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Visualizing complexity: Infographic materials as complementary tools for data-rich articles

Scientific communication in the natural sciences relies on a standardized set of graphical conventions. This predominantly relies on two- and three-dimensional plots, such as scatter plots, bar charts, and surface diagrams. These formats are essential for precisely and efficiently communicating quantitative relationships. They provide clear answers to fundamental analytical questions by directly representing data trends, variances, and model fits. Consequently, manuscripts incorporating these standard elements are often deemed sufficient in terms of their graphical component.

However, this established model faces challenges in an increasingly intricate research environment. Contemporary studies are often characterized by high-dimensional datasets, complex systemic interactions, and the integration of information from various sources. This complexity demands corresponding advancements in visual communication methods. A significant yet frequently underutilized opportunity lies in the strategic adoption of infographics and composite graphical materials. These resources are not intended to replace traditional plots, but rather to serve as supplementary tools; the latter extend conventional analytical exposition by incorporating deeper strata of insight (often qualitative, relational, or distributive) directly into the visual presentation. A proficiently constructed infographic can elucidate structural hierarchies, map conceptual networks, illustrate procedural workflows, and condense complex statistical summaries into comprehensible formats. Therefore, its value transcends basic data presentation, entering the realms of synthesis, interpretation, and pedagogical clarity. It effectively connects empirical findings with their broader scientific context.

Recognizing this potential, the editorial board of Chimica Technica Acta continues to help authors achieve exemplary scientific communication [1]. We believe that providing accessible, specialized tools for advanced visualization can reduce the technical barriers to creating high-quality illustrative graphics. To this end, we are pleased to introduce three novel web-based applications designed to address visualization needs beyond the capabilities of standard plotting facilities. Designed with academic rigor and user accessibility in mind, these tools allow researchers to generate publication-ready figures that enhance the depth and clarity of their scholarly narrative.

The first application is **Word Cloud Generator** [2], which provides a focused solution for visualizing textual metadata. It automates the creation of weighted tag clouds from frequency data, which is a particularly useful technique in literature reviews, meta-analyses, and any other type of study where the relative prominence of terms requires immediate visual emphasis. The operational principle is efficient and effective: the frequency with which a term occurs within a defined corpus is proportional to its typographical scale. This process transforms a tabular list into an intuitive overview of lexical prominence, instantly highlighting dominant themes or terminological foci within a research sample, Figure 1.

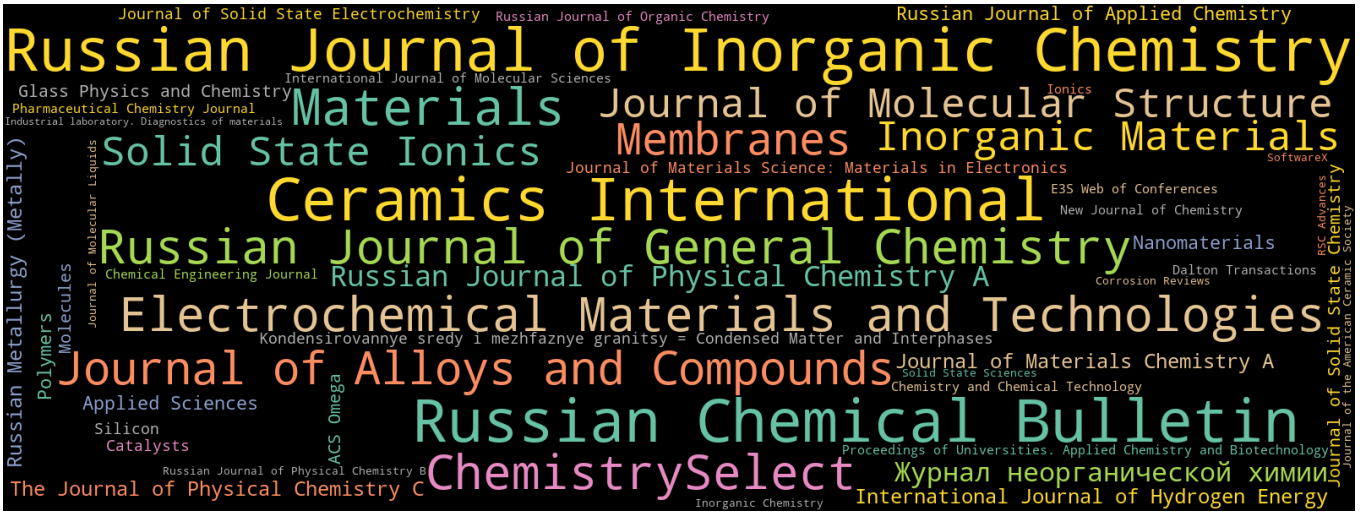

Figure 1 Most frequent journals that cited articles published in the Chimica Techno Acta journal between 2014 and 2024.

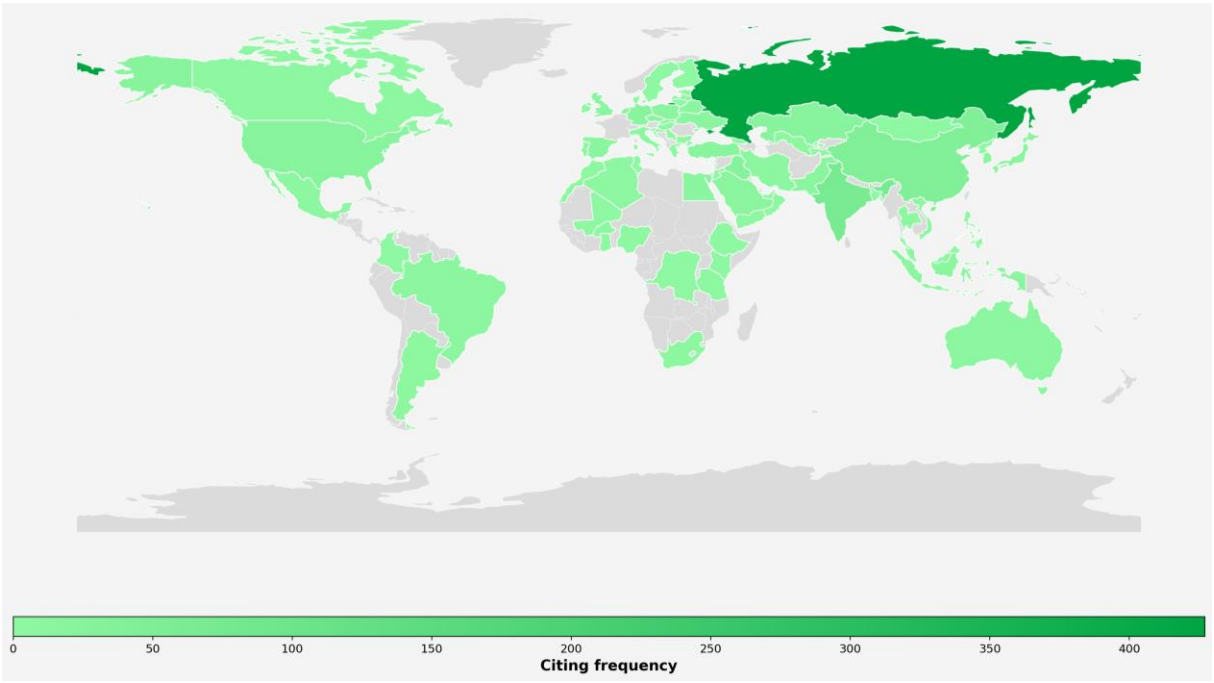

Figure 2 Most frequent countries that cited articles published in the Chimica Techno Acta journal throughout its entire lifespan.

The second tool, **World Frequency Map** [3], is a sophisticated solution for geographically or collaboratively oriented research. It processes data sets containing country codes and their associated frequencies. The application performs two primary analytical functions. First, it generates a global heat map that shades nations according to their specified frequency, displaying geographical prevalence or regional focus (Figure 2). Second, it creates dynamic chord diagrams that map collaborative linkages between countries. These diagrams visually represent the strength and topology of international networks, such as co-authorship patterns. This combined visual summary of distribution and connection is invaluable for analytical work in fields such as scientometrics and global studies.

The third application, **Data Visualization with Marginal Distributions** [4], addresses a common challenge in exploratory data analysis by enabling users to observe the relationship between two primary variables while simultaneously visualizing their individual distributions. Built on the logic of the ggside package, this tool seamlessly adds density plots or histograms to the margins of a primary scatter plot. This composite figure reveals the central trend and the underlying probability density of values along each axis (Figure 3). The technical implementation uses the familiar syntax of the ggplot2 framework, enabling researchers to create these layered visualizations with minimal adaptation. By appending these marginal distributions, the tool clarifies whether observed trends are driven by specific data clusters or outlier effects. This provides contextual information that is often absent from standard two-dimensional plots.

In summary, the foundation of scientific graphics will continue to prioritize precise Cartesian coordinates. However, incorporating infographic elements can enhance scholarly exposition. The textual, geospatial, and enhanced statistical visualization tools described here demonstrate how targeted applications can empower authors. These tools facilitate the production of figures that perform advanced functions such as explaining, contextualizing, and synthesizing. We encourage our contributors to consider the narrative and analytical capacity of graphical materials and use these resources where appropriate. Through this practice, the scientific community can collectively foster a robust, insightful visual culture in which graphics are integral, thought-provoking components of scientific discourse rather than supplementary ones. The fundamental objective remains clear and effective communication of scientific knowledge. These tools provide an expanded graphical vocabulary for achieving this goal.

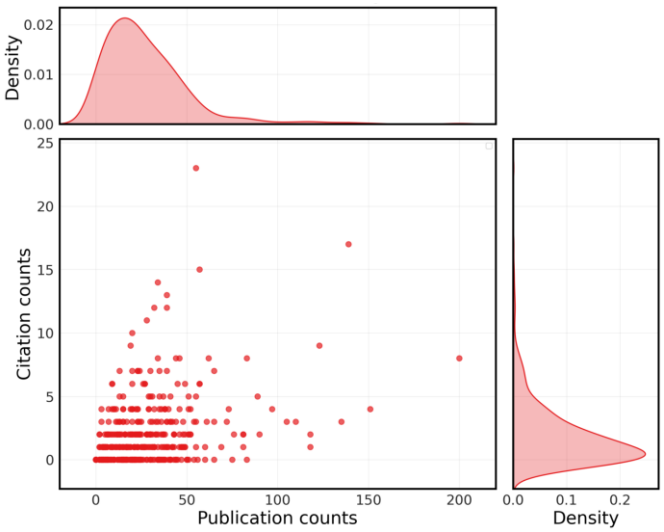

Figure 3 Relationship between number of references and number of citations for the papers published in the Chimica Techno Acta journal between 2014 and 2024.

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