Overview of QCA Software & Recent Developments with Kirq

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QCA as both Technique and Approach

As a technique

- Measures of degree of set membership
- Subset relations measured by consistency and coverage
- Taxonomies as truth tables
- Sufficiency solutions via Quine-McCluskey minimization
- Requires software

As an approach

- Rihoux, et. al. (2009, Ch 1 of *CCM*)
- Ragin (1997/2004) "Turning the Tables"
- Ragin & Fiss (2017) *Intersectional Inequality*
- Doesn't require software
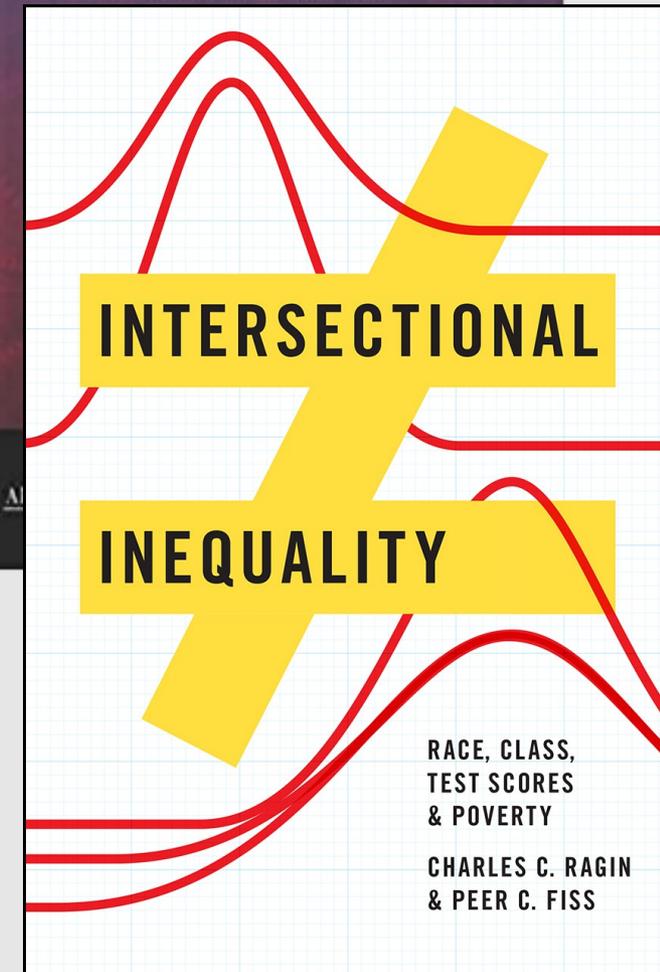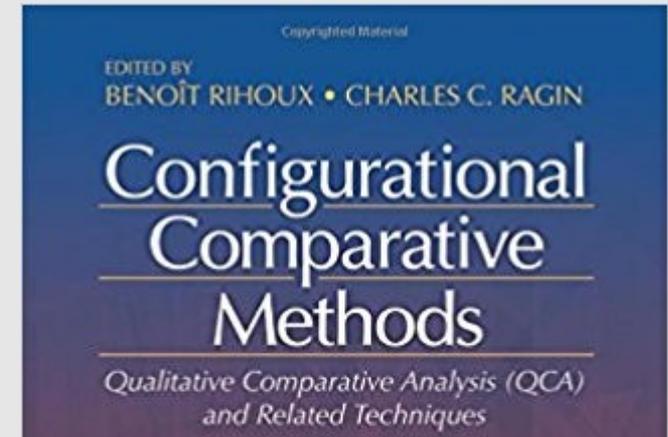
Major QCA Software Packages
(see Compasss.org for a complete list)

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                        ┌─────────────────────────┐
                        │ QCA                     │
                        │ (Drass and Ragin 1992)  │
                        └─────────────────────────┘
                           │                │
        ┌──────────────────────────┐    ┌──────────────────────────────────┐
        │ TOSMANA (.NET, Mono)     │    │ fs/QCA (Win, OSX)                │
        │ (Cronqvist 2003)         │    │ (Ragin, Drass, and Davey 2009)   │
        └──────────────────────────┘    └──────────────────────────────────┘
          │              │                 │              │
  ┌───────────────┐ ┌──────────────┐ ┌────────────────────────┐ ┌─────────────────────────────────┐
  │ QCA3 (R)      │ │ QCA (R)      │ │ fuzzy (Stata)          │ │ acq & Kirq (Win, OSX, Linux)    │
  │ (Huang 2012)  │ │ (Duşa 2006)  │ │ (Longest and Vaisey    │ │ (Rubinson and Reichert 2012)    │
  └───────────────┘ └──────────────┘ │  2008)                 │ └─────────────────────────────────┘
                                      └────────────────────────┘
                 fork ┊         │ add-on package
        ┌───────────────┐ ┌──────────────────┐
        │ QCApro (R)    │ │ SetMethods (R)   │
        │ (Thiem 2016)  │ │ (Oana, et. al.   │
        └───────────────┘ │  2013)           │
                          └──────────────────┘
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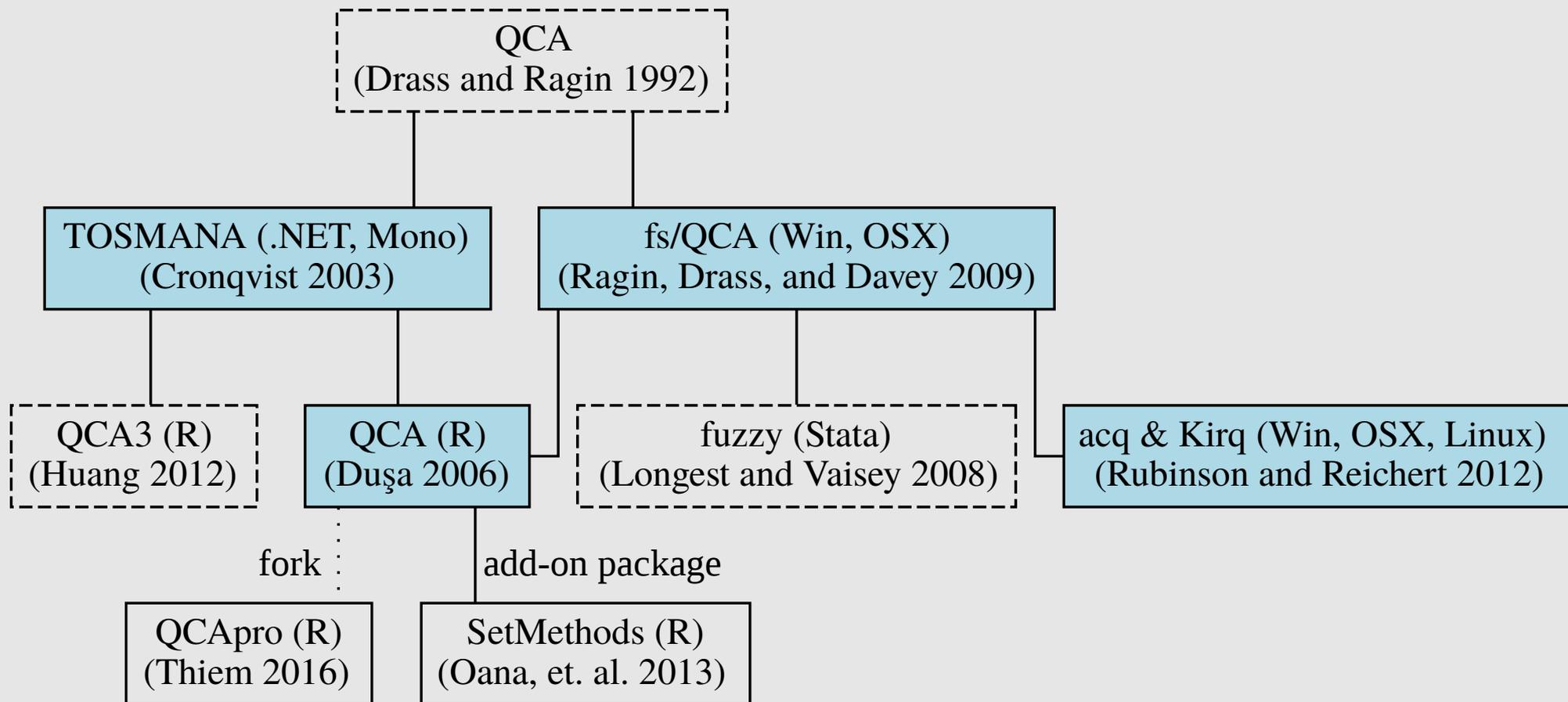
Current Work on Kirq: Symbolic Boolean Computation

- Strengthens and makes explicit the set-theoretic foundation of QCA
- Increases the expressiveness of QCA
  - Boolean expressions may be arbitrarily complex
  - Encourages analysis of sets, rather than individual conditions and outcomes
- Researcher can associate Boolean expressions with particular constraints to define, e.g., impossible conjuctions and theoretical expectations
- Incorporation of multivalued sets
  - by converting multivalued set to series of (disjoint) crisp sets and defining derived conjunctions as impossible:
    - mv{white, black, latino} →
      w{0,1}; b{0,1}; l{0,1}; Imp{wb, wl, bl}
- Future directions:
  - Set-theoretic longitudinal analysis, robustness tests
  - Extend Boolean algebra implementation to accommodate:
    - Missing data (partially implemented)
    - Extended fuzzy-set operations? (partially implemented)

Current Work on Kirq: Set-theoretic Visualization

- Integrating visualizations into Kirq
  - originally designed as an independent web-application
- Interoperability with other software:
  - Using JSON for serialization (integration with R packages?)
  - Read fs/QCA output?
- Renders: LaTeX/Ti*k*Z, GnuPlot, GraphViz
- Can render visualizations locally, or by calling out to cloud.

Visualizations

XY/Enhanced XY plots
– *complete*

Fiss configuration charts
– *partial*

Linear diagrams
– *complete*

Lattices & directed graphs
– *complete*

Star & radar charts
– *not begun*

Venn/Euler diagrams?
– *partial*

2x2 tables?

Treemaps?

Branching diagrams?

Current Work on Kirq: Implementing QCA as an Approach

- Goals:
    - Keep Kirq's user-friendliness and ease-of-use
    - Support and encourage retroductive, case-oriented analysis and configurational thinking
    - Improve maintainability and provide extensibility
- Design still evolving
- Cross-platform GUI application with command syntax
    - GUI still to be designed; focus is on:
        - viewing and visualizing data set
        - visualizing, comparing, and interrogating results
    - Procedures for data transformation and calibration
    - Mathematical/statistical operations
    - Integrated scripting language
- Relational data management using SQL
- File format/session history is portable and platform independent

Recommendations

- Distinguish between QCA as a technique and QCA as an approach. *A good QCA embraces the approach*.

- Different software packages approach QCA in different ways; each will help you think about your analysis in different ways.

- Software is just a means to an end. It automates the mundane and repetitive parts of the analysis, so that you can focus on what's really important—getting to know your cases.

- Follow COMPASSS for updates on QCA/CCM software: http://www.compasss.org/