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 currentgeneration products and API's

METHODOLOGY

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

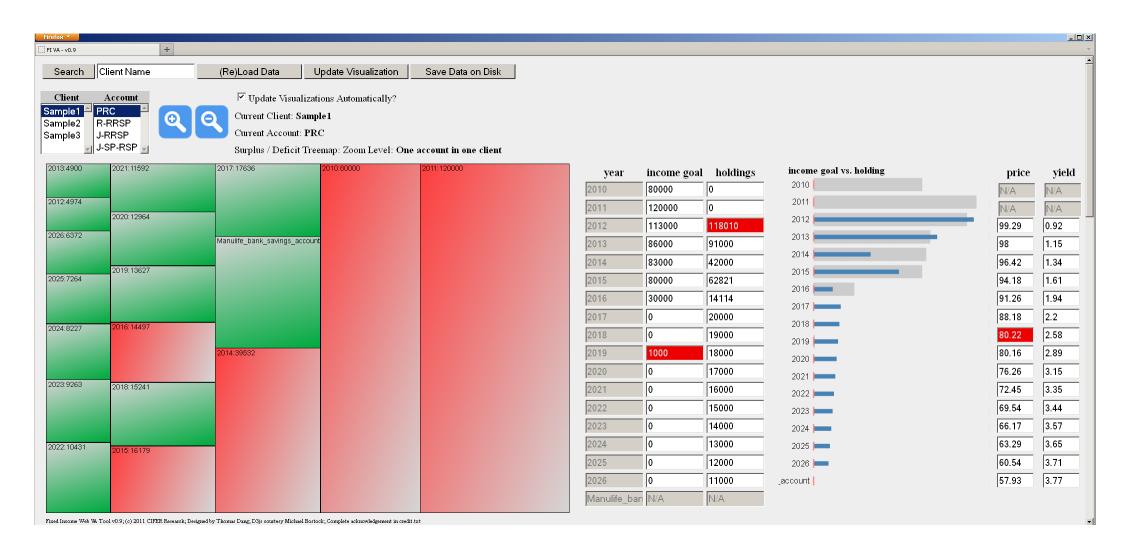
FIXED-INCOME VA DASHBOARD

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

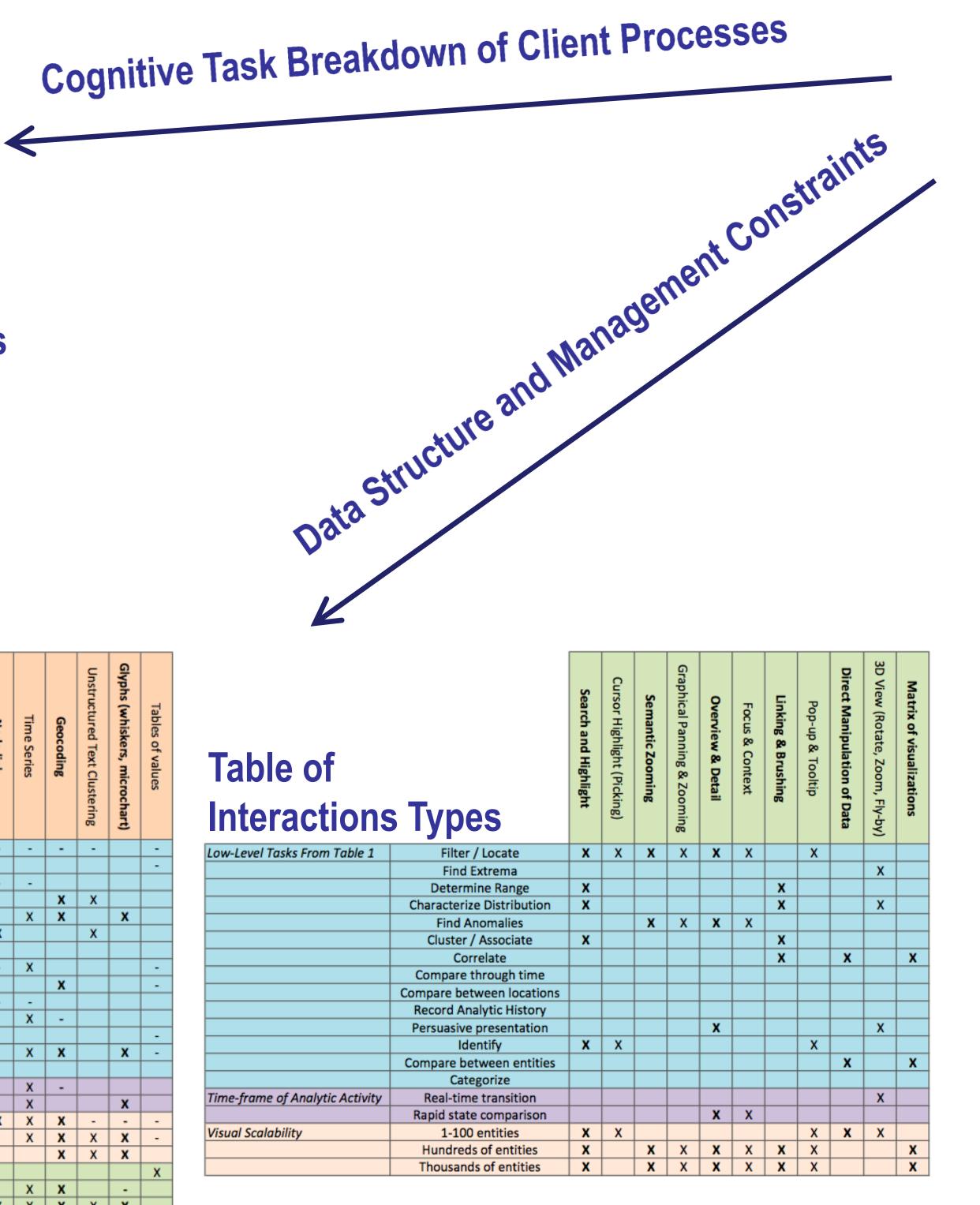
	Conceptual,		Earning and price	Earning and price			
	qualitative	Earning and	forecast, semi-	forecast,	Relationship		
	analysis of	price forecast,	automated,	automated,	management	Portfolio	Scenario
	prospect	fundamental	technical	technical	(client & peers)	Monitoring	Analysis
Filter / Locate	X	х	X	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



Table of Visualizatio	on Types	Parallel Coordinates	Scatterplot	Dot Plot	Bullet Graph	Line Graphs	Stack Graphs	Bar Graphs	Candlestick (a form of glyph)	Heatmap	Treemap	RSF (ringmap, sunburst)	Horizon Graph	Pie Charts	Adjacency Diagrams	Node-link	Time Series	Geocoding	Unstructured Text Clustering	
Low-Level Tasks From Table 1	Filter / Locate	-	-	-	-		-	-	-		-	-	-	-	-		-	-	-	ł
	Find Extrema		x	x	х	x	x	x	x	-	-	-		x						t
	Determine Range		X	X	X	X	X	X	X				-			-	-			t
	Characterize Distribution	x	X	X	X	X	X	X		-	-	-	x	x				х	X	t
	Find Anomalies	X	X	X	X	X	X	X	X	X	-	-					x	X		t
	Cluster / Associate	X	X	X						-	-	-			-	x			X	t
	Correlate	х	X	X	х	X	X	X												t
	Compare through time			-	-	-	-	-	-				X			-	X			t
	Compare between locations			-	-	-	-	-		-	-	-	X		X			x		t
	Record Analytic History		-	-		-	-		-				-			-	-			t
	Persuasive presentation	-	X	X	х	x	X	X	X	-	-		-	X			X	-		t
	Identify																			t
	Compare between entities	x	x	x	х	x	x	x	x	x	x	x	x	x	x		x	x		t
	Categorize	X		X		X	X	-			X	X			X					t
Time-frame of Analytic Activity	Real-time transition		X	X		X	-	x	X	х	-	-	-		-		x	-		t
	Rapid state comparison	x			х	X	x	X									X			t
Visual Scalability	1-100 data point	X	-	X	X	X	X	X	X	x	X	x	X	X	X	x	X	х	-	t
	Hundreds of data points		x			X	<u> </u>		X	X	-	-	X				X	X	X	t
	Thousands of data points		X				<u> </u>											X	X	t
Level of Detail of Value Retrieval					-	-	-	-			-	-		x	-					t
	Quantitative estimates	x	X	x	х	x	X	x	x				-	X			x	x		t
	Qualitative estimates				Х	X	X	X	X	X	X	X	X	X	X	X	X	X	X	t
Unit Data Type	Cardinal	х	X	X	Х	X	X	X	X	X	X	X	X	X	X	X	X	X		t
	Ordinal	х	-	X	-	-	-	-		X										t
	Interval				Х		X		X											T
	Nominal			X		-					X	x	-	X	X	x				T
	Structured Text										X	X			X	X			X	T
	Unstructured Text																		X	T
Data Model & Organization	Flat (Table-like)	х	X	X	Х	X	X	X	X	X	-		X	X			X	X	X	T
	Hierarchical (Tree-like)									-	X	X			X	X				Γ
	Network						1								X	X				Ī
	Multi-variate	х	1				1	1	-				-					1		T
	Unstructured Collection (Files)		•				-	1					•					1	X	F

Reference T Products ar	D3Js / Protovis	Panopticon	In-Spire	
Visualizations 1-N From Table 2A	Parallel Coordinates	1		
	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		
	Heatmap	1	2	
	Treemap	2	2	
	RSF (ringmap, sunburst)	1		
	Horizon Graph	1	2	
	Pie Charts	2	2	
	Adjacency Diagrams	1		
	Node-link	2		
	Time Series	1	2	2
	Geocoding (programmable with GDAL)	1		
	Unstructured Text Clustering			2
	Glyphs	0	2	
	Tables of Values			
Interactions 1-N From Table 2B	Search and Highlight	1	2	2
	Cursor Highlight (Picking)	1	2	2
	Semantic Zooming	1	2	
	Graphical Panning & Zooming	1		2
	Overview & Detail	0		
	Focus & Context	0		
	Linking & Brushing	1	2	2
	Pop-up & Tooltip (on the visualizations)	1	2	
	Direct Manipulation of Data	1		2
	3D View (rotate, zoom, fly-by)			2
	Matrix of visualization instances	2		
Data Semantic	Domain-agnostic	2	2	2
	Designed for finance	1	2	
	Designed for a sub-domain in finance	1	1	
Data Storage & Transmission Format	Built-in, unmodifiable data	2		

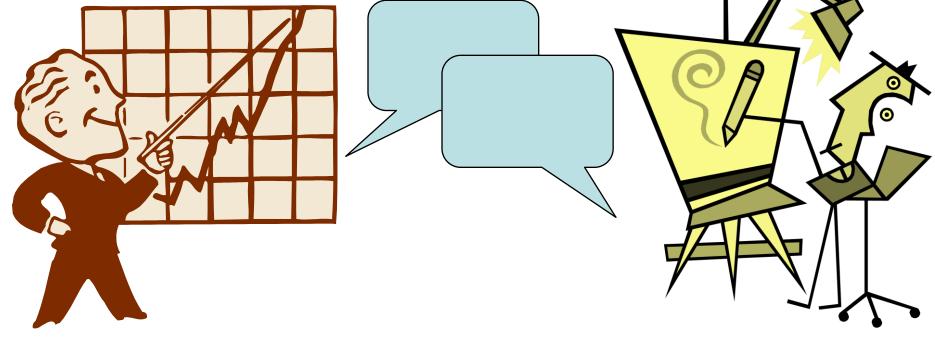




VA-product-vendor specific					
Excel, Microsoft specific	0	2			
Delimited value spreadsheets (CSV, etc.)	1	2	2		
Word, Microsoft specific			2		
PDF, Adobe specific			2		
XML, user-customizable schema	1				
XML, product specific schema	1		2		
XBRL	1				
Row-oriented Database (Oracle, etc.)	1	2			
Column-oriented Database (Sybase IQ, etc.)	1	2			
OLAP	1	2			
JSON	2				
Customizable text format	1		2		
Java Message Service (ActiveMQ, SonicMQ)		2			
Advanced Message Queuing Protocol (QPID)		2			
RSS feed	1		2		
Email server retrieval	0				
Web crawler retrieval	0				
Search engine retrieval	0		2		
Manual Input	2	2	2		
Pull Update (interval refresh)	1				
Push Update (best effort "true" real-time)	1	2			
Clean & normalize heterogeneous or bad data	0		2		
Entity selection					
Entity extraction			2		
Sentiment Analysis					
Statistical Analysis					
Scalable to 10000+ records		2	2		
Dashboard building	0	2			
Excel UI integration					
Online sharing of visualizations	2	2			
Exporting & printing visualizations	2	2	2		
Availability (1: Yes, 0: No)	1	1	1		
Licensing (1: Free to use, 2: Commercialized,		_	-		
3: Free for Educational Use)	1	2			
Tech support and documentation (0: None,		7			
1: Free, 2: Paid, 3: Both)	1	2	3		
Documentation Helpful? (1: Not at all helpful - to - 5: Extremely Helpful)	1	3	4		
	Excel, Microsoft specific Delimited value spreadsheets (CSV, etc.) Word, Microsoft specific PDF, Adobe specific XML, user-customizable schema XML, product specific schema XML, product specific schema XBRL Row-oriented Database (Oracle, etc.) Column-oriented Database (Sybase IQ, etc.) OLAP JSON Customizable text format Java Message Service (ActiveMQ, SonicMQ) Advanced Message Queuing Protocol (QPID) RSS feed Email server retrieval Web crawler retrieval Search engine retrieval Search engine retrieval Search engine retrieval Manual Input Pull Update (interval refresh) Push Update (best effort "true" real-time) Clean & normalize heterogeneous or bad data Entity selection Entity selection Sentiment Analysis Statistical Analysis Statistical Analysis Scalable to 10000+ records Dashboard building Excel UI integration Online sharing of visualizations Exporting & printing visualizations Availability (1: Yes, 0: No) Licensing (1: Free to use, 2: Commercialized, 3: Free for Educational Use) Tech support and documentation (0: None, 1: Free, 2: Paid, 3: Both) Documentation Helpful? (1: Not at all helpful	Excel, Microsoft specific0Delimited value spreadsheets (CSV, etc.)1Word, Microsoft specific1XML, user-customizable schema1XML, product specific schema1XML, product specific schema1Row-oriented Database (Oracle, etc.)1Column-oriented Database (Sybase IQ, etc.)1OLAP1JSON2Customizable text format1Java Message Service (ActiveMQ, SonicMQ)1Advanced Message Queuing Protocol (QPID)1RSS feed1Email server retrieval0Web crawler retrieval0Search engine retrieval0Manual Input2Pull Update (interval refresh)1Push Update (best effort "true" real-time)1Clean & normalize heterogeneous or bad data0Entity selection1Entity selection1Scalable to 1000+ records1Dashboard building0Excel UI integration2Dashboard building2Availability (1: Yes, 0: No)1Licensing (1: Free to use, 2: Commercialized, 3: Free for Educational Use)1Tech support and documentation (0: None, 1: Free, 2: Paid, 3: Both)1Documentation Helpful? (1: Not at all helpful1	Excel, Microsoft specific02Delimited value spreadsheets (CSV, etc.)12Word, Microsoft specific		

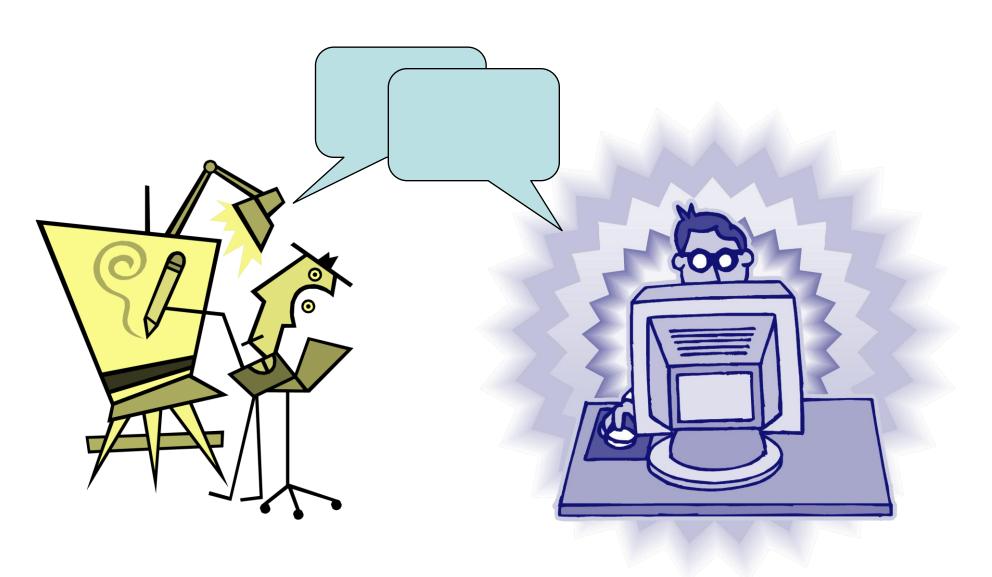


IMPLEMENTATION OR Choose API's and **Develop**



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

Choose Existing Products and Integrate