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RealViz – Visual Methods For Real-life Systems Research Group

DATA INNOVATION NETWORK
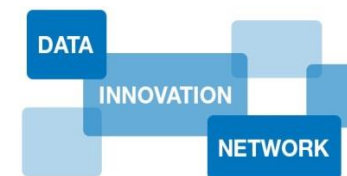
Jennifer Xu

Wendy Lucas (CIS)

Tamara Babaian
PI (CIS)

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Nathan Carter
(MATH)

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Sandeep Purao (IPM)

and students

RealViz Talk Series 2016-2017 videos online
## cis.bentley.edu/realviz/talk.html

1. Matthew Brehmer, Microsoft Research

2. Martin Wattenberg, Google's "Big Picture" data visualization group

3. John Stasko, Georgia Institute of Technology

4. Remco Chang, Tufts University

Examples and Motivation

- Interactive data visualizations are now widely available, e.g.

  - [Educational Attainment per School District in US (NYTimes)](#)
  - [d3 gallery](#)
  - [Google Maps](#)

- Visual approaches to user interfaces remain scarce in the workplace

- Studies show that users report employing useful visualizations decreases system complexity

- We investigate **developing and employing interactive visual interfaces within real-life (business information) systems** to enhance software system effectiveness, lower users' perceptions of system complexity and increase user productivity.

- **"We don't just need these systems to be technically better than the alternatives — we need them to be more user-friendly."** Fidelity chairman and CEO Abigail Johnson at a New York blockchain conference, May 2017

Research program

Design
principles

Interactive
Visual Data
Interfaces

Human factors

Technical
methodologies
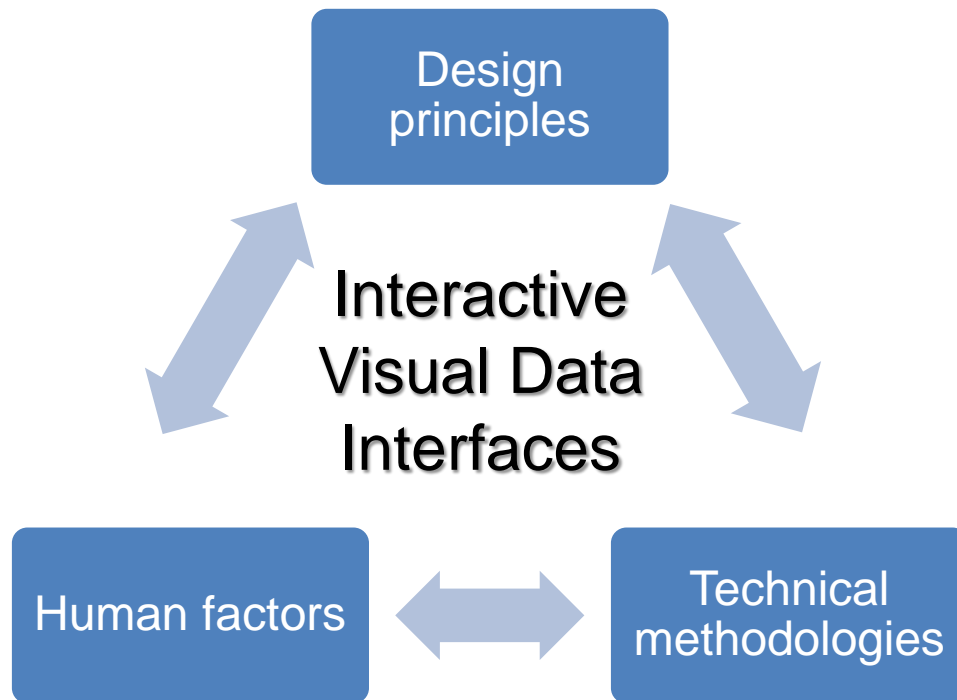
Goal: Go beyond just an *interactive display* of data, but also serve as visual interface to system function, enabling users to *act* on the data.

To be useful (not just "eye candy"), visualizations need to be **effectively embedded into the system,** i.e. be designed to fit a specific task context & user goals.

This means we must

1. Design/Select an appropriate visual representation
2. Select an effective interaction model
3. Connect the visualization with the rest of the system components: data, functions.
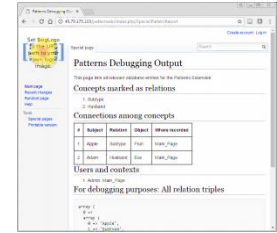
plus:

⇒ Evaluate with users
⇒ Formulate design principles

Contributions

- Models
  - Visual design
  - Interaction
- Methods
  - Technical
  - Procedural
- Design principles

RealViz Projects 2016-2017

Visual Design Patterns Catalog

- **Purpose:** To help practitioners in selecting an appropriate visual representation and interaction model

- **Goal:** create a new type of a *self-organizing* catalog of visual design patterns that is *searchable* and *navigable* and provides *recommendations* based on a rich set of parameters, including:

  - the description of the design pattern,

  - user goal,

  - and history of simultaneous pattern access by the user performing the search, and other users.

 A prototype is under development, implemented as a WikiMedia instance.

- **Contact faculty:** Carter, Hübscher

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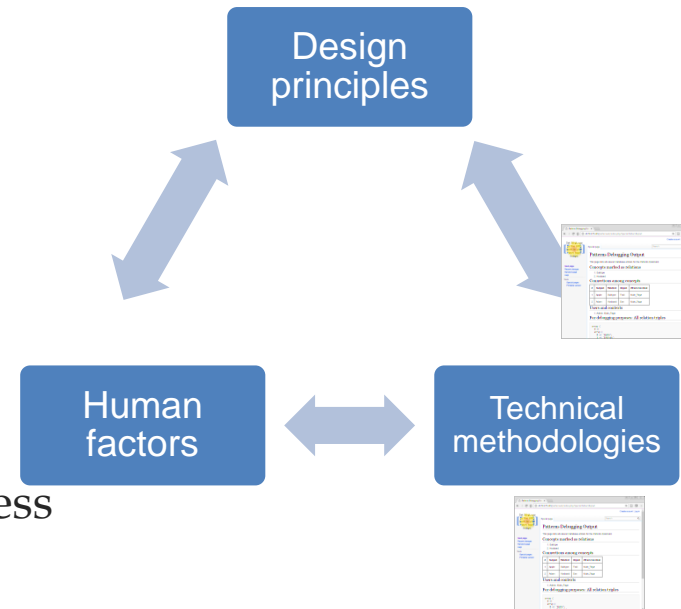
Association Map – interactive visual alternative to tables
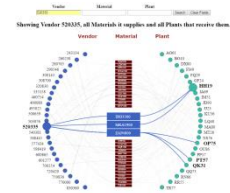
- **Purpose:** To help enterprise system users explore and review associations between data items, select items matching specified criteria
- Several iterations of
  - Design and implement
  - Evaluate with users in a side-by-side comparison with *tabular* interfaces in SAP, Oracle reports
  - Analyze and explain user testing results
- Formulate theoretically justified and empirically supported design principles

- **Contact faculty:** Babaian, Lucas, Chircu

Design principles

Human factors

Technical methodologies
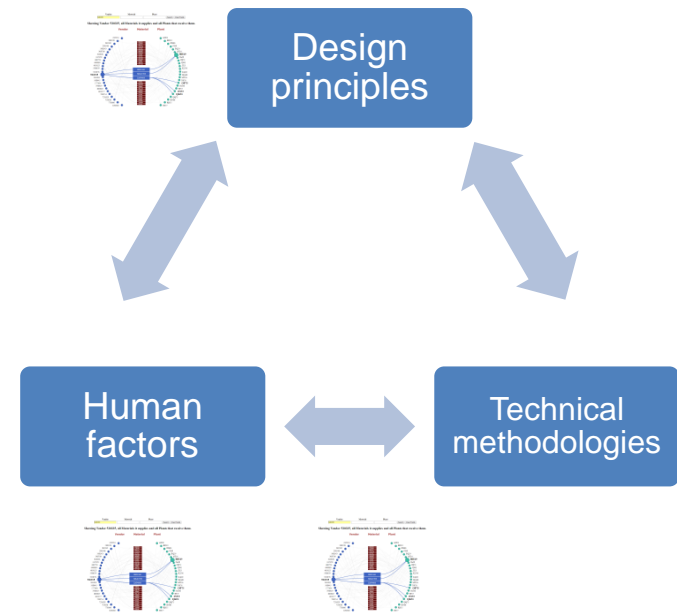
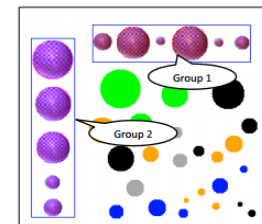# Dynamic Task Map – DTM*i* an *i*nformed task navigation interface
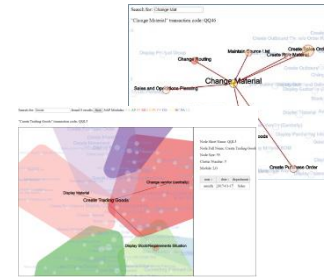
- **Purpose:** To help enterprise system users locate and navigate to desired functionality

- An interactive graph, derived from usage logs, showing

  - Tasks that were actually performed (according to the system log),
  - Connections to *related* tasks i.e. tasks that co-occur or follow
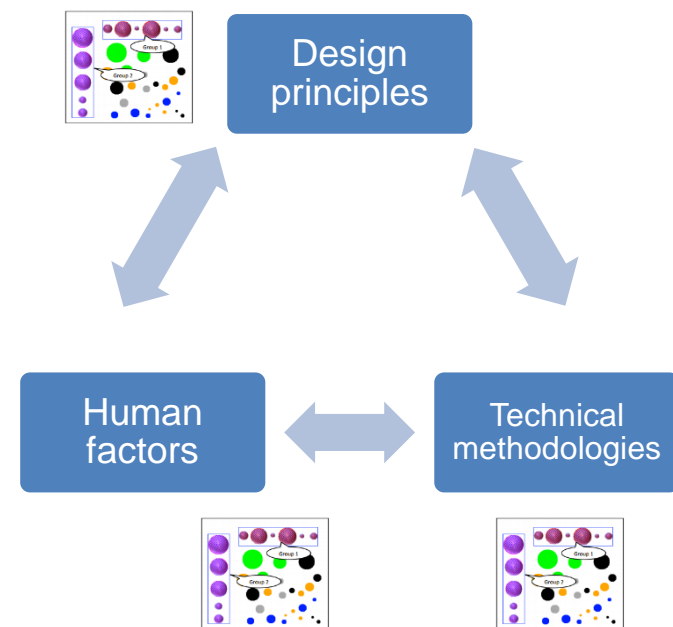 - (Version DTMi) Additional task info shown alongside the main display
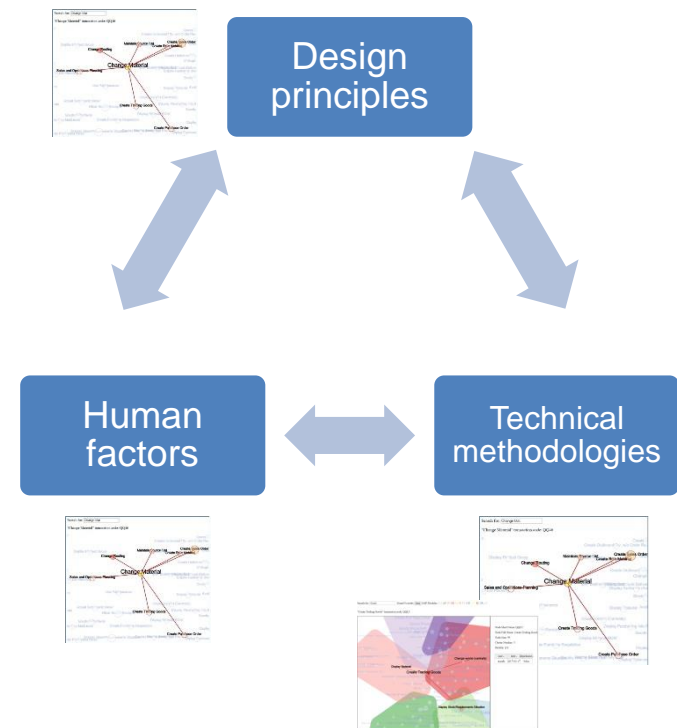
A new navigation tool, outperformed SAP menu and search mechanism in comparison user-tests.

- **Contact faculty:** Babaian, Lucas

Design principles

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Technical methodologies

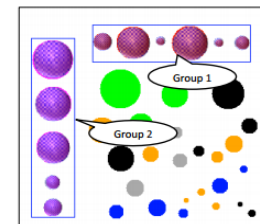# VisConstraints - techniques for easy layout of graphical objects

- **Purpose:** develop techniques for helping users specify force-directed and other constraint-based layouts.

- A language and graphical user interface for

  - Describing layout of graphical objects created from data stored in a database
  - Specifying and fine-tuning constraint-based layout options using a graphical user interface
  - Tested with users

- **Contact faculty:** Lucas

Design principles

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VisConstraints - techniques for easy layout of graphical objects

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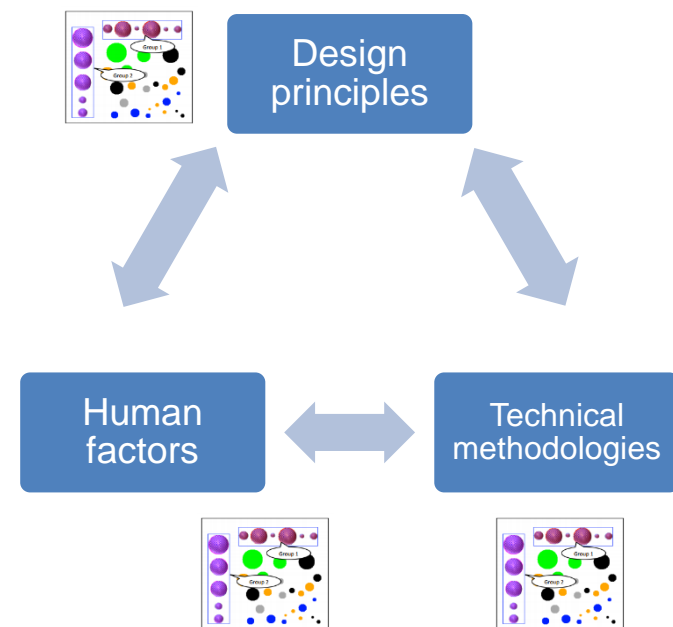 - Tested with users

- **Contact faculty:** Lucas

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# Visual Interfaces for Course Registration - ClassGrid

Purpose: Demonstrate how common task interfaces (e.g. Course registration) can be designed using visual representations for interaction and data manipulation.
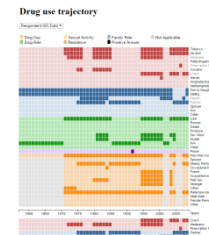**Honors Project by K. Wood**

A prototype interface implementing course ranking and selection based on
- students' major,
- time preferences,
- course history of this and similar students.

Implemented using Excel, Visual Basic.

Contact faculty: Carter

Design principles

Human factors

Technical methodologies

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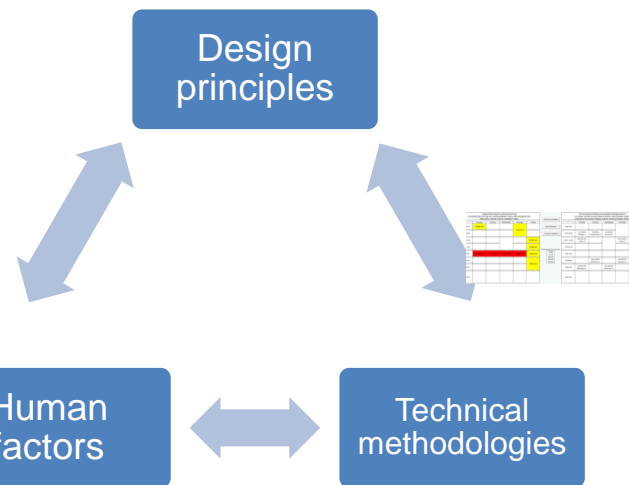
Drug Users' Life Trajectory

(with M. Boeri, Sociology)

Purpose: present several important parameters of personal history of a drug user alongside the history of drug use, facilitating pattern detection and analysis.
Independent Study Project by G. Ligure

An enhanced interactive version of a visualization from : M. Boeri et al., Drug use trajectory patterns among older drug users. *Substance Abuse and Rehabilitation*, 2011

Contact faculty: Babaian

Design principles

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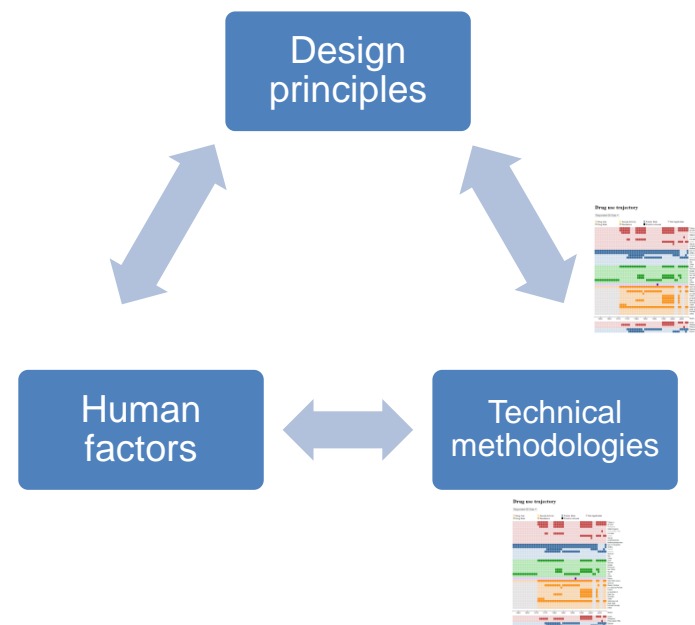
Challenges

- implementation
  - requires highly developed technical skills and time
  - need qualified and committed students for long-term projects
  - need server space dedicated to faculty development projects (CIS has some, but faculty need more)

- evaluation
  - A/B comparison of novel approaches with traditional ones is difficult
  - need to evaluate in a with experienced users, yet access to domain experts is difficult, requires industry partnerships

- transfer solutions to practice
  - access to interested industry partners

- publishing
  - between too applied and too technical
  - tie to real industry experiences/evaluations helps a great deal