IM942-15 Visualisation Foundations

23/24

Department
Centre for Interdisciplinary Methodologies
Level
Taught Postgraduate Level
Module leader
Cagatay Turkay
Credit value
15
Module duration
10 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Visualisations have become a fundamental currency for the exploration of data and the exchange of information. In this module we will explore this highly interdisciplinary subject from a wide variety of views - from cartography to statistics, to architecture and information design, and from science to the arts. Some of the labs and activities will involve coding and sketching activities, but there are no pre-requisites for this course. We encourage students from diverse backgrounds to bring their own perspective and skills to this exciting and interdisciplinary topic.

Module web page

Module aims

(1) To provide a contemporary overview of information and data visualisation in terms of design and the science;
(2) To develop an appreciation of the theoretical and practical considerations in designing and using visualisations;
(3) To develop skills in developing and evaluating visualisations in terms of real-world problems.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be

covered. Actual sessions held may differ.

Week 1 - Lecture (1 hr): “Visualisation – the objects, methods and subject” An introduction to what visualisations are, what visualisation is as a set of methods, and how we can understand the scope of this interdisciplinary subject. By examining ’visualisation’ from these three perspectives, this lecture will introduce the components of a visualisation that must be considered when using, making and critiquing visualisations. Week 1 - Coding Lab (2 hrs): “Introduction to graphics in R” Understanding R and what it can do. Understanding the R graphics device. Methods to carry out a basic workflow from inputting data and producing basic plots to outputting image files.

Week 2 - Lecture (1 hr): “The Fundamental Visualisation Principles told through Small Multiples” The core principles of visualisation will be introduced through the lens of the ‘Small Multiples’ technique – where data is separated across a panel of multiple graphs. A variety of topics will be introduced, from Pre-attentive Processing and Cognitive Load, to Visual Encodings and Hierarchies. Week 2 - Coding Lab (2 hrs): “Formatting graphics in R” Understanding the structure of an R graph and how to format each features. How to define and use colour schemes. Basic computing topics to enable this work.

Week 3 - Lecture (1 hr): “Decoding Errors and Precision” This lecture will explore how we decode information from a graphic, and how the effectiveness of a visualisation can depend on the task, data characteristics and different literacies. We will examine some of the frailties of visualisation as a medium used to reveal and communicate, and so explore how visualisations can be ambiguous visual puzzles and a source of disinformation. Week 3 - Coding Lab (2 hrs): “Layouts and Panels in R” Layout functions and methods for subplots, linked layouts and multi-panel ‘dashboards’. Some more basic computing topics to enable this work.

Week 4 - Lecture (1 hr): “Controversies in visualisation – visual junk, rainbows and censorship” Visualisation techniques and approaches are not without controversy and in this lecture we will explore our relationship with aesthetics, narratives, best practices in design and the actual impact of visualisations. We will explore some contemporary debates and critique some of the claims surrounding visualisation Week 4 - Coding Lab (2 hrs): “R Packages and Project Work” Installing and using R packages for specific types of visualisations. Getting started with the project work that will lead to the assignment.

Week 5 - Lecture (1 hr): “Critical visualisation – where are the limits of visualisation?” Having examined visualisation through the lens of design and the craft of creating visualisation, we will look at how we can critique visualisations using principles from Critical Cartography and Feminist Science and Technology Studies. This lecture will explore issues beyond the visual interface that may or may not be folded back into design. What are the limits of visualisation as a medium? Week 5 - Coding Lab (2 hrs): “Project work and Feedback” Feedback and further development of the project work that will lead to the assignment.

Week 7 - Lecture (1 hr): “Reasoning with visualisations” This lecture explores visualisation as a data analysis approach. We discuss how visualisations underpin an informed, engaged and critical reasoning process when working with data. We examine the role of visualisation within exploratory data analysis and how it can support or bias decisions made from/with data. How can interaction be introduced in this process and what job does it do? Week 7 - Coding Lab (2 hrs): Using sequences of visualisations generated in R to make inferences from data and reflect on observations, and curate narratives that interrogate data in insightful ways.

Week 8 - Lecture (1 hr): “Design-ing visualisations” This lecture reflects deeply on the visualisation design process? We’ll explore design methodologies and frameworks from human-centred design and human-computer interaction, as well as exploring methodologies to empathise and engage with the “users” and “uses” of visualisation designs. Week 8 – Design & Coding Lab (2 hrs): Reflect on the affordances and needs of different visualisation audiences, and re-purpose and re-design visualisations in R for different contexts.

Week 9 Lab (3 hrs): The visualisation lab will focus on an activity/task from themes such as spatial visualisations, interrogating software, activating visualisations, drawing visualisations. The hands on tasks/activities allow students to explore questions surrounding, for example, technology, interactions, representation and design choices.

Week 10 Lab (3 hrs): The visualisation lab will focus on an activity/task from themes such as spatial visualisations, interrogating software, activating visualisations, drawing visualisations. The hands on tasks/activities allow students to explore questions surrounding, for example, technology, interactions, representation and design choices.

Learning outcomes

By the end of the module, students should be able to:

- Demonstrate an understanding of visualisations and their usage in a wide variety of applications;
- Explain the nature of visualisation as an interdisciplinary subject;
- Demonstrate an understanding of the role of technology in changing visualisation practices;
- Demonstrate an appreciation of the trade-offs involved in developing visualisations through examples;
- Explain the range of affordances that different visualisations can offer through examples;
- Evaluate visualisations in terms of users and tasks, and best practices and aesthetics;
- Understand and demonstrate the core skills required to create effective visualisations.

Indicative reading list

1. Bertin, J. (2010). Semiology of Graphics: Diagrams, Networks, Maps. Esri Press.
2. Brody, H., Rip, M. R., Vinten-Johansen, P., Paneth, N. & Rachman, S. (2010). Map-making and myth-making in Broad Street: the London cholera epidemic, 1854. The Lancet, 356, pp. 64-68.
3. Cairo, A. (2012). The Functional Art: An Introduction to Information Graphics and Visualization. New Riders.
4. Cleveland WS, McGill R. Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods. Journal of the American Statistical Association. 1984; 79(387): 531-554.
5. Crampton, J.W., Krygier, J., 2006. An introduction to critical cartography. ACME: An International E-Journal for Critical Geographies 4 (1), 11–33.
6. D’Ignazio, C., & Klein, L. F. (2016). Feminist data visualization. Workshop on Visualization for the Digital Humanities (VIS4DH), Baltimore. IEEE.
7. Dork, M., Feng, P., Collins, C., & Carpendale, S. (2013). Critical InfoVis: Exploring the Politics of Visualization. In: Proc. CHI'13, Extended Abstracts of the SIGCHI Conference on

Human Factors in Computing Systems, ACM, pages 2189-2198, May 2013.
8. Few, S. (2013). Information Dashboard Design.
9. Hall, P. (2008) "Critical Visualization." In Design and the Elastic Mind, edited by Paola. Antonelli. 122-131. New York: Museum of Modern Art.
10. Healy, K. & Moody, J. (2014). Data visualization in sociology. Annual Review of Sociology, 40:105–128,
11. Meirelles, I. (2014). Design for Information - An Introduction to the Histories, Theories, and Best Practices Behind Effective Information Visualizations. Rockport.
12. Munzner, T. (2015). Visualization analysis & design. CRC Press.
13. Robison, W., Boisjoly, R., Hoeker, D., & Young, S. (2002). Representation and Misrepresentation: Tufte and the Morton Thiokol Engineers on the Challenger. Science and Engineering Ethics, (8)1, pp, 59–81.
14. Tufte, ER. (2001). The Visual Display of Quantitative Information. Graphics Press, USA.
15. Viégas, F. & Wattenberg, M. (2015). Design and Redesign in Data Visualization. Malofiej 22. https://medium.com/@hint_fm/design-and-redesign-4ab77206cf9#.ubwv83fvv
16. Walker, K. (2014). Pretty vacant: What we're not seeing in graphics today. New Scientist.
17. Ware, C. (2012). Information Visualisation - perception for design. Morgan Kaufmann

Interdisciplinary

The module explores visualisation as a highly interdisciplinary subject from a wide variety of views - from cartography to statistics, to architecture and information design, and from science to the arts.

Subject specific skills

- Demonstrate an appreciation of visualisation as a multi-disciplinary practice;
- Demonstrate an understanding of how visualisations support specific applications and are re-applied to secondary applications;
- Demonstrate basic computing skills to create data visualisation;
- Discuss the role of visualisations in society and culture;
- Understand and appreciate future professional challenges relating to visualisation and technology;
- Discover and share new material in a particular branch of visualisation;
- Extend general and current knowledge in visualisation in support of design tasks.

Transferable skills

- Think critically, creatively and independently in relation to a topic provided each week;
- Demonstrate time-management skills;
- Demonstrate problem solving skills;
- Demonstrate independent learning skills;
- Participate in class discussions;
- Make productive links between theoretical ideas and practical phenomena;
- Demonstrate written and oral communication skills: to articulate arguments orally and through well-argued essay writing, supported by wide reading and research.

Study

Study time

Type	Required
Lectures	7 sessions of 1 hour (5%)
Practical classes	20 sessions of 1 hour (13%)
Private study	123 hours (82%)
Total	150 hours

Private study description

Prescribed reading and self-directed study for assessments.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time
1000-word Critical Review	40%	
1000 word Graphical Report	60%	

Feedback on assessment

Visualisations developed during the coding lab Verbal feedback provided in class and with class discussion.

Critical Review a) Written feedback provided to each student online via Tabula; b) Aggregate/general verbal feedback provided in class.

Graphical report a) Written feedback provided to each student online via Tabula; b) Aggregate/general verbal feedback provided in class. Labs Verbal feedback provided in situ in class in response to class discussion, findings and visualisations produced.

Visual Lab reports a) Written feedback provided to each student online via Tabula; b) Aggregate/general verbal feedback provided in class.

Availability

Courses

This module is Optional for:

- Year 2 of TIMS-L990 Postgraduate Big Data and Digital Futures
- Year 1 of TCSA-G5PA Postgraduate Taught Data Analytics
- TIMA-L99A Postgraduate Taught Digital Media and Culture
    - Year 1 of L99A Digital Media and Culture
    - Year 2 of L99A Digital Media and Culture
- Year 1 of TIMA-L99D Postgraduate Taught Urban Analytics and Visualisation

This module is Core option list A for:

- Year 1 of TPSS-C803 Postgraduate Taught Behavioural and Data Science

This module is Core option list C for:

- Year 1 of TPSS-C803 Postgraduate Taught Behavioural and Data Science

This module is Option list A for:

- Year 1 of TIMS-L990 Postgraduate Big Data and Digital Futures