

Structuring Relations Between User Tasks and Interactive Tasks using a Visual Problem-Solving Approach

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Extended Abstract

This paper presents a refined taxonomy of user tasks and interactive tasks based on a review of the fields of information visualization, geovisualization and visual analytics. User tasks refer to cognitive operations performed by a user to address domain problems, whereas interactive tasks refer to selecting and performing visual encoding and interactive techniques in sequences to fulfill a user task. Both user and interactive tasks consist of multiple primitives, leading to the existence of many task taxonomies described from diverse perspectives. Moreover, the associations between user tasks and interactive tasks are often disconnected, leaving a gap in between. This disconnect results in a clear need to classify all of the primitives and organize them into a logical structure. Our aim is to meet this need to support those who seek parameters for designing visual solutions to users' domain problems.

We first define the relations between user tasks and interactive tasks according to their role in a visualization design process, which aims at solving users' problems (Figure 1). Users have domain problems, which can be translated into user tasks. Taking into account user tasks and related data, a designer should provide visual solutions by developing an interactive visualization environment consisting of visual representations and analytical functions. Meanwhile, interactive tasks are part of the visualization environment design. Interactive tasks should provide sequences of interactive functions to allow users to accomplish user tasks through interactively exploring in the environment. Therefore, user tasks play an important role in both domains of user's problem and designer's visual solutions, whereas interactive tasks are a key factor in the domain of designer's solution.

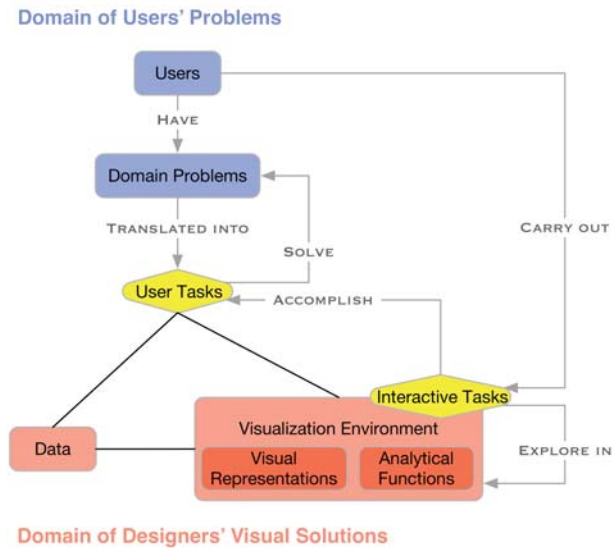


Figure 1. The roles that user tasks and interactive tasks play in a visual problem solving approach, consisting of a user's problem domain and a designer's visual solution domain. The problem domain introduces user tasks translated from user problems, and the solution domain provides visual solutions to the user tasks through interacting with a visualization environment. The user tasks bridge the two domains, and the interactive tasks are one of the components to be designed in the visualization environment.

We then identify three primitive user tasks—*identify*, *localize* and *compare*—and all other user tasks are considered as compound tasks consisting of sequential primitives. This way allows complex tasks to be decomposed into sequences of simpler tasks. Moreover, User tasks can be conducted in an elementary level targeting at low-level data characteristics of data components (i.e. data values of attributes), or in a general level targeting at the pattern emerging from the data components that are treated as a whole.

Furthermore, we analyze the definition and examples of interactive functions in the existing taxonomies, in order to clear up the confusion caused by the diverse vocabulary used in literature. We then merge these interaction functions with same/similar end purposes into eleven categories: *re-encode*, *arrange*, *coordinate*, *aggregate/segregate*, *filter*, *derive*, *navigate*, *query*, *search*, *select* and *enabling*. The resulted taxonomy provides the interactive primitives. Interactive tasks are further composed by sequences of these interactive primitives.

We expect this refined taxonomy to provide a more intuitive view to visual solution designers for understanding the role that both tasks play, and further to help designers come up with suitable visual solutions for users.