

SMART METHODS FOR COMPLEX POLICY EVALUATION



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MethodsCon

Rethinking the boundaries of methods
in health and social science research

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RESEARCH METHODS



Gallery

Welcome to the Shiny Gallery! Below you can find a myriad of Shiny apps to be inspired by and to learn from. We have organized the apps in two main categories:

🏠 **Shiny User Showcase** comprised of contributions from the Shiny app developer community.

🏠 **Shiny Demos** that are designed to highlight specific features of shiny, the package.

Shiny User Showcase

The Shiny User Showcase is comprised of contributions from the Shiny app developer community. The apps are categorized into application areas and presented with a brief description, tags, and for many, the source code. Note that many of these apps are winners and honorable mentions of our [annual Shiny contest!](#)

Education

Apps designed for teaching



- Advances in the integration of smart technology with interdisciplinary methods has created a new genre, **approachable modelling and smart methods** – AM-Smart for short.
- AM-Smart platforms address a major challenge for applied and public sector analysts, educators and those trained in traditional methods: accessing the latest advances in interdisciplinary (particularly computational) methods.
- AM-Smart platforms do so through nine design features. They are
 - (1) bespoke tools that
 - (2) involve a single or small network of interrelated (mostly computational) methods
 - (3) they also embed distributed expertise
 - (4) scaffold methods use
 - (5) provide rapid and formative feedback
 - (6) leverage visual reasoning
 - (7) enable productive failure
 - (8) promote user-driven inquiry
 - (9) while counting as rigorous and reliable tools

- Critical reflection on AM-Smart platforms, however, reveals considerable unevenness in these design features, which hamper their effectiveness.
- A rigorous research agenda is vital.
- **PURPOSE OF SESSION**
- This session will introduce this newly emerging field, provide some examples, and then explore with attendees how to critically engage and develop new smart methods for social science and health research.
- The goal is to
 - Examine the utility of this field
 - Identify key concerns
 - Sketch out ideas for possible AM-Smart methods
 - Explore possible collaborations or venues for future research

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Approachable modeling and smart methods: a new methods field of study

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ABSTRACT

CATALOGING AM-Smart Methods

- Given the fast-changing, endemic nature of smart app life today, it is presently difficult to bracket, count, or create a definitive catalogue of the AM-Smart methods currently in play.
- Examples range from computational modelling suites and statistical apps to digital research environments and smart phone apps to public-sector data management platforms and visualisation tools, such as those that flourished during the COVID pandemic

CATALOGING AM-Smart Methods

To gain a basic impression of the field, we did the following.

First, we reviewed the gallery of apps on R Shiny.² ‘Shiny is an R package that makes it easy to build interactive web apps straight from R. Given its open-source flexibility, a significant number of AM-Smart apps are made using R.

Second, we did a Google search, using such terms as ‘computational modelling and app’ and ‘shiny and machine learning,’ which yielded most platforms we found.

Third, we searched for AM-Smart platforms on the Apple App Store, which were primarily statistical or data management in nature.

Finally, we put out a call on Twitter asking colleagues for examples, to which we received a handful of replies.

CATALOGING AM-Smart Methods

Two caveats are important to note from our basic review.

First, the majority of AM-Smart platforms are in the natural, engineering and computational sciences and applied mathematics.

Second, we could not find a rigorous AM-Smart platform for qualitative inquiry.

The closest we found were some of the R COMPASSS packages for running qualitative comparative analyses. But these were rather conventional.

The development of qualitative AM-Smart methods could be a major avenue for anyone here today to pursue.

CATALOGING AM-Smart Methods

Based on our initial survey, we identified a handful of ‘best example’ platforms for social inquiry and, along with them, the nine key design features we listed earlier.

- **COMPLEX-IT** for computational modelling and data visualization
 - **Radiant** for statistics and machine learning
 - **JASP** for Bayesian statistical modelling
 - **PRSM** for participatory systems mapping
 - **SAGEMODELER** for learning systems dynamics through designing models
 - **MAIA**
 - **NetLogo** for designing and exploring agent-based models
 - **Cytoscape** for modelling complex networks
 - **ExPanD** for visually exploring your data.
-
- All these platforms are online and include tutorials, datasets, and published examples to explore

HISTORICAL BACKGROUND

- AM-Smart methods are part of the wider shift in the *knowledge economy*, particularly in the last two decades, toward smart technology.
- Smart technology builds on, extends, and adds to advances in smart environments, ubiquitous computing, smart devices, and the internet of things.
- AM-Smart platforms draw more specifically from two interdisciplinary fields of study: the learning sciences and human-computer interaction.

HISTORICAL BACKGROUND

- LEARNING SCIENCES
- Support the development of the complex and adaptive skills and knowledge needed for the knowledge economy and smart globalised world in which we now live.
- Extensively studies how computational technologies may be leveraged to support learning

HISTORICAL BACKGROUND

- HUMAN-COMPUTER INTERACTION
- Interdisciplinary field focused on understanding, designing, and evaluating the interface between people and computational technologies.
- Extensively involved in the development of many types of software, including those dedicated to research methods
- Its integration with the learning sciences to support the development of methods software is less common.

WHY AM-SMART METHODS?

- IN THE SOCIAL SCIENCES, THREE REASONS:
- Massive growth in computational methods.
- Big data and the datafication of everything.
- Complexity and wicked problems.

WHAT IS AN AM-SMART METHOD?

- They employ the latest advances in nonconscious machine cognition to create a methods environment in which the method acts as an expert guide for social inquiry.
- **They do this by design:** by allowing users to *cognitively offload* the challenges of running otherwise complex methods, they increase non-expert access to highly novel forms of methods-driven inquiry.
- Expertise is built into the smart technology of the platform.

CORE CHARACTERISTICS

Features 1 and 2: Bespoke methods

AM-Smart platforms are not like statistical packages such as SPSS or wide-breadth platforms such as MATLAB.

AM-Smart platforms are bespoke tools that increase access and approachability by focusing on a single method or small network of closely interrelated methods.

CORE CHARACTERISTICS

Feature 3: Building distributed expertise systems

Most computational methods require a high level of user expertise.

AM-Smart platforms address this issue by building expertise into the software, allowing the platform to become part of the user's distributed cognition system, primarily by acting as a skilled guide for social inquiry

CORE CHARACTERISTICS

Feature 4: Scaffolding practice

AM-Smart platforms are designed to increase effective usage of new methods.

To do so, AM-Smart methods employ guides or supports, referred to as scaffolding in the learning sciences.

Scaffolding involves a more knowledgeable entity (e.g. teacher, peers, or a tool) supporting a novice or new user to engage in practices or processes they may not otherwise be able to perform.

The first type of scaffolding – which overlaps with Embedding Expertise – minimizes or removes low-level, tedious, routine, or overly complicated tasks.

The second type is procedural scaffolding, which guides users through the operational aspects of a platform.

CORE CHARACTERISTICS

Feature 5: Rapid and formative feedback

AM-Smart platforms employ learning science strategies to provide rapid feedback that facilitates user understanding – what scholars call formative, as opposed to summative, feedback

CORE CHARACTERISTICS

Feature 6: Leveraging visual reasoning

People often excel at processing and analysing visual information over other information formats.

In our present data saturated world, visualisation has become a core area of methods study, contributing to several fields including data visualization, software design, visual complexity, and data science.

Computational methods are intentionally visual in output – from fractals and complex network diagrams to systems maps and agent-based model simulations.

Visualizations tap strongly into distributed cognition.

CORE CHARACTERISTICS

Feature 7: Enabling productive failure

Within a research methods platform, 'failure' could entail incorrectly specifying method parameters, selecting inappropriate factor types (e.g. categorical versus numerical), executing method-steps out of order, or misinterpreting results.

While it may be tempting to scaffold these possible missteps, over-scaffolding can create an inauthentic and unrepresentative interaction with a method, where users are able to execute a method but not really learn how to use it correctly.

AM-Smart platforms balance scaffolding with productive failure.

Users can run a method-step with limited guidance, for example, and receive formative feedback if the results are outside typical ranges or expectations.

By striking a balance, users recognize gaps in their knowledge of a method and begin to develop their mental model of it

CORE CHARACTERISTICS

Feature 8: Supports user-driven learning and inquiry

While multiple models for guiding learning through scientific inquiry exist, synthesized them into a meta-model involving five stages.

They are orientation, conceptualization, investigation, conclusions, and discussion.

CORE CHARACTERISTICS

Feature 9: Rigorous, authentic, and reliable method platforms

Whenever a method is simplified for non-expert usage, there is the immediate tension around issues of rigor and reliability.

- While useful, is the platform dependable?
- While informative, are its algorithms accurate?
- While its results lead to new insights, can they be published or shared with others?
- And, while it facilitates learning, can the platform actually be used to guide decision making?

AM-Smart platforms actively embrace this tension, seeking to support accessibility with highly rigorous programming. Case in point are the R packages and programming out of which many AM-Smart methods are built.

Still, given the field is just emerging, unevenness does exist, making it critical that any AM-Smart app be vetted and field tested by experts in those methods.

CORE CHARACTERISTICS

Feature 9: Rigorous, authentic, and reliable method platforms

The other issue is **task authenticity**, which is particularly important to applied researchers and public sector analysts.

Task authenticity refers to the degree to which a learning environment is sufficient complex to effectively model the real-world problem being studied

EXAMPLES

Radiant – Business analytics using R and Shiny

Radiant is an open-source platform-independent browser-based interface for business analytics in R. The application is based on the [Shiny](#) package and can be run locally or on a server. Radiant was developed by [Vincent Nijs](#). Please use the issue tracker on GitHub to suggest enhancements or report problems: <https://github.com/radiant-rstats/radiant/issues>. For other questions and comments please use radiant@rady.ucsd.edu.

Key features

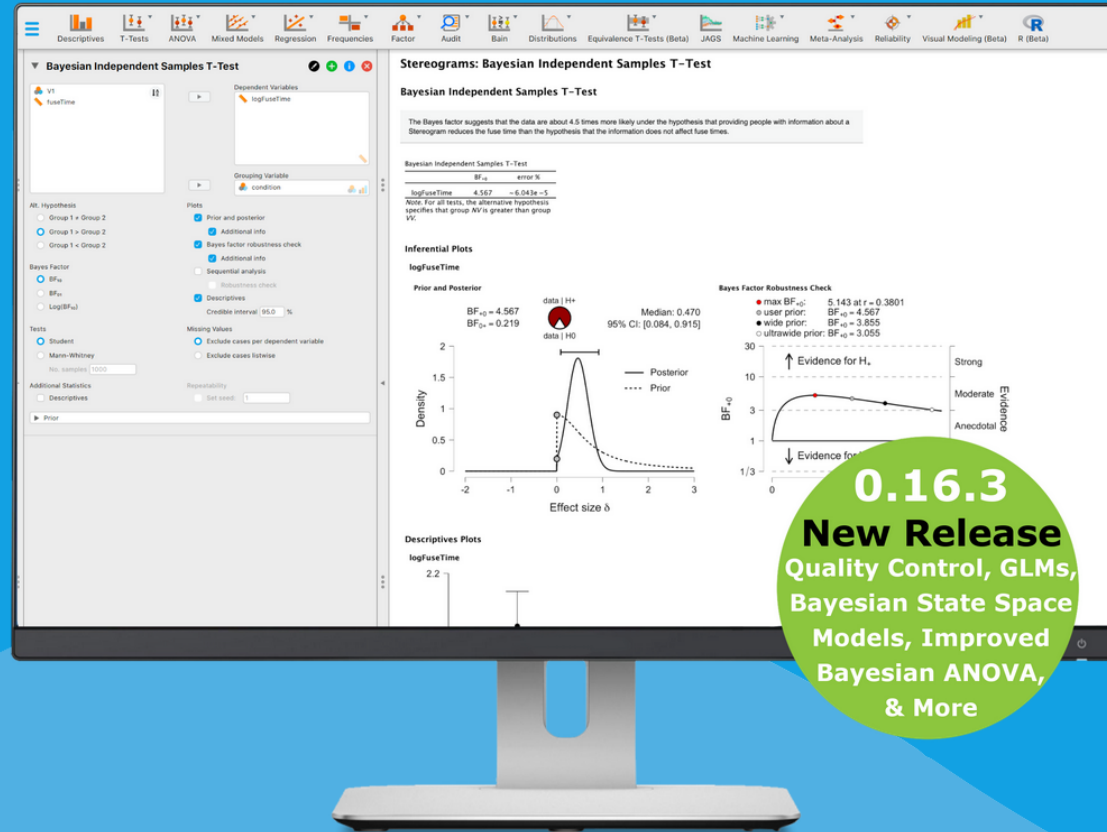
- Explore: Quickly and easily summarize, visualize, and analyze your data
- Cross-platform: It runs in a browser on Windows, Mac, and Linux
- Reproducible: Recreate results and share work with others as a state file or an [Rmarkdown](#) report
- Programming: Integrate Radiant's analysis functions with your own R-code
- Context: Data and examples focus on business applications





A Fresh Way to Do Statistics

 Download JASP



0.16.3
New Release
Quality Control, GLMs,
Bayesian State Space
Models, Improved
Bayesian ANOVA,
& More



PRSM

The Participatory System Mapper (PRSM) is a free, open-source and secure tool for mind-mapping and system visualisation



About

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Free, web-based, and open-source software to engage students in systems thinking through designing, building, and revising models.

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About MAIA

The MAIA meta-model (Modelling agents based on Institutional Analysis)

formalizes the IAD framework and extends it with other social theories and methods.

It provides a comprehensive set of concepts for developing agent-based models. To validate the conceptual comprehensiveness of MAIA, we have developed six case studies to date (e.g., the wood-fuel market, e-waste recycling sector, manure-based bio-gas energy system). For more information please contact Amineh Ghorbani : a.ghorbani at tudelft.nl

The web-based application

To increase the usability of the MAIA meta-model and ensure that the conceptualized models conform to the meta-model, we have developed a modelling environment. This modelling environment consists of two tools that are the interfaces for using MAIA: a web-tool and an Eclipse plugin. The MAIA web tool which can be opened in any web browser guides the conceptualization process by presenting tables and diagrams in the order they need to be filled in and automatically completing many other fields.

Furthermore, the tool checks the input information for consistency and outputs the information provided by the user in a format that can be used to produce executable code.

[Link to the web-tool.](#)

E-core Plugin

It is also possible to make a MAIA-based model using an Eclipse plugin that we developed using E-core in the Eclipse Modelling Framework (EMF). The conceptualized model in Eclipse also has an XML specification which is produced in the same format at the MAIA web tool output. This plugin can also be used by non-programmers. However, the MAIA concepts are more formalized and restricted in the plugin tool than the web-based application. This gives less flexibility in defining concepts but results in a more complete automatic code generation.

NetLogo Web



Runs in Your Browser

Basic Feature Set

Functional on Mobile Devices

NetLogo

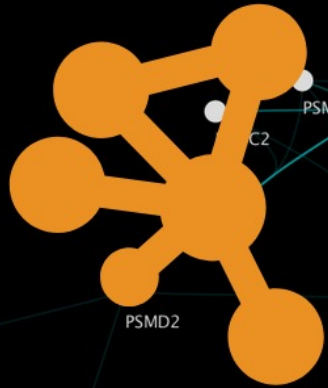


Desktop App (requires download)

Complete Feature Set

High Performance

The desktop version of NetLogo is recommended for most
uses

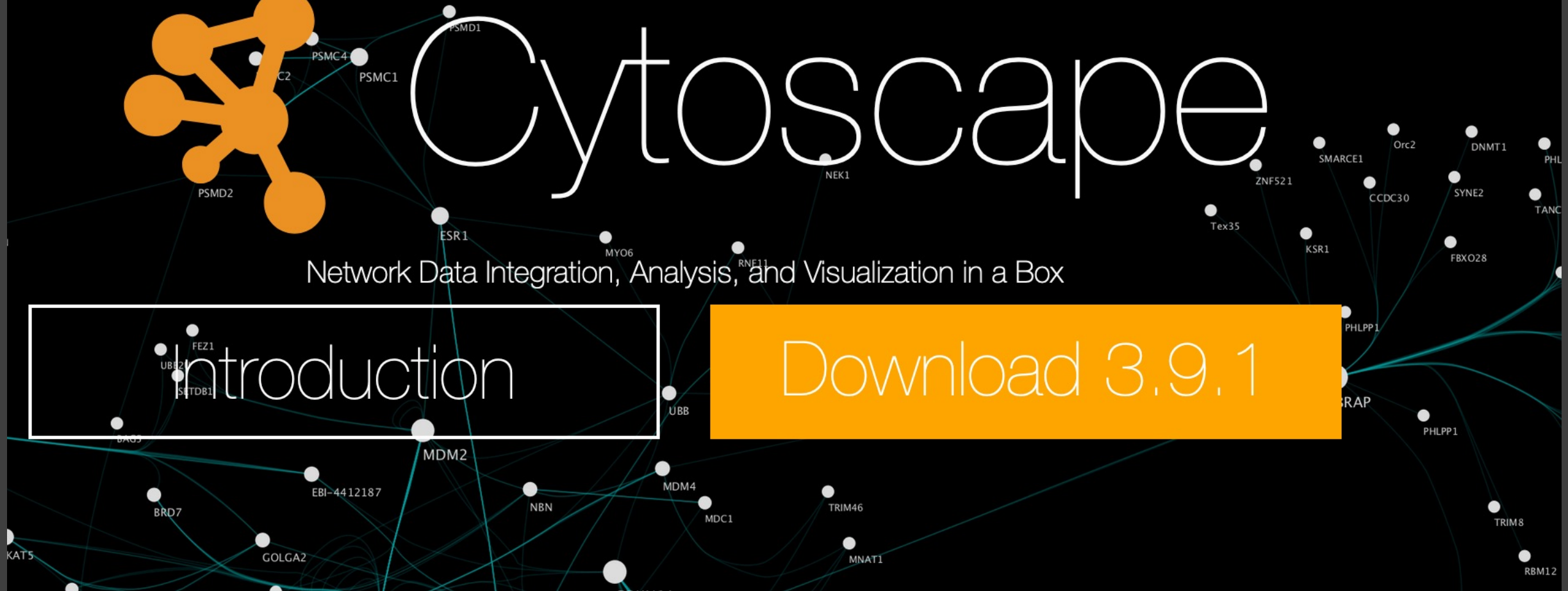


Cytoscape

Network Data Integration, Analysis, and Visualization in a Box

Introduction

Download 3.9.1



ExPanD - Explore your data!

Welcome to ExPanD! To start exploring your data, please upload a data file containing at least two numerical variables. For panel data, the data needs to be in long format and without duplicate observations. Currently supported formats are Excel, CSV, RData, RDS, STATA and SAS.

Browse... No file selected

Select cross sectional identifier(s)

Area

Select the variable(s) that (together) identify(ies) a cross-sectional unit. Selecting multiple variables is possible. You can use the row names of the data frame to identify cross-sectional data.

Select time series identifier

Income2014 ▼

Select the variable that identifies a the time series. It needs to be coercible into an ordered factor. If you select 'None', then the data is treated as cross-sectional.

Balanced panel

Check if you want only observations included that have data for all periods.



Exploring complex data from a case-based perspective

Build the Model

- 1. Build Database and Import Cases
- 2. Cluster Cases

Test the Model

- 3. The Computer's turn
- 4. Compare and Visualise Results

Extend the Model

- 5. Simulate Interventions
- 6. Predict New Cases

Export Results

- 7. Generate Report

beta version
release 2019

COMPLEX-IT is a web-based and downloadable software tool designed to increase your access to the tools of computational social science (i.e., artificial intelligence, micro-simulation, predictive analytics). It does this through a user friendly interface, with quick access to introductions on concepts and methods; and with directions to richer detail and information for those who want it.

The result is a seamless and visually intuitive learning environment for exploring your complex data -- from data classification and visualisation to exploring simulated interventions and policy changes to data forecasting.

You don't need any technical expertise to start using COMPLEX-IT, all that is required is a data set you want to explore, and a curious mind!



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Meet the team

