Micro Visualizations:
Data-driven typography and graphical text enhancement

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ABSTRACT

At the intersection of information visualization and typography lies the design space of micro visualization, a family of basic techniques enriching text in regard of its accessibility, comprehensibility, and memorability. We propose a taxonomy that differentiates specific types of visualizations applied to text design and layout. We elaborate two main approaches to aligning the visual appearance of a text and its content. The first explores the addition of graphical elements embedded into or adjacent to a text, while the other approach explores the visual modification of a text by means of typographic visualization. For this we evaluate how different techniques can be used as visual variables.

Keywords: Text visualization, typography, graphic design.

Index Terms: H.5 Information Interfaces & Presentation.

1 INTRODUCTION

Despite their common origin, text and images drifted apart in their application and thus truly integrated combinations are rarely used. While textual elements play a secondary role in visualization design as legends or labels, visualizations are typically standalone elements alongside the textual content of documents. An atypical approach to integrating typography and visualization is FatFonts, a technique varying font weight to represent data [1]. However, the typical layout of text in printed works has not changed much since Gutenberg's invention of the letterpress. The typographic appearance of newspapers or magazines does mostly represent the brand but not the text's content itself.

Psychological research by Mayer et al. [2] has shown that with the integrated combination of images and text the reader benefits from a *dual coding* of the information. Research on the *cognitive load theory* by Chandler and Sweller [3] demonstrates that an interwoven presentation can help the reader to better comprehend the information. By integrating graphics into the text and making the text more graphical through typographical emphasis we aim to achieve these effects. Both image and text have unique qualities, each fulfilling its purpose. We try to bring these two sides closer together, creating a more complete image.

2 TYPOGRAPHY

When one reads a text, one is not just reading. One is also seeing how the text is presented. The importance of the appearance of the text is well known and generations of type designers developed a variety of techniques to enhance the "text-seeing" and reading process. However, typography is mostly used cautiously and

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conservatively. We argue for a more exploratory approach to typography incorporating methods from visualization.

Listings of visual variables, one of the key ingredients of visualization design, often summarise text as a singular variable. However, there is a range of "typographic variables" available to the information designer. Following Bertin's visual variables, Table 1 lists an expanded selection of *typographic variables*.

Shape	Typeface
	Style (caps, italic, …)
	Font weight
	Font width
Position	Kerning / Spacing
	Indention / Margin
	Alignment
	Superior / Inferior
	Line spacing
Appearance	Colour
	Texture
	Opacity
Size	Scale
Orientation	Rotation
	Font slope
Additional variables	Underlining
	Strike through

Table 1. Visual variables as basis for typographic variables

These typographic properties raise a few considerations for the visualization and typographic design. Extensive use of some typographic variables may compromise legibility. In contrast, a rectangle in a regular visualisation may suffer in visibility but not in legibility. In fact, this is a complete new relationship between entity and label. Normally the entity is modified, while the label remains unaffected. In our approach the label is also the entity and thus requires careful modification. In regular visualisations each object represents an individual or aggregated data element. There are no objects on the plane that look like data points, but hold no data. But typographic changes may be only applied to some text elements. The other words remain in their original form and thus can be mistaken to represent data as well but can also act as "normal" for comparison. Typographic properties can be applied at different granularities of the text: the entire paragraph, the sentence, for one word, or only one letter. Especially when working with single elements one needs to be aware that the modification of any of the typographic variables influences the grey value of the text. Sometimes, this is not intended. Typography holds additional visual variables available due to conventions like underlining or line-height.

3 VISUALIZATION

Tufte introduced sparklines [4] that now find many applications especially in the finance sector. The idea is to insert *datawords* that

visualize for example the history of a value in a minimalistic graph right within the text. This has two advantages: First, the reader does not need to switch back and forth between text and image; secondly, sparklines are directly positioned at the relevant point within the text. This immediate embedding in the text and the inclusion of historic values can provide useful context.

Another approach of integrating text and graphic has been popularized by "The Russia Left Behind", a rich online story by the New York Times. Adjacent to the article a minimalistic travel route progressively updates as the reader scrolls down. As she reads through the article, the corresponding street segments and cities are highlighted. The coupling between figure and text is very elegant: First, the map is very minimalistic, making it instantly understandable. Then, the map gradually updates, without distracting the reading flow, and provides constant accessibility due to the fixed position on the side. The type of context provided by the map, would be difficult to express in words. Lastly, the map also acts a graphical progress indicator and navigation widget.

4 MICRO VISUALIZATION

To better understand the principles of the above mentioned techniques that elegantly integrate typography and visualization, we propose the term "*micro visualization*". It aims to describe visualisations that are small in physical space and represent few data dimensions or points. Micro visualisations are basic graphical modifications or additions that enhance the comprehension of text.

Micro visualizations can act at three levels:

- *abstraction*, revealing the overall structure of the text,
- *amplification*, supporting, contextualising, or questioning the written statements visually, or
- *detail*: adding new information to the text.

Despite the fact that a number of projects and concepts have been developed that may count as micro visualizations, they have not been compiled under the suggested concept. In order to examine this field and define a starting point for future research and design, we propose a taxonomy featuring two dimensions that group micro visualizations into segments (Figure 1) designers can work with.

LEVEL OF CHANGE

POSITIONING/SCOPE	Modification	Addition
Integrated	INTEGRATED MODIFCATION	INTEGRATED ADDITION
Adjacent	ADJACENT MODIFICATION	ADJACENT ADDITION

Figure 1: Four types of Micro Visualization applications

The proposed taxonomy is meant to help choosing a form of visualization if one field is fixed (i.e. no available space in the margin) or when either the comparison or the contextualization is more important. We see the combination of multiple as promising: If adjacent and inline elements show the same information, the link between entities and visualization can be strengthened. Inline elements can also act as thumbnails for the complete visualizations adjacent to the text.

The first differentiation describes the **level of change** made to the original text by the additional data layer. The first and restrained approach is *modification* through purely typographical instruments described above. The second direction is the *addition* of graphical elements to the original text. While additional elements are

separated from the entity, modifications affect the entity itself; here visualization and entity are the same object.

We use the **positioning** of integration and **scope** of modification to further differentiate the level of change. While one is smaller and directly integrated into the text, the other is more spacious and occurs adjacently for example in the margin of the text. Integrated visualizations directly support the contextualization of information during the reading flow, while adjacent visualizations allow for a better comparison of multiple data points, that would otherwise be spread out across the text. The differentiation also affects the relation to the corresponding entity (Figure 2). While integrated visualizations (modification and additional) refer to one entity, adjacent additional graphics can also relate to multiple entities. Adjacent modifications still refer to only a single entity.
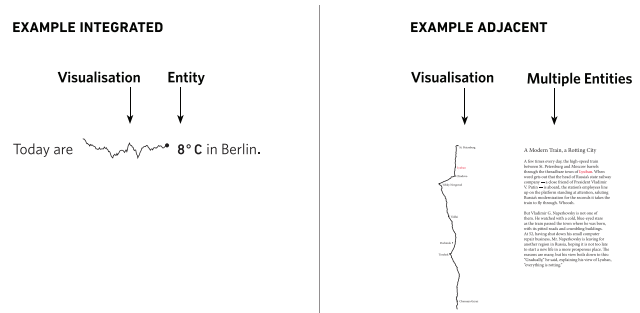

Figure 2: Visualization/entity-relation in integrated and adjacent visualizations

5 CONCLUSION

Typography is not only one visual variable among many, but rather a complete new "object" that can be modified with the visual variables described by Bertin and others. While typo-graphic visualizations may not always be as easy to decode as regular visualizations, they can play an important role for the text and thus enhance its comprehension. Supported by evidence on the comprehensibility of texts and images, datawords and other "reduced" graphics are a promising direction for visualization and graphic design. Micro visualizations open up a new field of experimentation and application for visualization. Especially devices with smaller screens like smart watches are possible environments of application.

6 ACKNOWLEDGMENTS

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