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Multiple Views: different meanings and collocated words

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Abstract

We report on an in-depth corpus linguistic study on 'multiple views' terminology and word collocation. We take a broad interpretation of these terms, and explore the meaning and diversity of their use in visualisation literature. First we explore senses of the term 'multiple views' (e.g.,'multiple views' can mean juxtaposition, many viewport projections or several alternative opinions). Second, we investigate term popularity and frequency of occurrences, investigating usage of 'multiple' and 'view' (e.g., multiple views, multiple visualisations, multiple sets). Third, we investigate word collocations and terms that have a similar sense (e.g., multiple views, side-by-side, small multiples). We built and used several corpora, including a 6-million-word corpus of all IEEE Visualisation conference articles published in IEEE Transactions on Visualisation and Computer Graphics 2012 to 2017. We draw on our substantial experience from early work in coordinated and multiple views, and with collocation analysis develop several lists of terms. This research provides insight into term use, a reference for novice and expert authors in visualisation, and contributes a taxonomy of 'multiple view' terms.

CCS Concepts

• ***Human-centered computing*** → ***Visualization; Visualization theory, concepts and paradigms;*** • ***Applied computing*** → ***Arts and humanities; Education;***

1. Introduction

The phrase *multiple views* is widely used in the visualisation domain. Authors write about *multiple views* being displayed on the screen or laid out as *small multiples*, describe visualisations that have *multiple levels of detail*, display *multivariate* or *multi-dimensional data* that can be *perceived from multiple perspectives*. But one of the challenges for a reader is that the same phrase can have several meanings. For example, the phrase "multiple views", can be interpreted as meaning 'many opinions', 'many visual depictions' or 'alternative mathematical projections'. By contrast, different phrases can have the same sense, e.g., *small multiples*, *trellis plots*, *matrix views* share similar properties. Therefore, it can be confusing for an author to know how to express their ideas. Authors want to use words that their readers will understand. But novice authors or non-native speakers do not necessarily know what words to use and how to express themselves clearly. In fact, domain experts use much tacit knowledge when they write papers and articles. Expert writers know implicitly how to explain and discuss issues of multiple views, because they have gained experience with the phraseology through writing in a field, for many years. Experts know the limitations of the vocabulary, but this 'good practice' is hidden within the texts that they write. Both novices and experts can be helped through a detailed analysis and taxonomy of terms used by authors as revealed in the texts.

We present a study of terminology and phraseology used in visualisation on the topic of *multiple views*. Terms are single or compound words that are used within a specialised domain and have a clearly defined meaning [BP02]. Our linguistic approach informs the community and encourages them to be more careful when using words. Through such analysis, researchers in the community can have a better grasp of the breadth and expressiveness of the ideas surrounding *multiple views*. Our taxonomy can help users to frame their ideas and could be used to underpin the development of a wider theory of visualisation. Additionally, learners will understand better how the words are used, and they will be able to improve their writing.

We have three goals: **(1) Categorise different senses of the use of 'views' in visualisation**. By exploring different senses and developing a taxonomy of their meanings, we explain the diversity of word usage within this field and make authors aware of the possible ambiguities in their writing. **(2) Quantify term popularity and investigate collocated words**. The knowledge gained from understanding term popularity and collocated words can be used by authors to help them use suitable vocabulary for their texts. Word collocation analysis extracts words that appear close together and are statistically more frequent. For example, an academic author may write a "powerful hardware", but is less likely to write "strong hardware". Similarly, an author discussing different visualisations