A Knowledge Task-Based Framework for Design and Evaluation of Information Visualizations

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GVU Center Georgia Institute of Technology





Representation Primacy

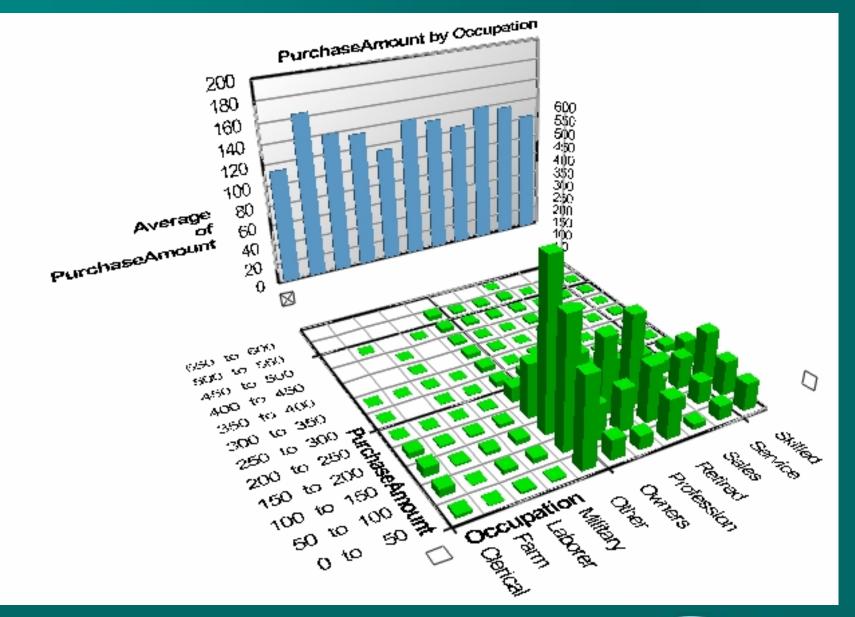
On the whole, InfoVis has been concerned more with

faithfully representing data

than with

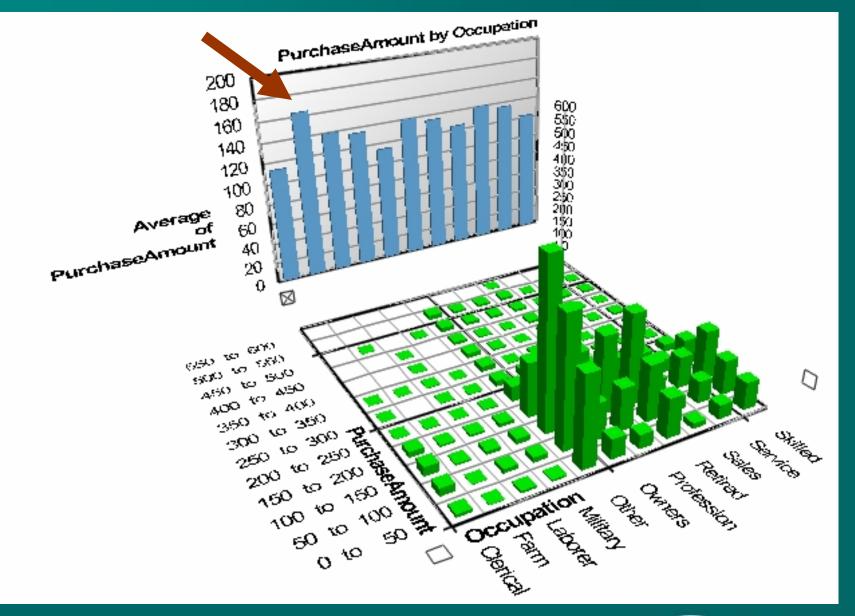
facilitating analytic processes.





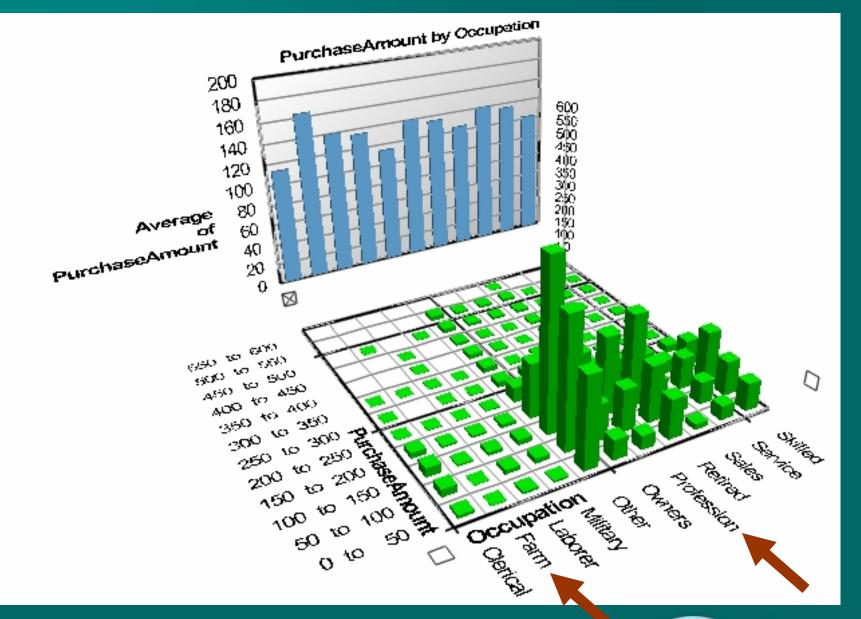
SeeIT (Visible Decisions) Grocery Store Spending Survey Visualization





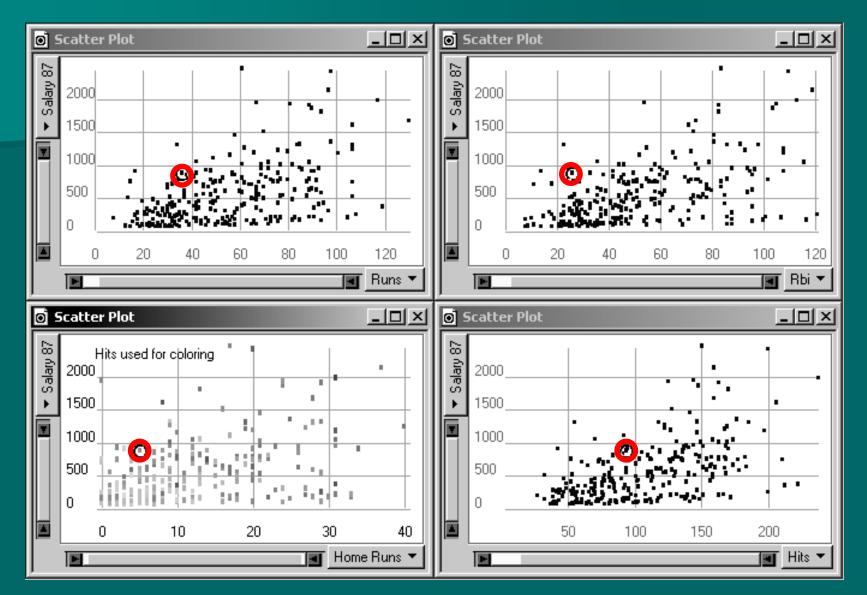
SeeIT (Visible Decisions) Grocery Store Spending Survey Visualization



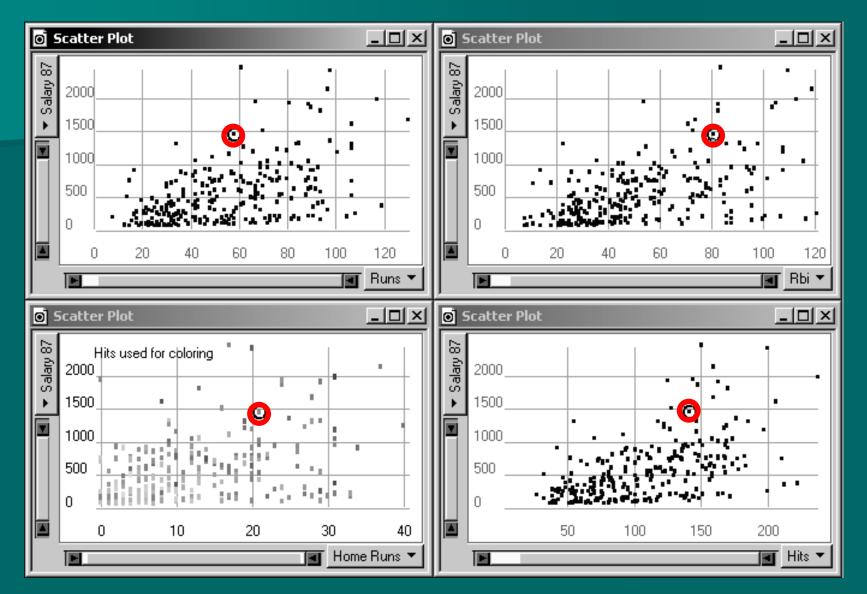


SeeIT (Visible Decisions) Grocery Store Spending Survey Visualization

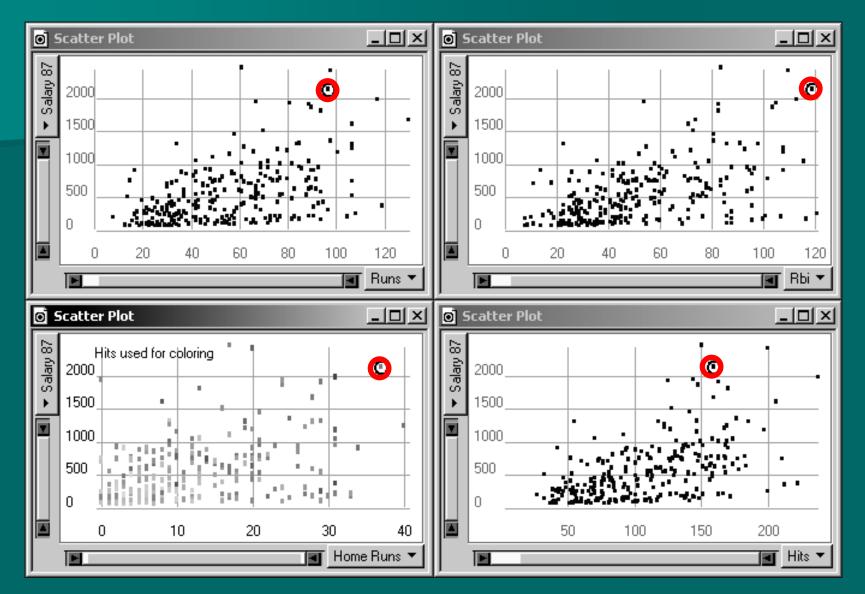




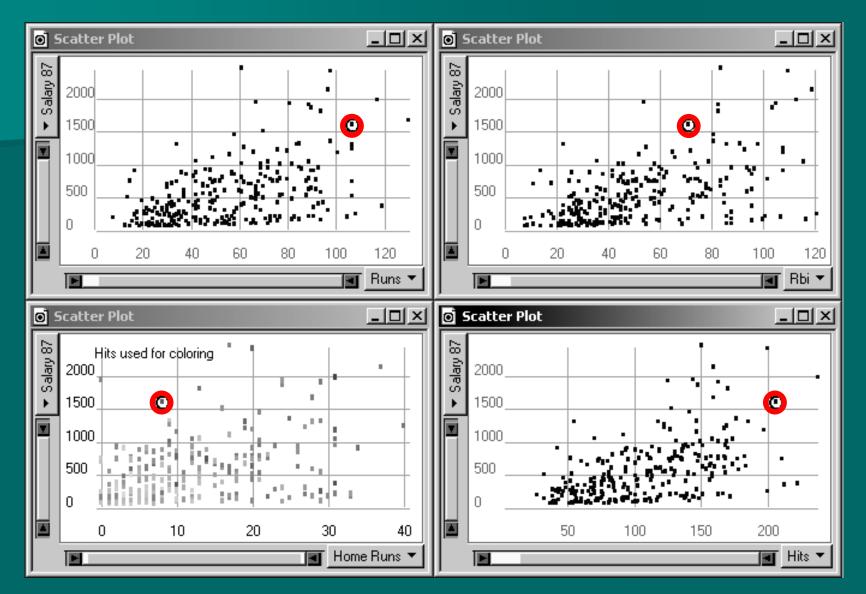




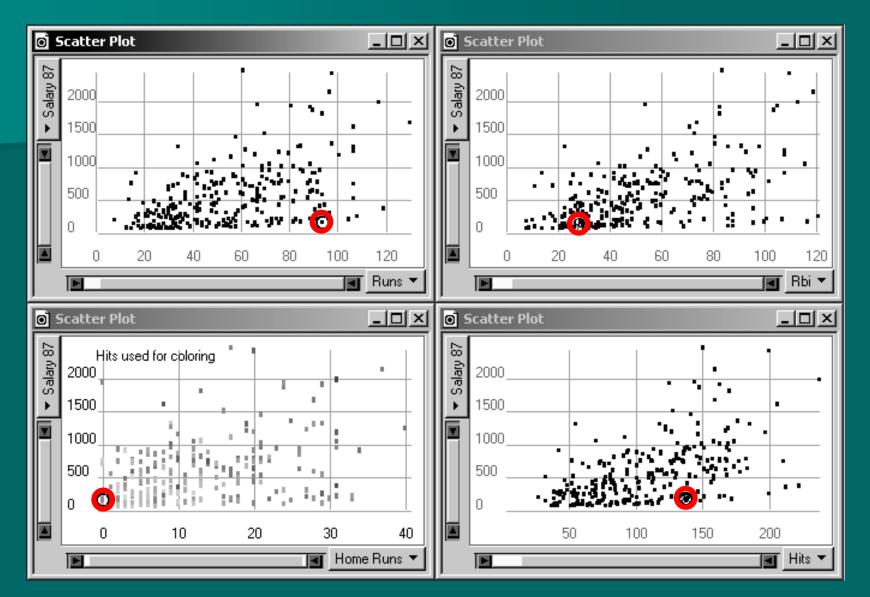














Not Just Information Anymore

"[Managers] *think* they understand the relationships between cause and effect in their organizations. But in fact, the links between actions and results are infinitely more complicated than most managers suspect..."

David Freedman Harvard Business Review

Can we help?



User Analytic Goals

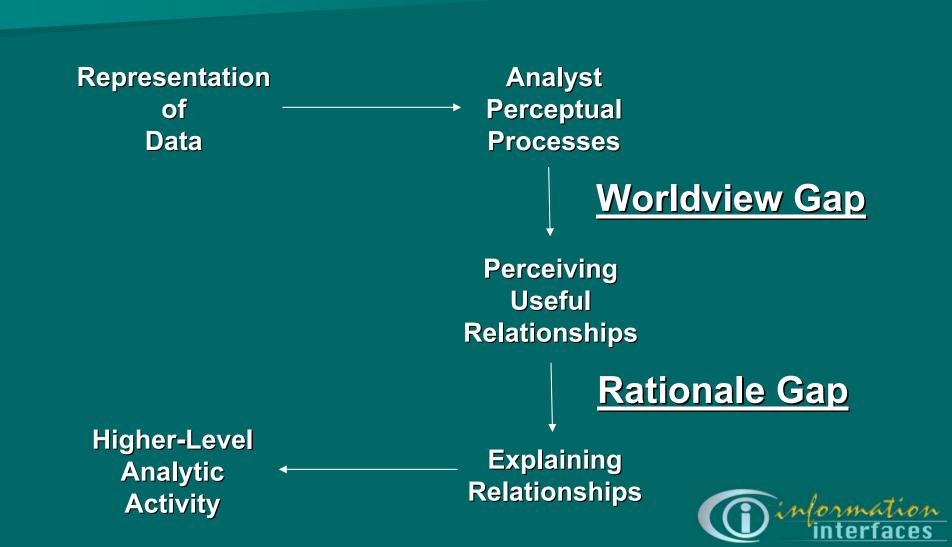
Complex decision-making

- Learning a domain
- Identifying the nature of trends

Predicting the future

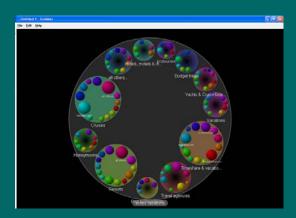


The Analytic Gaps



Bridging the Gaps

 Six knowledge tasks for designers for bridging analytic gaps
 – Grouped according to which gap they fill (worldview, rationale)



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Knowledge Task Summary

Worldview Tasks "Do we show the right things to the user?"

- 1. Domain parameters
- 2. Multivariate explanation
- 3. Hypothesis confirmation

Rationale Tasks "Will the user believe what they see?"

- 1. Expose uncertainty
- 2. Concretize outcomes
- 3. Formulate cause/effect



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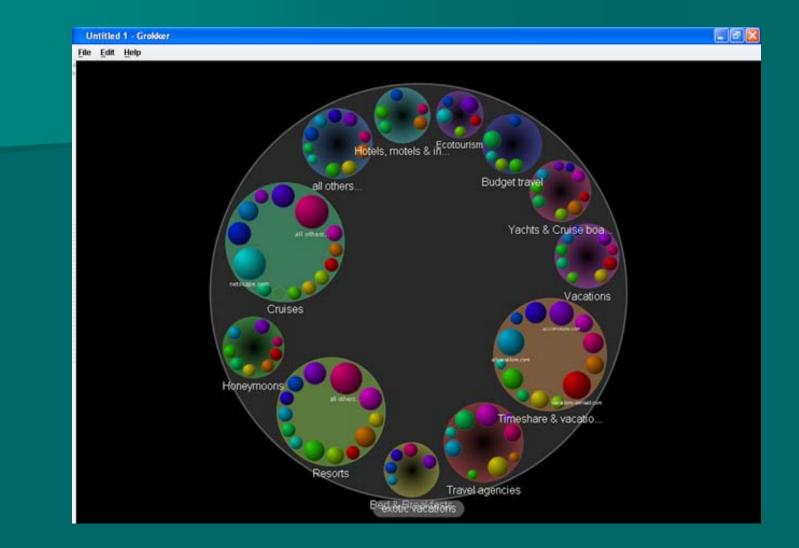


Worldview Task 1: Determine Domain Parameters

Facilitate acquisition and transfer of knowledge and/or metadata about domain parameters



Worldview Task 1: Determine Domain Parameters



Grokker 2 (Groxis) WWW Map for "Exotic Vacations"

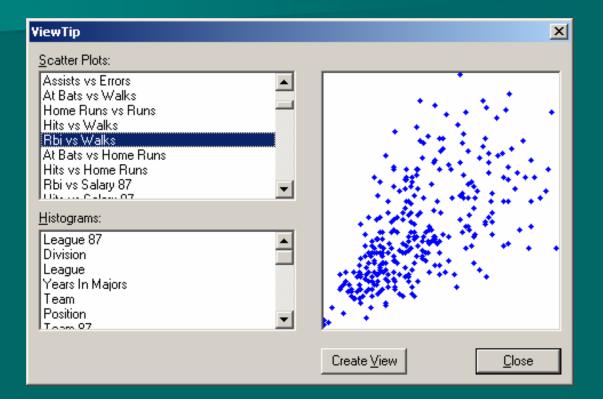


Worldview Task 2: Multivariate Explanation

Support the discovery of useful correlative models – especially those involving many variables



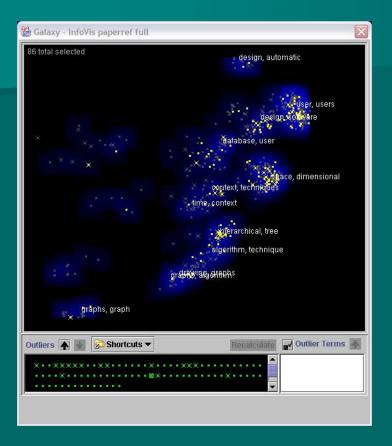
Worldview Task 2: Multivariate Explanation

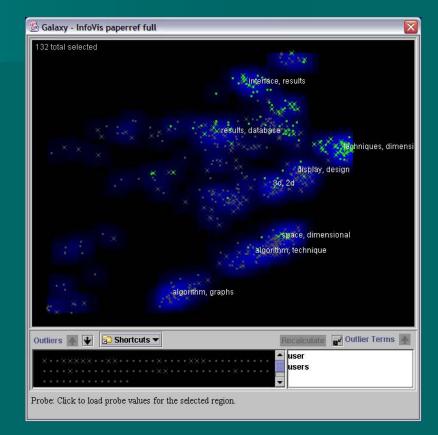


Spotfire Pro 4.0 View Tips



Worldview Task 2: Multivariate Explanation





IN-SPIRE (PNNL) Dynamically Adjustable Categorization



Worldview Task 3: Confirm Hypotheses

Provide facilities for users to formulate and confirm hypotheses about the data set



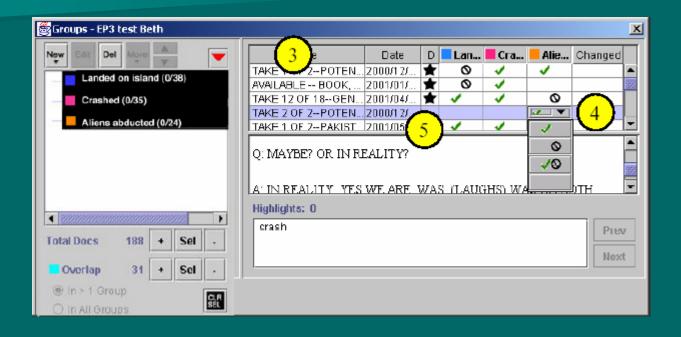
Worldview Task 3: Confirm Hypotheses

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InfoZoom 3.71 (HumanIT) Retail Data Visualization



Worldview Task 3: Confirm Hypotheses



IN-SPIRE (PNNL) Hypothesis Verification



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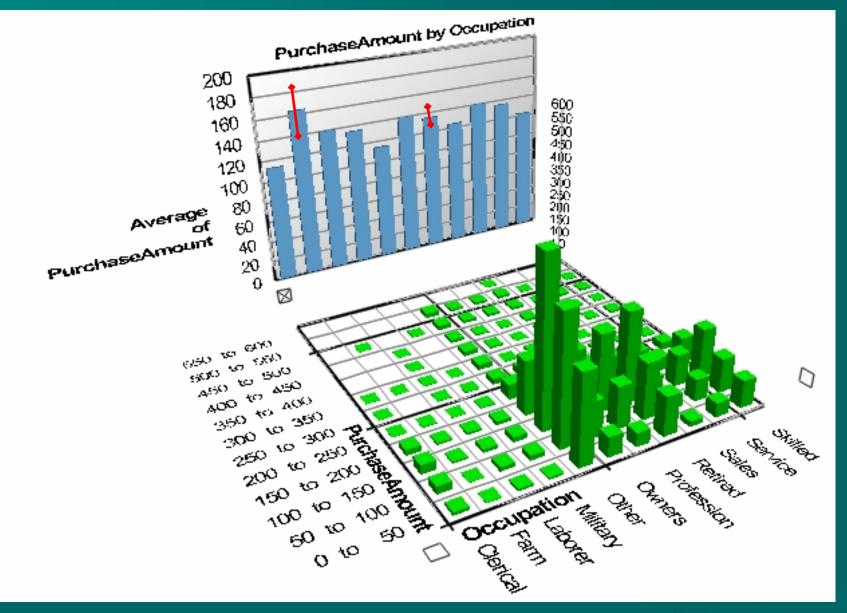


Rationale Task 1: Expose Uncertainty

Expose the sources and effects of uncertainty in data measures and aggregations



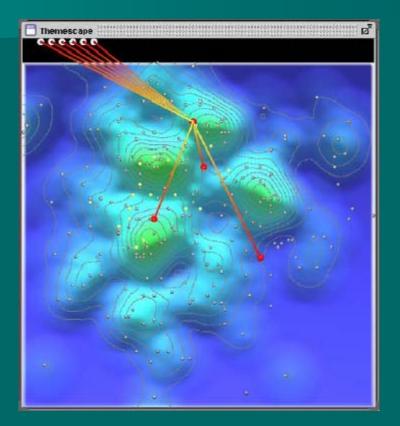
Rationale Task 1: Expose Uncertainty



SeeIT (Visible Decisions) Grocery Store Spending Survey Visualization, Augmented



Rationale Task 1: Expose Uncertainty



ThemeExplorer (Diakapoulos et al., InfoVis '04) Explicitly Representing Uncertainty in a Themescape

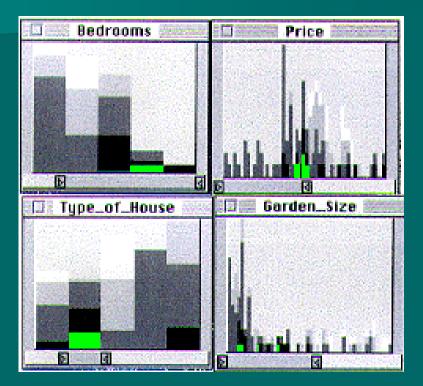


Rationale Task 2: Concretize Relationships

Show the elements comprising relationships and translate into real-world outcomes



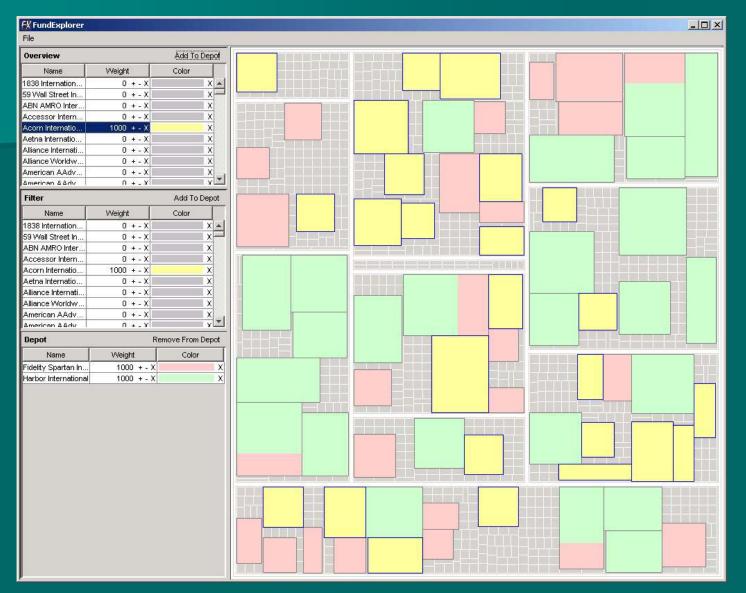
Rationale Task 2: Concretize Relationships



Attribute Explorer (Tweedie et al., CHI '94) House Searching



Rationale Task 2: Concretize Relationships



FundExplorer (Csallner et al., InfoVis '03) Mutual Fund Diversification Tool

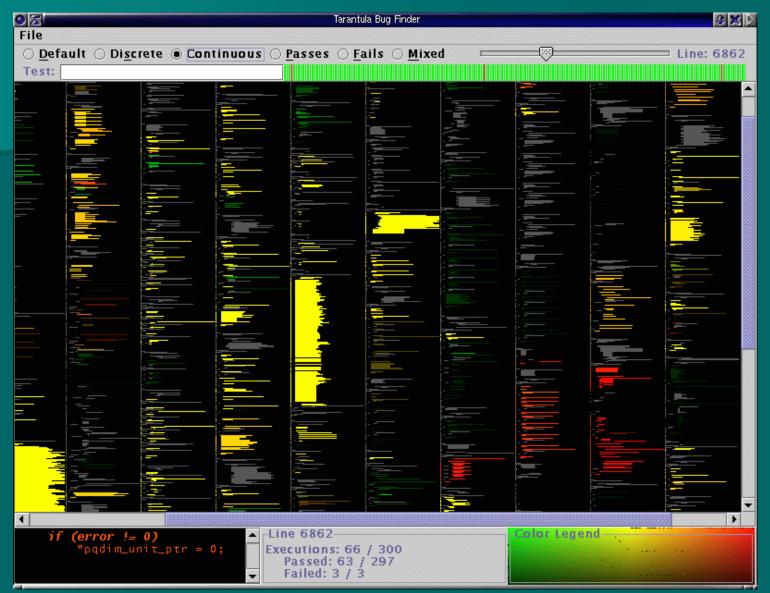


Rationale Task 3: Formulate Cause and Effect

Clarify the source and nature of possible causations



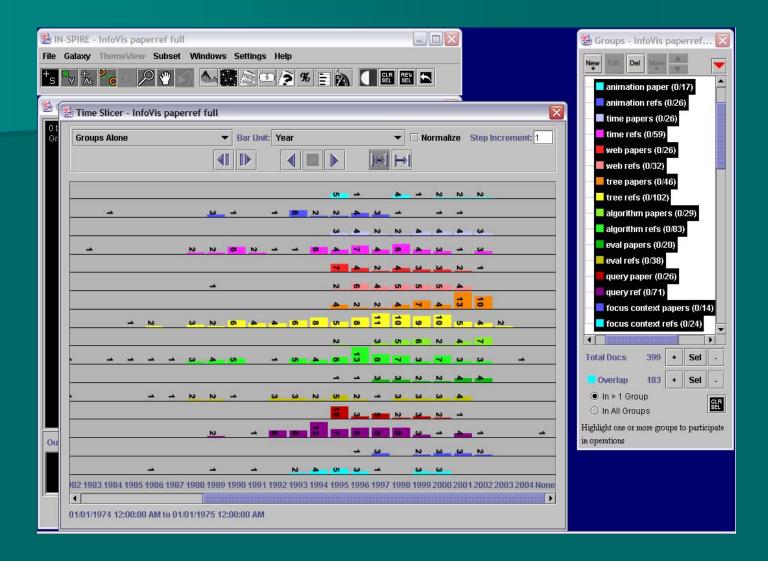
Rationale Task 3: Formulate Cause and Effect



Tarantula (Eagan et al., InfoVis '01) Software Fault Visualization



Rationale Task 3: Formulate Cause and Effect



IN-SPIRE (PNNL) Time Evolution of Document Themes



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Using the Tasks

Generate novel user and system subtasks
Identify shortcomings in data
Discover useful representations
Heuristic evaluation of analytic capability



Future Directions

Conduct case studies of design and evaluation

Rethink lower-level tasks and task taxonomies in an analytic light



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