EXAM PROJECT

In data visualization design 2023

In this project, you will create a data visualization prototype. Starting from a dataset that you collect: you produce an interactive visualization prototype and an academic report that describes your work and your process.

Key points:

- Normal groups: four to five students; small groups: one to three students.
- Use design approaches introduced during the course and include suitable evidence of this in your reporting.
- Develop static (that is; non-interactive) visualization design alternatives in code (three alternatives for normal groups).
- Create one interactive prototype in Altair that presents at least two separate visualization views.
- Produce a report that describes your process and the prototype (20-30 normal pages for normal groups).

GROUP COMPOSITION AND DIVISION OF WORK

Most of you work in groups of four to five students. You have been assigned to these groups in the first weeks of the semester. All students are expected to contribute to both artifacts, but you should identify and divide some aspects of your work into tasks and assign these to individual members of your team. The member assigned to a task is responsible for managing the design and reporting of that task, but other members can assist and comment on it. Thus, each student receives an individual grade (exam variation C1G).

However, a few students work in small groups of one to three students. For these students, some of the expectations scales with the number of students. The reduced expectations are indicated in the respective sections below. However, many aspects of the project work do not scale well. Thus, smaller groups should expect a higher workload, perhaps in trade for less coordination overhead.

THE PROJECT

The project tasks you with creating an interactive data visualization prototype that visualizes a data set that you have collected from your own lives.

It may be beneficial to consider who you are creating the visualization product for as the intended end-user or consumer of the information. You might Imagine that you are creating this for yourself, but perhaps other people might find interest in the data you have chosen to collect and visualize? No matter who you imagine might be using your product, you might benefit from gaining clarity about who will be using what you create. For example. to help you better scope the project and state your design goals, visualization tasks, or insights that you want to support. However, with the focus on personal data, you may also consider taking your project in a more creative, artistic, or expressive direction or perhaps take a critical design approach to it.

The project includes making decisions about the project focus and goals. It includes planning and collecting a data set, producing data visualization sketches at varying fidelities (such as pen and paper and Figma drawings), and preparing a final visualization prototype. Finally, it includes documenting your project work in an academic report. The exam submission therefore consists of two artifacts: The visualization prototype and a report that describes this and your process.

While you only submit one prototype, the report should ~~for example~~ include alternatives considered in the design process and reflections on the design process followed. For example, we expect that you have developed at least three alternative designs in code before creating one interactive design (smaller groups: at least two alternatives). We recommend you use Altair to develop these and note that it is ok that you went beyond our expectations of static visualizations, and, for example, have explored different interaction alternatives. You might describe how you considered which visualizations or interactions to include, potential alternative and incompatible interactions, analysis of inspirations, user test results, and any secondary information to show as part of your entire design.

We expect that you utilize and gain inspiration from the approaches introduced in the six design exercises in the course.

THE VISUALIZATION PROTOTYPE

The interactive data visualization is built in Altair or Vega/Vega-lite, plus potentially other technologies. You share this as part of the exam submission, either as:

- a Python programming notebook,

- a zip file that should be extracted and executed as a website from a local webserver (for example, running this from a command line: *python -m http.server*), or

- a URL that is accessible online.

In addition, you should attach a video that demonstrates the prototype that you created (up to five minutes).

While the prototype should be interactive, you should choose interaction that makes sense for the design. Thus, from a design perspective, the prototype should allow the user to meaningfully analyze the data. You might consider how the interaction facilitates the analysis goals. Remember that secondary information, such as text descriptions, labels, legends, or axes are important when putting the prototype together.

From a more technical perspective, the prototype should also demonstrate your skills and thus, that you satisfy the courses' learnings goals. At a minimum, the prototype should show two different charts with some type of interaction between them. For example, these Altair examples demonstrate such interaction between two charts:

- https://altair-viz.github.io/gallery/seattle_weather_interactive.html
- https://altair-viz.github.io/gallery/interactive_cross_highlight.html
- https://altair-viz.github.io/gallery/interactive_layered_crossfilter.html
- https://altair-viz.github.io/gallery/scatter_with_histogram.html

More complex possibilities might export your Altair work as html and juxtapose several charts that are interactively linked in a dashboard or scrollytelling piece with the use of additional Python or JavaScript libraries (for example, Streamlit or Scrollama.js). While we acknowledge these more complex possibilities, they will not on their own be reflected in the grading. However, they provide a level of freedom that may make it easier for you to design a convincing prototype.

Thus, while you need to show a minimum level of technical skills (for example, by creating interaction between two charts), you need to strike a sensible balance. Essentially, technical finesse and design elegancy needs to come together in your prototype.

REPORT
The report should be written in English and be between 20-30 standard pages, excluding figures and appendices. The lower bound is scaled for smaller groups of students (smaller groups: 5 pages per person). For example, a student working individually should hand in a report between 5-30 pages.

The report should clearly describe:

- The contributions of each group member.
- The data that you have worked with, including how you collected it and any pre-processing that you have done.
- The chosen design goals (and potentially, your full design brief as an appendix if you think that makes sense).
- The produced visualization prototype.
- The design principles and inspiration considered.
- The design process, as well as the ethical and societal issues of your work.

SUGGESTED OUTLINE
We suggest using the following outline:

- **Front page:** Remember to include the usual formal information on the frontpage of your report.
  In addition, we ask you to include a one-to-two sentence description of how to access your prototype. For example, "to access our prototype, please extract the attached zip file into an empty directory and start Jupyter notebook from this directory", or "to access our prototype, please visit http://dvd2023-group37.github.io".
  Finally, you are free to include an image on the front page.

- **Foreword:** This should clearly describe how each member contributed to the design project and to the writing. For example, you might indicate all the members that contributed to each section.
  This foreword is not counted towards your page limit. You might put this section before a table of contents (if you have one such).
- **Introduction:** This outlines your report and describes your project focus, including a brief description of the data that you collect, and the motivation for it.
- **Data set and collection:** This describes your data and your data collection approach, including potential alternative data sets and approaches considered.
- **Design goals and process:** This describes the process you followed in designing the visualization and the design goals that you defined, including reflections on both. Perhaps considering interaction made you revise some ideas? Perhaps prototyping made you realize something about the data that you had not previously noticed? You include sketches and screenshots from the process as appropriate.
- **Your prototype:** This describes the prototype that you built and for example, answers how it meets the design goals you defined. You should include screenshots from the final visualization prototype as appropriate.
- **Discussion:** This discusses your project and your product. You might for example reflect on what you were able to create versus what you intended to create, aspects of your design process, or challenges that you encountered. You may also reflect on possible data insights from the visualization product or possible other aspects of the real-world impact of your design in the world. You might also reflect on what the design offers, how it might be used, and what insights might be had from using it. You can also discuss what would have been interesting to do if you had more time/resources, the advantages/disadvantages of the visualizations, and your main insights from doing the project. For example, what you learned or what you need to learn more about.
- **Conclusion:** This summarizes your main points and responds to what you stated in the introduction. For example, you might respond to how you addressed the focus and motivation for the project.

You should cite literature appropriately and to a sensible extent, including the course syllabus. We expect that strong reports will include at least ten appropriate citations (smaller groups: three per person). Appropriate use of literature includes (but is not limited to) explaining or arguing for your design choices, the design process you followed, and the results that you achieved (see also the section *Evaluating your work*). Most importantly, citations should be *used* for something! Think about how you use them well. Thus, it is ok to include multiple citations to the course book if they reference different points in the book (please provide the page number in book citations).

For example, citations in a section on design goals and process might use concepts introduced in the course to describe or argue for your decisions. Citations in a section on your prototype might use concepts to explain how your prototype behaves. Finally, citations in a discussion might reflect on your design choices and your results in relation to existing theory and knowledge.

EVALUATING YOUR WORK

We will evaluate your work based on the learning goals (ILOs). We will evaluate your work according to several aspects: how you informed your work from design process recommendations and visualization design principles; the designs you created; and the efficiency with which you communicate these in written and visual products. The table on the following page shows a breakdown of the rubrics we use to evaluate your work.

DESIGN PROCESS

We hope to see projects that follow design processes discussed in the course (or similar – explain and argue), design decisions that are clearly aligned with that process, and reflections on design trade-offs and how your process navigated you towards your decision.

	Design Process	Design Principles	Implementation	Style of Report	Visuals
Excellent	You followed design processes discussed in the course (or similar – that you explain and argue for) and your design decisions are clearly aligned with that process. You reflect on design trade-offs and how your process navigated you towards your decision	Your design shows significant evidence that they were supported by research or design principles, e.g., by citing papers and topics you learned in the course. Your terminology is precise and correct	Your visualization is interactive and functional. It may be extremely creative/ambitious but slightly buggy. It may also have polished, bug-free interactions but not as creative/ambitious as the top prototypes	Both style and tone are very strong, but a reader would be able to differentiate between your work and that of a company. For example, this could be because of grammatical issues, unclear pacing, etc.	Visuals clearly shows the design process and aligns with the design decisions made. They may not completely capture interaction or may not be of professional quality
Good	You mostly followed a design process, but the level of reflection leaves something to be desired. You may be writing summaries more than reflection. Important aspects of your design may be glossed over or important steps in the design process appear rushed	Your writing contains evidence that your decisions are aligned with existing principles, but your terminology may be imprecise. You may be missing some key concepts or some of your references may be incorrect	Your visualization is functional with some small bugs. While most of the interactions make sense, some lead to confusing user experience	Style and tone were pitched correctly, but there are areas of improvement - there may be a section of the writing that could use a subheading, or key points emphasized. Writing may be too casual or too formal. Visuals may be distracting	There are visuals in the document, but it may not align with your writing. There may be a disconnect between the evidence you show and your decisions. An aspect of the design process may have been addressed inadequately
Developing	A significant component of your reflection may be missing. It may read like a summary rather than a reflection. The length is likely too short with little structure that reflects the design process	Your writing refers to a couple of design principles, but largely lacks precision and citations (links)	Your visualization is limited. The scope of your project was defined in such a way that this should have been completed	Writing or structure does not work well in some respects. The writing might be incoherent, or the specified structure might not be used well. In addition, there are likely clarity issues, either due to writing content or style	Critical components of your design process are lacking evidence. From looking at the pictures in the document, it is very difficult to discern how your design progressed
Lacking	Writing is incomplete. Little to no reflection of the design process	There is little to no evidence that the readings/lectures have been incorporated into this assignment. At best, there are loose references	While there is evidence of progress towards a visualization, there is nothing to interact with	The reporting structure was not used and there are likely issues in how figures are included and referenced	Very little evidence. The images that are there do not demonstrate a connection to the design process
Missing	No reflection	No design principles referenced	There is little to no evidence of work on this project	No style to judge. Perhaps not submitted as a pdf	No documentation of the design process to explain your decisions

How to interpret the rubrics: By the end of the term, it is our goal for you to be consistently achieving the Excellent row in the rubric.

	Design Process	Design Principles	Implementation	Style of Report	Visuals
Expert **(Exceeding expectations for the course)**	You clearly reflect on each significant step of the design processes discussed in the course that is relevant to this project. They are in alignment with both your goals and with your decisions. Your description is indistinguishable from that written by a vis researcher, and the depth of reflection demonstrates mastery over the design space	You have supported each decision you made by research or design principles discussed in lectures or readings. Those principles are clearly articulated, use precise terminology, and properly cite their original source. Your decisions are supported to a degree passing peer review at top publication venues	Interacting with your visualization is virtually indistinguishable from interacting with a polished product. Your design is not just functional, but also ambitious and creative	Your writing is professional in quality. Your document exemplifies a tone and visual style that makes it indistinguishable from highly visible authors and companies	Visual evidence clearly shows the design process and aligns with the design decisions made. All visuals are extremely high quality

DESIGN PRINCIPLES

We hope to see significant evidence that your designs are supported by research or design principles, for example, by citing papers and topics you learned in the course, and that you use precise and correct terminology.

IMPLEMENTATION

We hope to see visualization prototypes that appear coherent and includes interactive aspects. The projects may be extremely creative/ambitious but slightly rough around the edges or they may be very polished but not as creative/ambitious.

STYLE OF REPORT

We hope to see reports in which both style and tone are very strong, but a reader would be able to differentiate between your work and that of a company or academic publication. For example, this could be because of grammatical issues, unclear pacing, etc.

As an academic text, the report should include references. In addition to the course textbook, syllabus, and other academic text, the references might include existing designs, projects, artworks, and journalistic pieces.

VISUALS

We hope to see use of visuals that nicely capture your interactive visualization designs and that clearly shows the design process and aligns with the design decisions made (in the report).

APPENDICES

DATA SET

You collect your own data set to work with in your project. If It Is relevant for your project, you might also rely on additional contextual data from other sources. It is important that you have the data available when you start the project. If not, you jeopardize your project success – see for example Sedlmair et al 2012 for arguments.

CHOOSING WHICH DATA TO COLLECT (ALSO COMMUNICATED EARLIER IN THE COURSE)

There are several aspects to consider when choosing the data to collect.

The most important seems to be the level of personal information collected and how you might feel about sharing it. On the one hand, you could collect something quite non-sensitive, such as the number of steps you have walked over a week. While this is likely not sensitive information to you, it is likely also not that interesting. On the other hand, you could collect something super-sensitive, such as your emotional state over a week. While this is likely super interesting to explore, it is likely also super sensitive.

Another aspect to consider is the temporal resolution and extent. Will you collect the number of yawns per minute or per week, and over how many weeks? Having discussed time, location is another interesting aspect. Staying with yawning, where are you yawning?

Since the exam project is a group project, you will share this data with other group members in addition to internal and external examiners. Thus, it is important to consider the how you would feel about sharing your data with these people and of course, to decide on collecting data that you all find interesting and doable.

Thus, you need to identify a data focus that speaks to the entire group and that the entire group feels happy and confident about. Groups in which some members are more interested in or have more knowledge about the data have in the past been more likely to run into collaboration issues. While this is less likely for data about yourself, it is not impossible to imagine this happening. For example, if a group were to collect and visualize data about their concert experiences and one member had been to ten times as many concerts as any other member, then this might be a red flag.

PRACTICAL DATA ASPECTS

The size and complexity of the data set is important. We started the course by an activity to sketch two numbers (73 and 35). While you could think of visualizations of just those two numbers, you likely need something bigger. To evaluate whether your data set is too small, you might consider whether it is so small that it gets difficult for you to show that you master and demonstrate the course ILOs.

On the other hand, it is also important to work with a data set that is not too big or too complex, to reduce the risk that you will be overwhelmed by its size and/or

complexity. Thus, decide on a data set that can comfortably be worked on in common tools and by all members of the project team. A common pitfall of a too big data set is that your main task diverges towards thinking about how you can enable people to filter your data set across a range of dimensions to arrive at a useful visualization. We would rather that you work on data sets where each data point can be represented as a mark, than a data set where you are only able to show aggregate values.

Finally, when you start to work on the data, consider what values are actually visualized. Considering the point of aggregate values above, one could argue that it would be the values of an aggregate data set that were visualized and not the raw values. Thus, it is important to consider and to describe both the source data (before pre-processing) and the data that is visualized (after potential pre-processing).

COURSE INTENDED LEARNING OUTCOMES (ILOS)

In doing the project work and reporting on it, we strongly advise you to consider the intended learning outcomes of the course (see the information box and/or official course description). The exam submission should show your mastery of these. Thus, you may use them to help focus and prioritize the tasks in the project.

INTENDED LEARNING OUTCOMES

After the course, the student should be able to:

- Sketch novel data visualization designs and build interactive visualization prototypes.
- Explain fundamental theories and design principles in data visualization, apply them in a design process, and reflect on these
- Interpret, deconstruct, and critique data visualizations.
- Reflect on the ethical and societal implications of data visualization.

We have designed the project such that it should guide you towards showing mastery of the ILOs. For example, we think the advice above, such as the points about size and complexity of data sets as well as the design brief and feedback you have received on this should help you do so.

DEADLINES AND FEEDBACK

The last part of the course focuses on the exam project. We integrate one to two means of feedback throughout before the exam submission.

PROJECT BRIEF

You were asked to submit a project brief on Friday March 3. You received feedback in the following week and some of you received suggestions for improvement and an additional change at submitting your brief for feedback.

EXERCISE EXHIBITION AND EVALUATION

The teaching team discusses the possibility for using the exercise on April 28 for a structured exhibition based on heuristic evaluation. More Info later.

EXAM SUBMISSION

Deadline for exam submission May 17 14:00 CET.