Visualization for Equity Analysts: Using the DSM in Stock Picking

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ABSTRACT

We use the Design Study Methodology in a short term project to apply visualization to equity analysis with a major supplier of information to the finance industry. Our interactive prototype is positively received and our work suggests that this kind of design and the application of the DSM to short term visualization projects have potential in stock picking and more broadly in financial analysis.

Index Terms: H.5.2 [User-centred Design]: ;— [J.1]: Administrative Data Processing, Financial—; K.8.1 [Graphics]: —

1 CONTEXT

Thomson Reuters (TR) is a leading multinational media and information company that provides professionals with high quality information in a wide variety of fields including finance. Since 1851, TR has been providing stock market quotations to brokers. The flagship product *Eikon* is used by 185,000 analysts around the World to find interesting investment opportunities. We design, develop and evaluate highly interactive visual interfaces to support equity analysts in *stock picking*, a creative process that involves vast amounts of information and is currently too complex to automate. We do so in light of existing work on visualization for financial visualization (e.g. [7, 5, 10]) to determine whether a visual approach to data exploration improves this process, with a view to developing the visualization capability in *Eikon*.

2 METHODS

We used the Design Study Methodology (DSM) [8] to frame work that was undertaken through a 3-month internship at TR's London headquarters at Canary Wharf.

2.1 Design and Development

DSM helped to structure the design process by providing the four nested levels of design: domain, data/task abstraction, visual encoding/interaction idiom and algorithm. Each level defines a set of activities and its required output. This division allowed the problem to be analyzed and the solution to be validated at each level almost independently. However the '*precondition*' phase took place throughout – in a non-sequential fashion – as the organization became aware of and adopted many of the ideas [9]: *Winnowing* – activity took place through working on site with close contact with domain experts. This facilitated rapid discussion and faster feedback loops informing the design. Data was made fully available; *Casting* – involved the work supervisor providing access to front-line analysts, who became more accessible as the project gained momentum and the data sketches developed became more useful; *Discover* – unstructured interviews with 7 different domain experts who were recruited and participated throughout the process.

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The nature of the problem and its organizational setting required that different design alternatives be explored and requirements remain flexible as [11] different domain experts provided input. An *Incremental Development* [4] combined with an *Iterative Prototyping* approach where found to be the best solution. These worked well in the flexible DSM context with the four levels of design helping structure the project: *Domain* – initial meetings where held with domain experts in order to understand the current workflow. Structured interviews followed where initial requirements where validated using mock-ups and sketches; *Task & Data Abstraction, Visual Encoding & Interaction* – we used the *Why?, What?, How?* framework [6] to abstract the tasks, explore visualizations and create interaction paradigms that would fulfil these tasks.

After an initial evaluation of different charting libraries and TR's technology stack (most products are web-based), D3[1] was considered the most suitable technology.

2.2 Evaluation

Visualization solutions are best validated with real datasets [2]. Thus the evaluation used a real data subset with which users performed various tasks derived from the requirements and task abstractions. The tasks were designed using *Visual Data Reasoning* (VDAR) [3] to evaluate not only performance efficiency but also how the visualization solution could support knowledge generation.

Comparison between the new visualization approach and the current tools on *Eikon* was performed using an empirical approach. Two types of tasks where designed: benchmark tasks and insight measurement tasks [3]. For benchmark tasks error rates and task times where measured. For VDAR tasks the number of findings about the data was recorded. These metrics were analysed in the context of rich qualitative feedback.

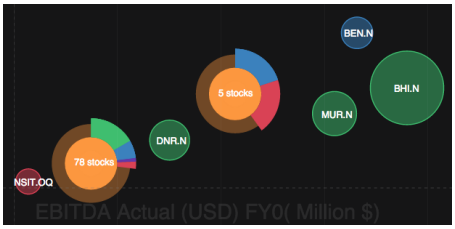

Figure 1: Clusters and Arcs – To avoid overlapping and to reduce noise we used a distance-based clustering algorithm. The arcs show the proportion of items of a given category inside the cluster.

3 RESULTS

3.1 System

Our fully functional prototype supports visual data mining for stock data exploration with linked views that provide complimentary concurrent perspectives of the data. Parallel coordinates are used to display multi-dimensional information about the stocks and to compare and filter. Qualitative data is color-coded enabling stock categories to be distinguished and compared quickly. The scatterplot and mini-map provide a wide overview of the entire dataset and exploration opportunities.

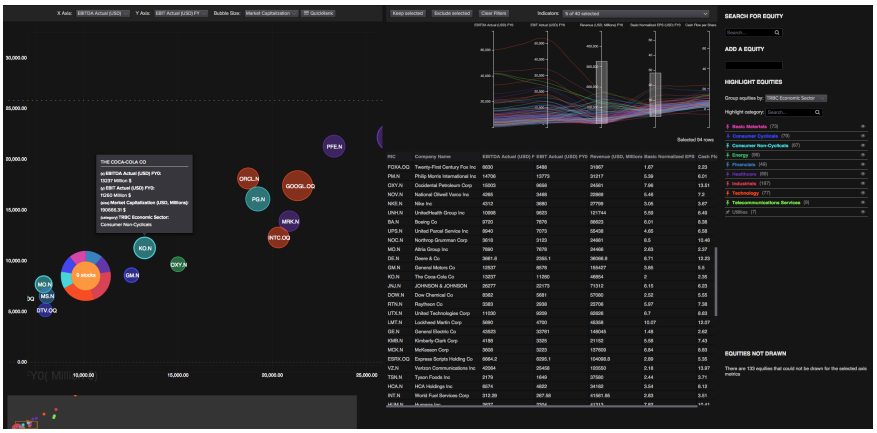

Figure 2: Final Prototype – The prototype exposes data in different visualizations with linked views encouraging exploration.

3.2 Findings

In short, the DSM approach with the incremental, iterative, multi-channel methodology helped structure the process and validate designs to produce a prototype with really useful features for analysts. Feedback from participants using a new method with little training for some complex tasks support this view and relate directly to functional requirements: "*it's so much easier comparing stocks in the prototype than with Eikon*"; "*visually doing the filtering is so much better than manually*"; "*I can see the data now ... this is really cool stuff for an analyst*."

Not all features were successful, however. A means of visualizing the quality of an equity was not clearly understood by the analysts as the visual encoding chosen was deemed ineffective.

In the broader context, stock prices in the two companies specifically selected by participants as being of investment interest in the final evaluation subsequently increased (see Fig. 3). Most notably, the developer's subsequent employment as a Data Visualization Specialist for the F & R Design team at Thomson Reuters is indicative of the level of success felt by the industrial partner.

Figure 3: ***TTWO*** (purple) & ***FUN*** (orange) were picked and increased in price – even surpassing the S&P 500 index (green).

4 Conclusion

Although DSM is normally applied in longer-term projects, the frequent and fast feedback loops allowed activities at each level to be performed successfully and in a timely manner. The task and data abstraction work helped us understand the problem, structure the design and deliver a visualization tool that met analytical needs. The prototype has potential to be developed into a fully functional application included in *Eikon* to provide a new way to explore and analyze the stock market data. As stated by the head of Investment and Management at TR: "*some of the features designed could go into the product*", the prototype "*will be taken into account for the set of features being designed for the upcoming year*".

Additionally some of the new features envisioned by product managers when asked to give feedback about the prototype could be implemented in the prototype to establish whether they enhance the analyst's workflow – a visual test-bed beyond the initial design.

Although the quantitative and qualitative data collected suggests that this approach can improve the equity analysis process, a more comprehensive evaluation is a priority. This evaluation should involve real-world users performing real equity analysis.

Finally, interactive visual approaches could be beneficial in many other applications of *Eikon*: its benefits are not obviously restricted to stock analysis. Many applications within *Eikon* could be enhanced by including such an approach.

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