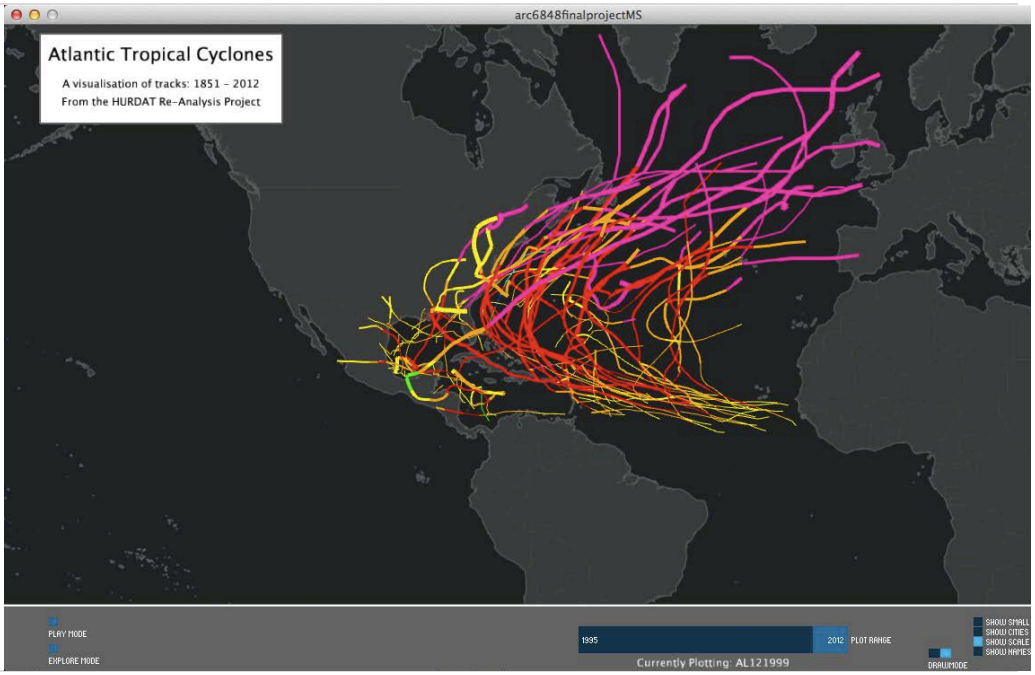
The University Of Sheffield.

School of Architecture

Module Handbook (2014/15)



Module ARC6848

Introduction to Computational Design

Semester 1

If you have any difficulty in accessing the information contained in this document, please contact:

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If you want to see me it is best to make an appointment.

The details in the handbook were correct at the time of going to press. However, the School cannot guarantee that minor details of the actual programme delivery won't differ slightly from those stated in this handbook. Learning and teaching hours are typical

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1. Module Introduction and Aims

Introduction to Computational Design provides students with a conceptual and practical introduction to the integration of data in the design process. Data is an important driver of design, and computational tools offer the most flexible and powerful means of analysing and communicating data. Students are introduced to a range of online data sources, to concepts of data visualization and to computational techniques for understanding data through visualization. The practical component of the module aims to equip students with the basic concepts and skills of scripting applied to data visualization, using short computer programmes that allow the designer to customize conventional design software or to create their own bespoke software tools.

The aims of this module are to:

A1 Introduce the basic concepts of computational design applied to data visualization.

A2 Develop knowledge and proficiency in working with a text-based (scripting) approach to the production of 2D geometry and interactive online applications.

A3 Develop basic familiarity with techniques for working with online data formats and common API's (application programming interfaces) for accessing live data streams.

A4 Enable students to develop their own conceptual framework for understanding the role of computational tools in the architectural design process.

A5 Introduce the principles of interactive visual representation relevant to data visualization.

A6 Introduce concepts of computational design in relation to data visualization.

A7 Introduce the fundamentals of web-based visual communication.

Option module, 15 Credits

Changes to modules since last session

The focus on information visualization will continue from the 2013/14 academic year. The module schedule has been adjusted to meet timetabling requirements, and there will be three projects rather than the four assigned in the previous year.

2. The Learning Approach

Typical notional hours spent in learning in this module									
Lecture	Seminar	Workshops	Independent Projects and Exercises	Laboratories	Field Work	Placement	Independent Learning	Other (includes supervised studio)	Total (credits x10)
8	3	10	109	-	-	-	20	-	150

The University of Sheffield conforms to the Higher Education convention that 10 credits = 100 notional learning hours, 15 credits = 150 hours, etc.

Lectures, Seminars and Workshops
Each class session will consist of a 60-minute Lecture; a 30-minute discussion of the week's assignment and related concepts (Seminar); and a 90-minute hands-on session to introduce specific techniques for working with data (Workshop).

Independent Projects and Exercises
Every two weeks an exercise is due which challenges students to implement concepts and techniques introduced in class while developing an independent project. The final assignment involves the development of a data visualization that critically presents and analyses a data source selected by the student. The assignments ask participants in the module to reflect on the role of visualization in critically evaluating and understanding the relevance of online data to a range of possible applications. The focus in the assignments this year will be representing movement and change over time.

- Exercise 1: **Understanding Data:** This assignment asks you to follow a series of steps outlined in class in order to come to an initial understanding of a dataset that is of personal interest to you. The emphasis in this assignment is on understanding data formats, documenting data, and presenting a particular point of view.

- Exercise 2: **Datapoints:** Taking the data collected in the previous assignment, you will build a visualization of this data in Processing. The visualization should highlight selected aspects of the data to present a specific interpretation of the topic you have selected for analysis.

- Exercise 3: **Mapping Time:** The goal in this exercise is to visualize change in a geo-located dataset over time. Your visualization should use animation and interactivity as tools for exploring and understanding your dataset, and should present a specific way of understanding the data in relation to change over time.

- **Final Assignment:** Your visualization should present a particular point of view that allows someone using the visualization to discover non-obvious answers to a range of questions that you define.

3. The Learning Outcomes

On successful completion of the module, students will be able to demonstrate the ability to:

LO1 Identify and evaluate online data sources based on relevance/reliability/accuracy (A3).

LO2 Use data visualization as a tool for critically communicating and analyzing data (A1, A2, A3).

LO3 Apply principles of parametric design in developing interactive data visualizations (A6).

LO4 Develop an individual conceptual framework for understanding the role of computational tools in the architectural/engineering design process (A4).

LO5 Master the basics of computational design as applied to data visualization and the creation of interactive data graphics (A1, A5).

4. Skills and employability

The knowledge and skills you are likely to gain from this module have the potential to be useful in a diverse range of situations that could be valuable to you in your career and that are likely to be useful and valued in graduate-level employment, including:

S1 The ability to effectively communicate using large, complex online data sources using visualization.

S2 The use of scripting to customize design software and to create bespoke online applications.

S3 The ability to identify and critically evaluate online data sources related to questions encountered in the architectural/engineering design process.

S4 The ability to use computational design concepts in the development of data visualizations that allow users to interactively explore information.

S5 The application of a design sensibility to the elegant communication of complex information.

5. Course content

Lecture 1: Concepts of Data Visualization

Workshop 1: Data formats; working with data in Excel

Lecture 2: Interacting with data sources on the web; sketching with code

Workshop 2: Introduction to the Processing environment: syntax, loops, logical operators, conditionals, functions, 2D geometry..

Lecture 3: Point of view in data visualization

Workshop 3: Working with 1D, 2D and 3+D arrays in Processing.

Lecture 4: Mapping: Introduction to visualizations of geographic data

Workshop 4: Geolocated data in Processing; data formats for live data feeds; working with API's.

Lecture 5: Interactivity and Animation

Workshop 5: Control P5 library in Processing; time-based visualization.

Lecture 6: Algorithmic approaches to data analysis and visualization

Workshop 6: Particle systems, agent-based modelling and physics simulation.

Lecture 7: Project-specific techniques for visualization

Workshop 7: Final Project tutorials

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6. Timetable

	week of	Lectures	workshops, reviews, deadlines	Online tutorials	assignments
November	17-11-2014	Concepts of Data Visualization	WORKSHOP: Data formats; working with data in Excel		1
	24-11-2014	Interacting with data sources on the web	WORKSHOP: Processing environment; functions, syntax, loops, logical operators, conditionals; 2D geometry.		2
December	01-12-2014	Point of view in data visualization	WORKSHOP: Working with loops and arrays in Processing		
	08-12-2014	Mapping: Introduction to visualization of geographic data	WORKSHOP: Geolocated data in Processing; data formats for live data feeds; working with API's		3
	15-12-2014	Interactivity and Animation	WORKSHOP: Control P5 library in Processing; time-based visualization		
	22-12-2014	CHRISTMAS BREAK			FINAL PROJECT
	29-12-2014	CHRISTMAS BREAK			
January	05-01-2014	CHRISTMAS BREAK			
	12-01-2014	CHRISTMAS BREAK			
	19-01-2014	Algorithmic approaches to data analysis and visualization	WORKSHOP: Particle systems, agent-based modelling and physics simulation		
	26-01-2014	Project-specific techniques for visualization	WORKSHOP: Final Project tutorials		
Feb	02-02-2012		Monday Feb 02: FINAL REVIEW, SUBMISSION DEADLINE		

7. Assessment Methods and Criteria

Proportions of assessment for this module						
Formal exam	Short (2 week) Exercises	Final Project	Web and in-class participation	Project (Includes design portfolio)	Other	Total (=100%)
-	50%	40%	10%	-	-	100%

Assessment criteria for assessed components
(linked to Learning Outcomes and Skills):

Mastery of technical skills (scripting): (LO1, LO3, LO5)	30%
Design quality: (LO2, S5)	10%
Clarity of communication and analysis: (LO2, S1)	40%
Conceptual clarity: (LO4, S5)	20%

Final Assessment Form

Student number:

Exercise:

Criterion		Mark (from fixed point MArch marking scale – see handbook)	mark x 0.3 or mark x 0.2
Mastery of technical skills	X%		
Design quality	X%		
Clarity of communication and analysis	X%		
Conceptual clarity	X%		
Total	100%	-	(mark)=

Written feedback

8. Plagiarism and Information Skills

The University takes **PLAGIARISM** very seriously.
“Plagiarism (either intentional or unintentional) is the using of ideas or work of another person (including experts and fellow or former students) and submitting them as your own. It is considered dishonest and unprofessional. Plagiarism may take the form of cutting and pasting, taking or closely paraphrasing ideas, passages, sections, sentences, paragraphs, drawings, graphs and other graphical material from books, articles, internet sites or any other source and submitting them for assessment without appropriate acknowledgement.” (The University of Sheffield Unfair Means Guide, 2010)

The basic principle underlying the preparation of any piece of academic work is that the work submitted must be your own original work. In addition to the examples given above, 'work' can be defined as data, statistics, tables, calculations, pictures, diagrams, charts, plans, maps, computerised data, computerised print out, ideas gained through group work, an essay plan or poem layout. (The University Library Information Skills Resource 2013)

Students are reminded that the Library provides a tutorial on plagiarism:
https://librarydevelopment.group.shef.ac.uk/shef-only/info_skills/plagiarism.html

There is also a suite of tutorials on information skills, including referencing which can be accessed from the Information Skills Resource home page:
https://librarydevelopment.group.shef.ac.uk/index.html

9. Academic support

Advice about **FEEDBACK**, including how to make the best use of the feedback you are offered, is available in the Feedback Handbook:
http://www.shef.ac.uk/architecture/study/your_learning

University guidance for students about the principles of **FEEDBACK** can be found here:
http://www.shef.ac.uk/polopoly_fs/1.281879!/file/ThePrinciplesofFeedbackStudentguidance.pdf

Support for **ACADEMIC SKILLS** is available from the Student Skills and Development Centre, 301 Glossop Road:
http://www.sheffield.ac.uk/ssid/301/services

10. Reading and Reference List

Information Visualization:

Bertin, J. (2010), *Semiology of Graphics: Diagrams, Networks, Maps,* ESRI Press.

Fry, B. (2008), *Visualizing Data: Exploring and Explaining Data with the Processing Environment,* O'Reilly Media.

Lima, M. (2011), *Visual Complexity: Mapping Patterns of Information,* Princeton Architectural Press.

McCandless, D. (2014), *Knowledge Is Beautiful: A Visual Miscellaneum of Compelling Information,* Harper Design.

Tufte, E. R. (1990), *Envisioning Information,* Graphics Press.

Tufte, E. R. (1997), *Visual Explanations: Images and Quantities, Evidence and Narrative,* Graphics Press.

Tufte, E. R. (2001), *The Visual Display of Quantitative Information,* 2nd edition, Graphics Press.

Tufte, E. R. (2006), *Beautiful Evidence,* Graphics Press.

Ware, C. (2012), *Information Visualization,* Third Edition: Perception for Design (Interactive Technologies), Morgan Kaufmann.

Yau, N. (2011), *Visualize This: The FlowingData Guide to Design, Visualization, and Statistics,* Wiley.

Computational Design and Processing:

Coates, P. (2010), *Programming.Architecture,* Routledge.

De Kestelier, X. & Peters, B. (2013), *Computation Works: The Building of Algorithmic Thought,* Paperback: 152 pages, John Wiley & Sons; 2 edition.

Reas, C. & Fry, B. (2014), *Processing: A Programming Handbook for Visual Designers and Artists,* The MIT Press.

Reas, C. & Fry, B. (2010), *Getting Started with Processing*, Maker Media, Inc.

Sakamoto, T., Ferré, A. & Kubo, M. (2008) *From Control to Design - Parametric/Algorithmic Architecture,* Paperback: 280 pages, Actar Publishers.

Shiffman, D. (2008), *Learning Processing: A Beginner's Guide to Programming Images, Animation, and Interaction (Morgan Kaufmann Series in Computer Graphics)*, Morgan Kaufmann.

Shiffman, D. (2012), *The Nature of Code: Simulating Natural Systems with Processing,* The Nature of Code.

Web-based resources:

Processing:
http://processing.org/ (download link, tutorials, documentation)
http://workshop.evolutionzone.com/
http://wiki.processing.org/w/Main_Page
http://www.flickr.com/groups/processing/
http://www.shiffman.net
http://www.openprocessing.org /
http://anar.ch/ (download link, tutorials, documentation)
tutorials by Guillaume Labelle on the Organicites web page
www.arch.udk-berlin.de/static/rationalsketching/

Java:
http://www.javaranch.com/campfire/StoryPoly.jsp
http://java.sun.com/docs/books/tutorial/java/concepts/

Computational design sites:
http://dataisnature.com/
http://www.materialsystems.org/
http://www.mediaarchitecture.org/
http://serialconsign.com/

Open Data:

http://opengovdata.io/ (Joshua Tauberer, (2012) Open Government Data)
http://www.theguardian.com/data (Guardian Data journalism)
http://studioopendata.wikispaces.com/ (studioOpenData)