

FUNCTIONAL FRAMEWORK FOR EVALUATING FINANCIAL VISUALIZATION APPLICATIONS

FIXED-INCOME ASSET MANAGER VISUAL DASHBOARD

Thomas Dang (M.Sc. Thesis), Victoria Lemieux, Ron Rensink, QianQian Yu, Yao Shen
Media and Graphics Interdisciplinary Centre (MAGIC)
Center for the Investigation of Financial Electronic Records (CIFER)



VA EVALUATION FRAMEWORK

- MOTIVATION**
- A practical guide for designers and implementers
 - Aid for designer to talk to client
 - Reference for visualization and interaction design
 - Feature reference for many visualization products and API's

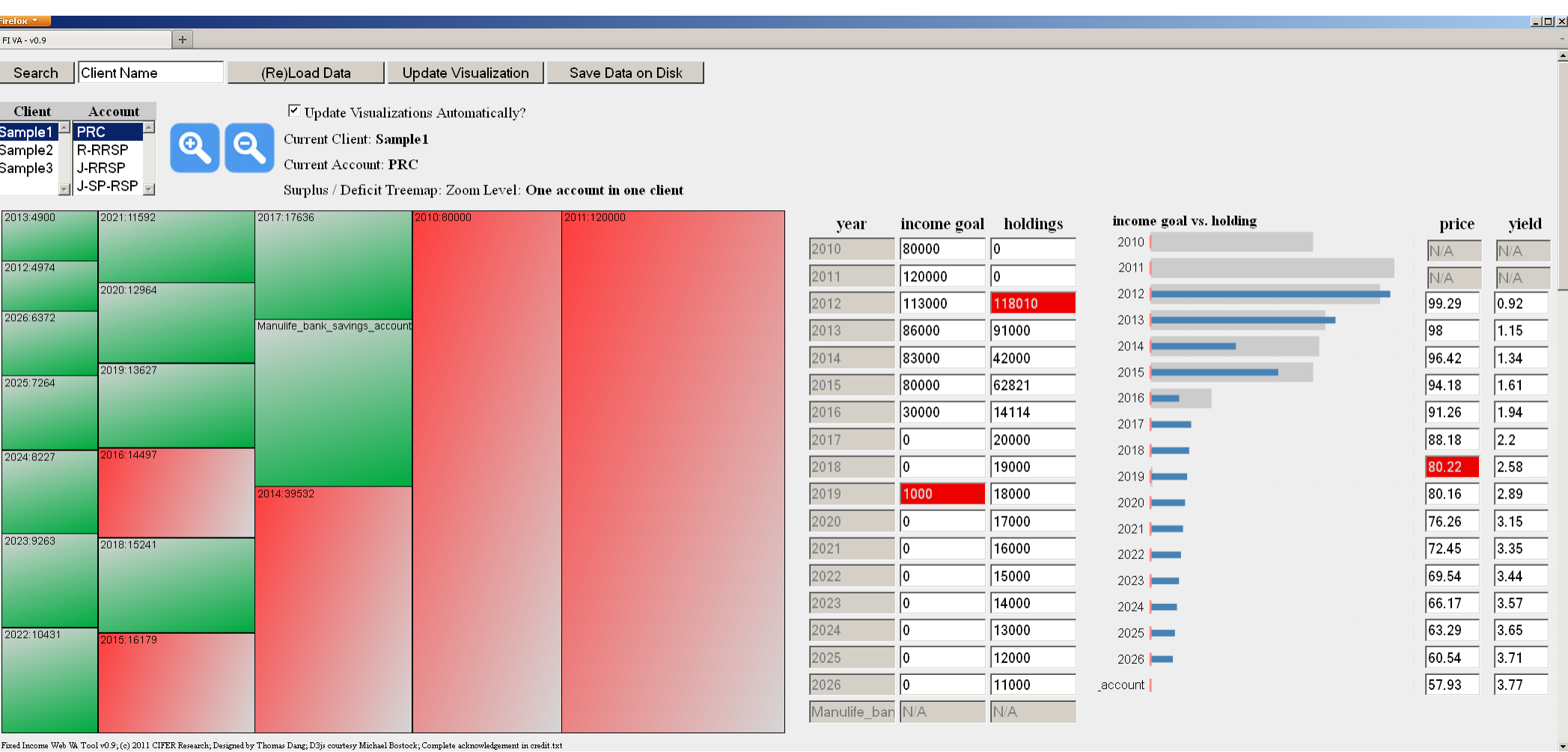
- FRAMING TO RELATED WORKS**
- **Low-level Cognitive Task Frameworks:** Amar et al. 2005, Wehrend & Lewis 1990, Zhou & Feiner 1997
 - **High-level Knowledge Task Frameworks:** Amar & Stasko 2004, 2007, Neumann 2007
 - **Application Design and Evaluation Frameworks:** Munzner 2009
 - This work builds upon previous works to create a practical design and evaluation framework based on current-generation products and API's

- METHODOLOGY**
- Literature Survey
 - Vadilate framework in project at a real financial firm

FIXED-INCOME VA DASHBOARD

- MOTIVATION**
- Validate and adapt user-centered design methods to Financial settings
 - Improve speed and accuracy of client's portfolio monitoring
 - Provide instant-feedback for simple scenario analysis tasks

- DESIGN PROCESS**
- Short weekly participatory design sessions with client
 - Team design and coding sessions in between
 - Agile element: concrete deliverables between meetings: design artifacts or working demo
 - Technology expert leads the project management process to ensure accurate time estimates



- FUTURE WORK**
- Track and visualize analytics history (request by client)
 - Incorporate more sophisticated financial analysis processes

	Conceptual, qualitative analysis of prospect	Earning and price forecast, fundamental	Earning and price forecast, semi-automated, technical	Earning and price forecast, automated, technical	Relationship management (client & peers)	Portfolio Monitoring	Scenario Analysis
Filter / Locate	X	X	X	X	X	X	X
Compute Derived Value		X	X	X		X	X
Find Extrema			X	X			
Sort / Rank			X		X	X	
Determine Range		X					
Characterize Distribution	X	X				X	
Find Anomalies	X		X			X	X
Cluster / Associate	X	X					
Correlate	X	X			X	X	
Compare through time	X	X	X		X	X	
Compare between locations	X				X	X	
Record Analytic History	X	X	X	X		X	X
Persuasive presentation	X	X	X	X		X	X
Identify					X	X	
Compare between entities	X	X			X	X	X
Categorize	X	X			X		

Example breakdown of financial analysis tasks

Table of Visualization Types

Low-Level Tasks From Table 1	Filter / Locate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Find Extrema	X	X	X	X	X	X	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Determine Range	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Characterize Distribution	X	X	X	X	X	X	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Find Anomalies	X	X	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cluster / Associate	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Correlate	X	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Compare through time	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Compare between locations	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Record Analytic History	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Persuasive presentation	-	X	X	X	X	X	X	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Identify	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Compare between entities	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Categorize	X	X	X	X	X	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-frame of Analytic Activity	Real-time transition	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Rapid state comparison	X	-	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Visual Scalability	1-100 data point	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Hundreds of data points	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Thousands of data points	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Level of Detail of Value Retrieval	Raw values shown	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
	Quantitative estimates	X	X	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qualitative estimates	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unit Data Type	Cardinal	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Ordinal	X	-	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Interval	-	-	X	-	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nominal	-	-	X	-	-	-	-	X	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Structured Text	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Unstructured Text	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Data Model & Organization	Flat (Table-like)	X	X	X	X	X	X	X	X	X	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hierarchical (Tree-like)	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Network	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Multi-variate	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Unstructured Collection (Files)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Reference Table of Products and API's

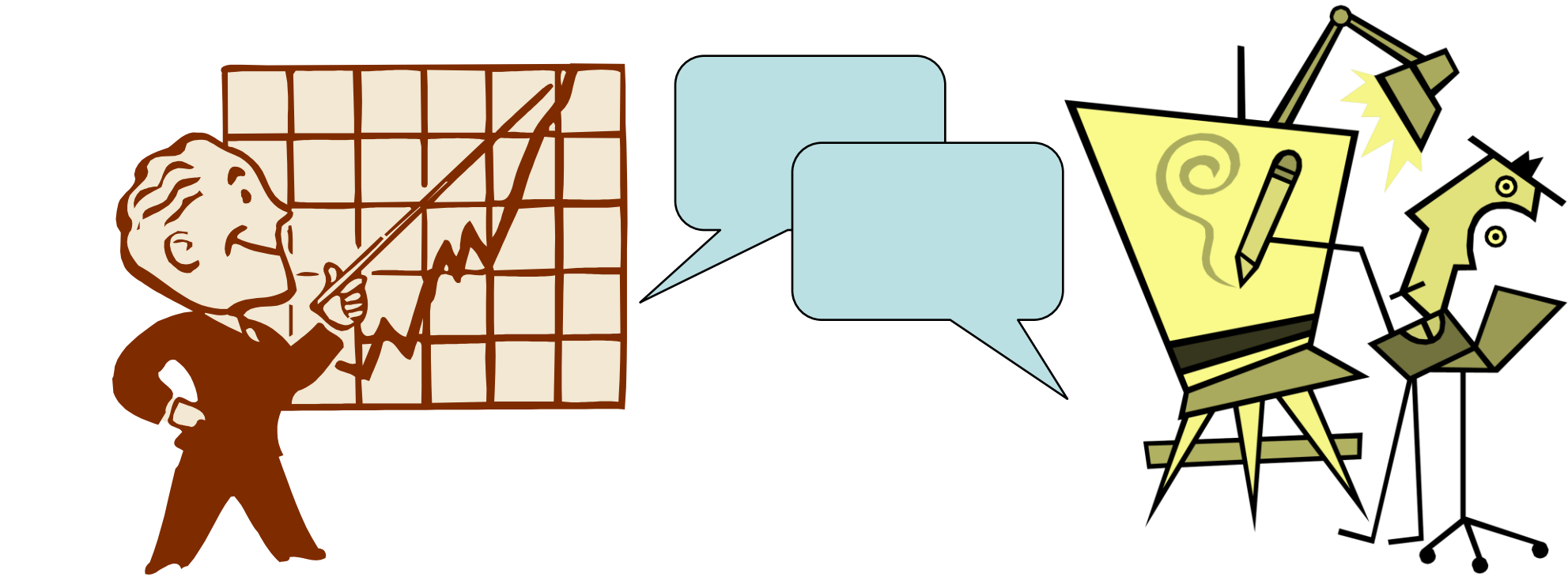
	DAIS / Products	InfoSphere
Visualizations 1-N From Table 2A		
Parallel Coordinates	1	2
Scatterplot	1	2
Dot Plot	1	2
Bullet Graph	2	2
Line Graphs	2	2
Stack Graphs	2	2
Bar Graphs	2	2
Candlestick	1	2
Heatmap	1	2
Treemap	2	2
RSF (ringmap, sunburst)	1	2
Horizon Graph	1	2
Pie Charts	2	2
Adjacency Diagrams	1	2
Node-link	2	2
Time Series	1	2
Geocoding (programmable with GDAL)	1	2
Unstructured Text Clustering	0	2
Glyphs	0	2
Tables of Values	1	2
Search and Highlight	1	2
Cursor Highlight (Picking)	1	2
Semantic Zooming	1	2
Graphical Panning & Zooming	1	2
Overview & Detail	0	2
Focus & Context	0	2
Linking & Brushing	1	2
Pop-up & Tooltip (on the visualizations)	1	2
Direct Manipulation of Data	1	2
3D View (rotate, zoom, fly-by)	1	2
Matrix of visualization instances	2	2
Data Semantic	2	2
Designed for finance	1	2
Designed for a sub-domain in finance	1	1
Data Storage & Transmission Format	2	2

Cognitive Task Breakdown of Client Processes

Data Structure and Management Constraints

Table of Interactions Types

	Filter / Locate	Find Extrema	Determine Range	Characterize Distribution	Find Anomalies	Cluster / Associate	Correlate	Compare through time	Compare between locations	Record Analytic History	Persuasive presentation	Identify	Compare between entities	Categorize	Real-time transition	Rapid state comparison	1-100 entities	Hundreds of entities	Thousands of entities
Low-Level Tasks From Table 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Time-frame of Analytic Activity	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Visual Scalability	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X



- REQUIREMENT ANALYSIS**
- Analyze workflows and analytic processes
 - Identify high cognitive-load bottlenecks
 - Identify information management constraints
 - Gather and examine existing data



- DESIGN**
- Choose **visualizations** to meet information presentation requirements
 - Choose **interaction techniques** to maximize usability and streamline workflow
 - Consider **information management constraints** (problems) in your designs



- IMPLEMENTATION**
- Choose Existing Products and **Integrate** OR
 - Choose API's and **Develop**