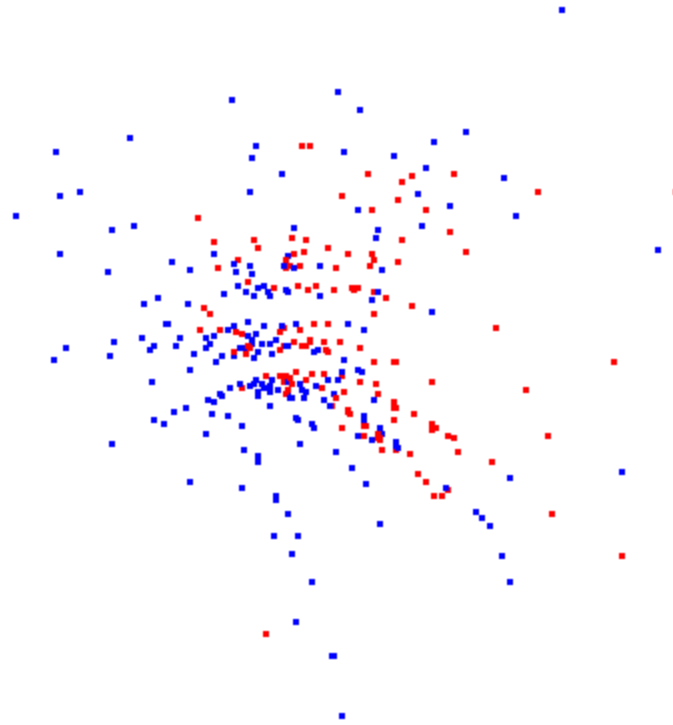
Female



Results: United States

Male

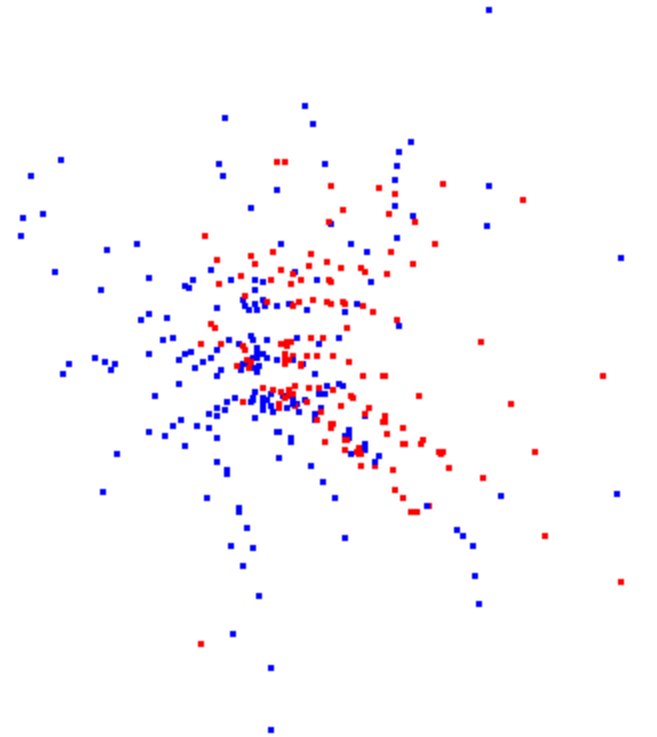
Female



Results: United States

Male

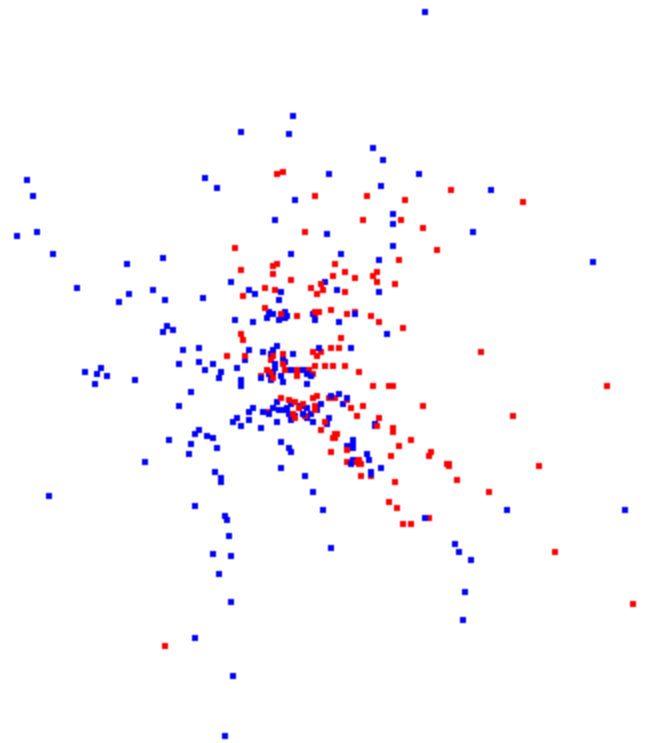
Female



Results: United States

Male

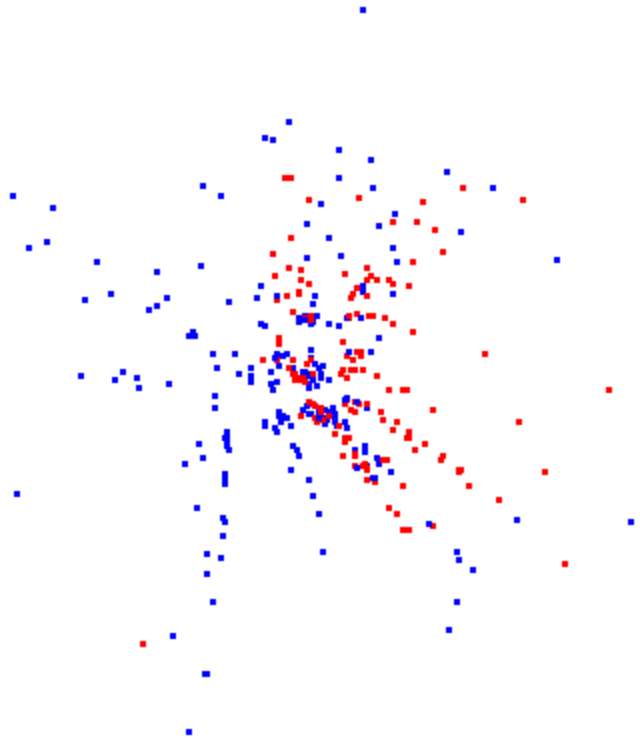
Female



Results: United States

Male

Female

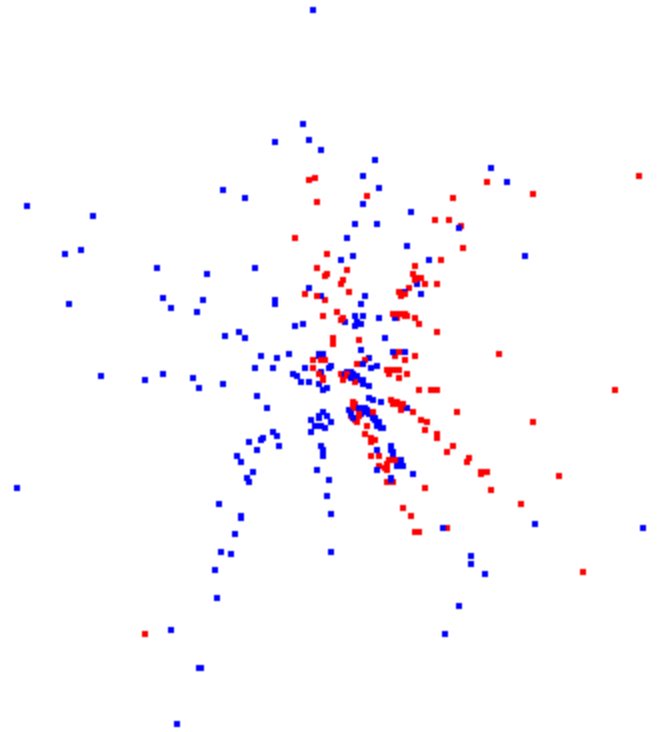


Results: United States

- Distinct clustering according to gender

Male

Female



Results: United States

- What is associated with differences in American lives?
 - Employment
 - Education
 - Military
 - Marriages
 - Gender

- Any common themes?
 - Where and why might family life play a bigger role in differentiating people's lives? Why would we expect education/work to play a role in other cases? In which cases would military participation matter?

Future Directions

- More data! Eastern European cases: Russia, Poland, several other former Soviet States
- Model-based scaling to overcome sampling issues (missingness, censoring)
- Application of latent variable models

Thank you!

An Interval Graph Method for Cross-Cultural Comparison
of Life Histories

Sean Fitzhugh, Carter Butts, Joy Pixley

`sean.fitzhugh@uci.edu`