

IMPLEMENTATION OF SHAPE AND STYLE INTO CONTENT RECOGNITION

Raša Urbas¹ , Nace Pušnik² , Urška Vrabič-Brodnjak¹ 

¹ University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Textiles, Graphic Arts and Design, Snežniška 5, 1000 Ljubljana, Slovenia,

² Xiamen University, Institute of Creativity and Innovation, University for the Creative Arts, 300 Nanbin Avenue, 363105 Fujian, China

Abstract: Humans perceive a considerable amount of information through vision, with an estimated 80-85% of environmental information being processed through our eyes. This emphasises the importance of vision for human perception and interaction. The visual system detects and interprets stimuli such as colour, brightness, contrast, shapes, movement, speed, depth and texture. This enables us to navigate our environment, interact with it and respond to it effectively. Vision is crucial for activities such as reading, driving, recognising people and objects and maintaining balance and coordination. As part of the bilateral cooperation between the Republic of Slovenia (University of Ljubljana, Faculty of Natural Sciences and Engineering) and the US state of Kansas (Wichita State University), a joint project entitled *Typography World Map* was initiated. One of the goals of the project was to educate students from both countries about the importance of data visualisation and information design. This collaboration emphasised the professional integration of technology and graphic arts design and showed how their synergy can enhance the presentation and understanding of complex data. Properly presented, this approach can simplify the perception of complex information, such as statistical data, by making it visually appealing and easier to understand. As part of the project, students were given pre-designed names of different US states. This paper presents the results of their assignment, which was to compile and visualise selected statistical data and key information about the assigned states in the form of an infographic. As the visualisation of key information can greatly enhance the presentation and understanding of data, we wanted to assess how well the students could apply their newly acquired skills in typography, design and graphic prepress techniques to create these infographics. The results were interesting and provided valuable insights into the importance of data visualisation and individual data presentation.

Key words: education, graphic prepress, graphic design, visualisation of information

1. INTRODUCTION

The dominance of visual perception is a key feature of human cognition and behaviour. By efficiently processing a variety of visual information, the human visual system enables us to interact meaningfully with our environment, demonstrating its critical importance in various contexts and activities (Harrison, Reinecke & Chang, 2015; Lin & Atkinson, 2011). The human visual system is not just a passive receiver of information, but an active and complex mechanism that recognises and interprets a variety of stimuli. Important visual attributes such as colour, brightness, contrast, shape, depth and texture are processed simultaneously, so that we can form a cohesive understanding of our surroundings.

The ability to perceive colours enables people to distinguish objects and assess their significance whether it's recognising ripe fruit or interpreting traffic signals. Brightness and contrast help to distinguish objects in different lighting conditions and improve our ability to cope in different environments. Shape recognition is crucial for identifying objects and facilitates tasks such as reading, where the brain quickly interprets letters and words based on their shape (Yarbrough, 2019).

These visual skills are the basis for many everyday activities, such as reading, driving and social interactions. Reading relies heavily on the rapid and accurate processing of visual symbols, while driving requires constant interpretation of a rapidly changing visual landscape, including road signs and the behaviour of other vehicles. Recognising people and objects also depends on visual cues, which are essential for effective communication and social cohesion.

In addition, the integration of visual information with proprioceptive and vestibular information is crucial for maintaining balance and coordination. This interweaving of different sensory modalities illustrates the complexity of human perception, as it involves the synthesis of information from different sources to produce a coherent experience of the world (Sober & Sabes, 2005; Evans & Treisman, 2011). The ability to combine visual cues with feedback from our body enables us to navigate and interact with our

environment. This emphasises the paramount importance of vision for human cognition and daily life. (Glaser & Schwan, 2020)

Recognising the importance of visual perception, a collaborative initiative entitled "*Typography World Map*" was launched as part of a bilateral partnership between the Republic of Slovenia (University of Ljubljana, Faculty of Natural Sciences and Engineering) and the US state of Kansas (Wichita State University) (Pušnik et al., 2022a, Pušnik et al., 2022b). The main goal of this project was to educate students from both countries in the principles of data visualisation and information design. This collaboration emphasises the integration of technology and graphics and shows how their interaction can improve the presentation and understanding of complex data.

The aim of this study was to find out how well students can design an infographic that incorporates the existing typography of a particular US state in a recognisable and representative way, while including important information about the state. We also wanted to find out how well first-year students could do this task without any prior knowledge, as one of our goals was to identify gaps in their graphic design skills. Specific research objectives included assessing students' ability to:

- Apply basic typography and design principles in the creation of infographics.
- Apply graphic prepress techniques to improve the clarity and aesthetics of data presentations.
- Analyse the effectiveness of their visualisations to facilitate understanding of the information.

2. METHODS

The first step of the project was performed in the winter semester of the academic year 2021/2022, when the Slovenian master's students of the Creative Typography course (led by Assist. Prof. Dr. Nace Pušnik) individually developed various typographic solutions, which were combined into sets, presented in the course's seminar and linked to the content of the "*Typography World Map*" semester project. The results of this project were presented in the works Pušnik et al. (2022a) and Pušnik et al. (2022b).

In the second step, data visualisations and information designs were created for 16 selected US states, using the same typography as in 2022. A total of 32 students (from the Graphic prepress course led by Prof. Dr. Raša Urbas) worked together to create 16 infographics, each showing the chosen typography along with relevant information highlighting the typical characteristics and statistics of each state. Students conducted in-depth research on their chosen state or country, exploring various aspects such as cultural, social, linguistic and natural characteristics, as well as important events representative of the U.S. states. Students conducted online research on specific U.S. states and then shared their findings with other students in the U.S. This was because it was important to present commonly known facts in either a short text or a graphic design/element. The students used various graphic programmes (e.g. Adobe Illustrator and Photoshop) to design the infographics, set the graphic prepress settings correctly and visualise them. A great deal of attention was also paid to the graphic prepress stage, as the students had to prepare the designs for publication on the internet and for printing.

To ensure that the project produced adequate results, the students had weekly consultation hours to help them complete the semester assignment. As part of the learning process, the aim of the project was also to determine how much practical knowledge the students took away from attending the lectures and how they applied the theoretical knowledge they had acquired to the practical application of graphic prepress in the form of infographics. At the end of the project, the infographics created were assessed in terms of the choice of appropriate typography, its size, alignment and placement of the text, the selection of the image material and its quality, the placement of the content in the final format and, of course, the preparation of the file for publication on the Internet and as printed media. All 16 infographics were also printed and an exhibition on the project was presented at the Faculty of Natural Sciences and Engineering, University of Ljubljana. As part of the peer assessment, the students also evaluated their work using the so-called "post-it method", in which they selected the infographics they thought were the best and worst. Green Post-it notes labelled the best and red ones the worst infographics.

3. RESULTS AND DISCUSSION

The students were provided with pre-designed motifs for the names of various US states, each of which was reproduced in a different typographic style (Figure 1). Some of these selected typographic motifs contained recognisable features typical of the respective states, which added to the complexity of the task for the students. To streamline the process of fulfilling the project requirements, students were first instructed to research meaningful facts and data about each state. These findings were then to be supported by the integration of carefully selected graphic elements and illustrations.



Figure 1: Motifs of US state names

In infographics design, students had the task of summarising the data they had collected for each state into visually compelling representations. The research covered a wide range of topics, including demographic data such as total population, religion and racial composition, important landmarks and natural monuments, notable wildlife, and data on climate and weather patterns. In addition, the students analysed the geographical characteristics of each state, considering information about its size, shape and historical significance. The infographics also highlighted aspects of the economy, major cities and other culturally or economically significant elements to ensure a comprehensive representation of each state's identity. The students showed a creativity with the choice of content for their presentations, often opting for unconventional and unexpected facts to represent the states. There were no restrictions on the selection of data; instead, they were encouraged to highlight what they felt was most representative of each state. The result was infographics with a variety of information ranging from the state's prestigious universities to unique details of state seals to the popularity of certain sports — such as the importance of golf in South Carolina. Some students emphasised the architectural significance of famous buildings, such as in New York, while others chose to highlight notable personalities or significant historical events, such as groundbreaking open-heart surgery in Minnesota. In addition, data on crime rates, cultural landmarks and other features were included in the final presentations, creating a rich and diverse picture of each state. The project involved first-year students on the Graphic and Media Technology programme, many of whom had little experience with graphic design. Therefore, our expectations were tempered as we expected some errors in the design and layout of their work. Although consultations were offered to the students throughout the process, we realised that some of them would still struggle to meet the technical

specifications required to create files suitable for both web publishing and print, as they were not yet as familiar with these industry standards.

Typographical and grammatical errors were among the most common problems with the infographics, partly due to the fact that the students are native Slovenian speakers, but the infographics had to be made in English. The most common errors included the selection of inadequate fonts and font sizes (Figure 2), which meant that the text was often too small to be displayed effectively or the contrast amount was poor.

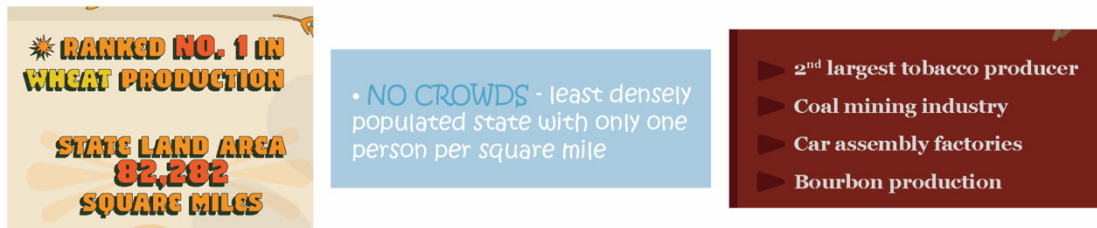


Figure 2: Examples of inadequate typography

Text alignment was also noticeably inconsistent, with inadequate word breaks and poorly structured indents further contributing to the overall lack of cohesion in the layout (Figure 3). In some cases, students did not place graphic elements properly next to the text, so that they occasionally obscured parts of the content (Figure 4). This problem was largely because most of the illustrations were not created by the students but taken from the Internet. Due to a lack of technical knowledge and attention to details, many students were not capable to select appropriate file formats for the graphics, resulting in some images not supporting transparency, which led to overlapping text and graphic illustrations. Quite a few infographics were placed too close to the edge, ignoring the bleed (Figure 5).

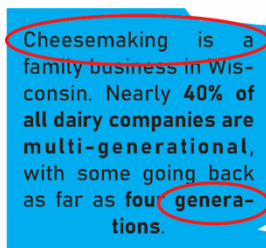


Figure 3: Examples of inadequate text alignment and hyphenation

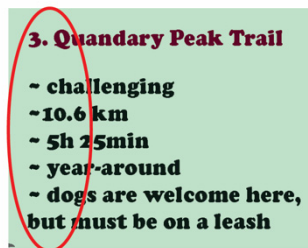


Figure 4: Example of inadequate layout

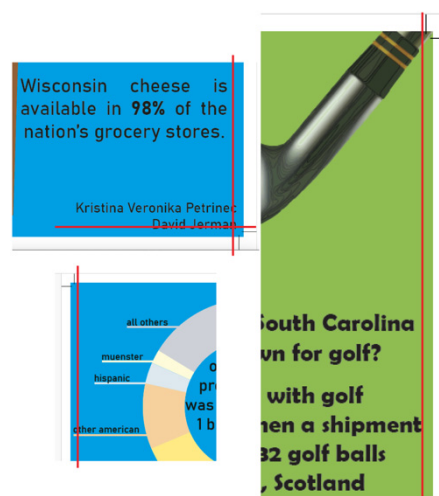


Figure 5: Example of inadequate content placement in regard to the margin

There were fewer problems with the choice of images than with the placement of the text. As already mentioned, the students mainly searched for the visual material on the internet and endeavoured to match the style of the pre-designed motifs of the state name, but they did not always succeed (Figure 6).

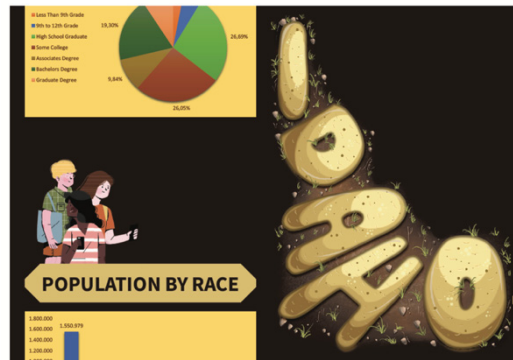


Figure 6: Example of a poorly choice illustration that does not correspond to the pre-designed motifs of state style

In addition, there were instances where the images were improperly cropped (e.g., square cropped river), lacked uniformity in size (e.g., the disproportionate scaling of animals such as the bison, bear, and beaver) and style (e.g., shopping cart, heart and canoe), and in some cases were rendered with a lack of detail or precision (e.g., watermelon) (Figure 7).



Figure 7: Examples of poorly chosen illustrations

Despite the challenges mentioned above, the students performed remarkably well. They created 16 different and highly engaging infographics that provided a compelling overview of the different US states, combining written content with visual elements. Some chose a minimal colour palette, while others opted for vibrant and colourful designs (Figure 8). All but one group of students showed a clear understanding of the task. The only omission from this group was that they did not include the given motif of the state name in their infographic. In general, they adhered to the guidelines for the use of text, which was kept to a minimum and mainly supplemented by illustrations and other graphic elements. It was also recommended to present the text in sentence-free formats, which was followed by all but one group (in addition to the already mentioned one).

The students had no major difficulties in preparing the files for printing and online use. Since vector-based illustrations were used, resolution problems were avoided. However, there were minor challenges, mainly due to graphic material from the internet that did not support transparency. When saving the infographics in PNG format for online publication and in PDF/X format for printing, some students forgot to convert the colour mode from RGB to CMYK and vice versa. Also, some forgot to add bleed marks and crop marks, which are essential for print.



Figure 8: Exhibition of 16 infographics evaluated with “Post-it method”

In a final step, the students were asked to evaluate both their own work and that of their peers. To assist them, they were given detailed instructions describing the essential elements of effective infographic design. These guidelines emphasised the importance of choosing appropriate typeface style and font size, the strategic placement of key elements within the chosen layout and the importance of harmonising text and visuals to create a coherent and balanced overall presentation. As already mentioned, the assessment was carried out using the “Post-it method”, with each student marking their best infographic with a green post-it notes and the one they thought was weakest with a red post-it notes. As expected, the selection of students differed somewhat from the mentor's assessment. Factors such as knowledge, experience, familiarity with proper graphic design process, graphic prepress, and personal visual preferences undoubtedly influenced these differences. The students preferred infographics that were more colourful, with little text and eye-catching graphic elements (infographics of the states of Arizona and Montana). They reasoned that these infographics most effectively emphasised the content using well-chosen illustrations. However, the mentor felt that part of the students' preference for a particular infographic was due to the vibrant, pre-designed motif of the Montana state name – a rainbow-coloured design highlighted in the centre of the layout. The students' choice for the weakest infographic also differed from the mentor's assessment. They chose the infographic of the state of Wisconsin as the worst, even though it was not the weakest in terms of design or content. The mentor surmised that this choice was likely due to the authors' decision to focus solely on one characteristic of the state - its association with cheese and beer products. While this focus was interesting, it did not fulfil the broader task of presenting several important and recognisable features of the state, which may have contributed to the lower score.

4. CONCLUSIONS

The “*Typography World Map*” project further explored the importance of visual processing through a project collaboration that emphasised the intersection between education and graphic technology. This project demonstrated how effective visual design can simplify complex data and make it more accessible and engaging for different audiences. Using a consistency in typeface style selection and information design for the different U.S. states allowed students to create cohesive, visually appealing infographics that reflected each state's unique characteristics. Immersing students in research about their chosen states provided them with a comprehensive understanding of the cultural, social, linguistic, and natural elements that make up these regions. By examining real-world events and representative features, students were able to create data visualisations that not only convey statistical data, but also capture the essence of each state or country. Their work shows that design and visual elements can play an important role in conveying nuanced information in a way that is both informative and aesthetically pleasing.

The project results, including the visual motifs, infographics and colour schemes, showed how research findings can be effectively translated into visual communication design. The unique characteristics of each state or country were expressed through the design choices, highlighting the importance of thoughtful, research-driven approaches to data visualisation. This approach emphasises that successful information design is not just about presenting data, but also about engaging the audience through a clear, creative and meaningful representation of subject's identity.

This project therefore underlines the crucial importance of visual perception and data visualisation in modern information design. By combining technical skills and creative empathy, the students have shown how visual elements can enhance the presentation of complex information to enable better understanding and engagement. Furthermore, the project is a testament to the value of interdisciplinary collaboration and the role of visual literacy in effective data communication.

6. ACKNOWLEDGMENTS

The project is supported by the Slovenian Research Agency and the bilateral agreement on scientific research cooperation between the Republic of Slovenia and the United States of America, which is listed under the number of the bilateral project BI-US / 22-24-157.

7. REFERENCES

- Evans, K. & Treisman, A. (2011) Natural cross-modal mappings between visual and auditory features. *Journal of vision*. 10 (1):6, 1-12. Available from: doi: 10.1167/10.1.6
- Glaser, M., & Schwan, S. (2020) Combining verbal and visual cueing: Fostering learning pictorial content by coordinating verbal explanations with different types of visual cueing. *Instructional Science*. 48, 159-182. Available from: doi: 10.1007/s11251-020-09506-5
- Harrison, L., Reinecke, K. & Chang, R. (2015) Infographic Aesthetics: Designing for the First Impression. *CHI '15: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. pp. 1187-1190. Available from: doi: 10.1145/2702123.2702545
- Yarbrough, J. (2019) Infographics: In Support of Online Visual Learning. *The Academy of Educational Leadership Journal*, 23. Available from: <https://www.abacademies.org/articles/Infographics-in-support-of-online-visual-learning-1528-2643-23-2-135.pdf> [Accessed 14th September 2024].
- Lin, L. & Atkinson, R. (2011) Using animations and visual cueing to support learning of scientific concepts and processes. *Computer and Education*. 56, 650-658. Available from: doi: 10.1016/j.compedu.2010.10.007
- Pušnik, N., Urbas, R., Weingerl, P., Puškarević, I., Pulaski, J., Sulyok, L. & Ray, J. (2022a) Education and its challenges in post covid time. In: *11th International Symposium on Graphic Engineering and Design GRID*, Novi Sad, Fakultet tehničkih nauka. Available from: doi: 10.24867/GRID-2022-p62
- Pušnik, N., Pulaski, J. & Puškarević, I. (2022b) World typography map project. V: *Abstracts book : papers presented at the 8th ICTVC, Thessaloniki, Greece, from 7 to 9 July 2022*. In: *8th International Conference on Typography and Visual Communication, Thessaloniki, Greece, 7-9 July 2022*. Engomi, Cyprus: Institute for Study of Typography and Visual Communication.
- Sober, S. & Sabes, P. (2005) Flexible strategies for sensory integration during motor planning. *Nature Neuroscience*. 8, 490-497. Available from: doi: 10.1038/nn1427



© 2024 Authors. Published by the University of Novi Sad, Faculty of Technical Sciences, Department of Graphic Engineering and Design. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license 3.0 Serbia (<http://creativecommons.org/licenses/by/3.0/rs/>).