Information Visualization

Final Project INFOMVIS

Utrecht University   **Period 2 | 2025/2026**

Visualization and Graphics Group
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Submission deadline:
Thu, 22.01.2026, 23:59.

Final Project Assignment
Sheet (100 points)
--Decision making with Visualization—
21.11.2025 – 23.01.2026

Project Description:

Your task is to develop a web-based visualization tool for the Naturvation Atlas. Your interface should support decision-making related to urban sustainability and nature-based solutions (NbS). The tool will enable users to make informed choices based on data-driven insights about urban ecosystems, green spaces, and NbS interventions, helping to evaluate and select the most suitable solutions for urban contexts.

Key Features:

1. **Support for Decision-Making Stages:**
    *   INTELLIGENCE (Data Exploration): Enable users to explore data on urban ecosystems and NbS, identifying relevant alternatives and criteria.

- CHOICE (Evaluation and Selection): Users can assess NbS alternatives (e.g., green roofs, urban parks) based on factors like cost, environmental impact, and resilience.
- OPTIONAL: DESIGN Stage: Users may design or model specific NbS interventions, simulating impacts like urban cooling or water retention.

2. **Transparency of Decision Elements:**
   - Clearly display Alternatives (NbS options), Criteria (e.g., environmental, economic, social), and Preferences (user-defined priorities such as biodiversity over cost).
3. **Dynamic Interaction:**
   - Allow users to modify, add, and adjust decision elements dynamically, such as criteria weights or alternative options, ensuring flexibility in the decision process.
4. **Coordinated Visualizations:**
   - Provide interactive visualizations, such as maps, graphs, and dashboards, to compare alternatives and display trade-offs. Include scenario simulations if applicable to the DESIGN stage.
5. **User-Centered Design:**
   - Focus on different user roles (e.g., urban planners, policymakers) with customizable features and an intuitive interface. Justify design decisions by demonstrating how the system aids in making well-informed decisions.

Required Readings:

- Naturvation Atlas Overview: Familiarize yourself with the Naturvation Atlas to understand the data and tools used for NbS in urban settings.
- Case Study: Review "Applying the Naturvation Atlas for Decision-Making" to understand how the Atlas has been applied in real-world decision-making.
- Critical Reflection on Existing Tools: Read "A Reflection on Existing Decision Support Tools for Urban Sustainability" to analyze strengths and gaps in current urban sustainability tools.

Deliverables:

- Functional Prototype: A web-based tool supporting urban sustainability decision-making.
- Use Case Scenarios: Structured scenarios describing how different personas interact with the tool.
- Design Justification: A detailed explanation of how the tool supports decision-making for NbS.

By focusing on these features, the tool will enhance decision-making for nature-based solutions, promoting sustainable, resilient cities.

General Information / Project Overview

- **Teams:** Teams of 3-4 students will work together, with grading based on collaborative contributions. Individual submissions may be accepted in special cases (form your team on the link).

- **Mentorship:** We will assist with guidance during lab sessions and through on-demand office hours.

- **Dataset:** The dataset can be accessed via Brightspace under Home --> Content --> Practical Assignment --> Practical Assignment --> nbs-xls-export 20251119.xlsx.
  Do not upload the dataset to public repositories. Based on our license agreement, it can only be used and shared within the scope of this course.

- **Design & Implementation:** Follow Munzner's Nested Process Model (also discussed in second week theory class) for understanding the decision making domain, selecting data modifications, visual encodings, visualizations, and interactive components to support informed decision making. Implement your system using HTML, CSS, JavaScript, and D3.

- **Deliverables:** Submit code, a README file, and present your results during the final project presentation session (more details on deliverables are provided below).

- **Deadlines:** A mandatory feedback session with your peers will be held on Friday, 12.12.2025. The final project submission is due on Thursday, 22.01.2026 at 23:59. There will be a final presentation session in class on Friday, 23.01.2026, where you will showcase your solution in person in a roughly [15-minute presentation + 5-minute Q&A session]. [We have 10 groups in total. Unless we get an extended reservation for the room that day, we will only have 105 minutes of class time. That means we can allocate at most 10 minutes per group. I think we will need to extend the reservation if possible.]

- **Points:** The project can earn a maximum of 100 points, with up to 10 extra points awarded for exceptional contributions.

- **Grading:** Grades will be converted into the UU grading scheme (linear mapping), with the project contributing 60% to the final course grade.

Project Tasks

There will be no separate grading for Phase 1 and Phase 2. All work (including Phase 1 and Phase 2) will be graded after the final presentation on 23.01.2026. Phase 1 is intended to provide feedback, serve as an intermediary sanity check, and help you plan your project development on time.

Phase 1 (21.11.2025 – 12.12.2025)

Task 1: Team Setup (0 points)

- Form a team of **3-4 students a**nd get yourself ready to work together. **(Deadline: Friday 21.11.2025 23:59; Assign yourself to groups in BrightSpace -> Groups)**
- Setup a https://git.science.uu.nl (or GitHub) project to share code between you, your team-mates, and the mentors. Setup a shared document store (e.g., for photos of hand-drawn sketches/prototypes)
- Optional: Make agreements to work with conventional commits, develop a scrum board, outline a rough timeline, install a linter, use your own experiences and best-practices.

Task 2: Persona Selection and Data Preparation and Interface Design for Persona's Task (5 + 5 + 5 + 5 points = 20 points)

1. **Persona Selection (0 points):** Select your persona (Real Estate Developer, Architect/Designer, Scientist, Policy Maker) and analyze the dataset and describe your the persona and their possible use of the dataset.

2. **Data Wrangling (5 points):** The data should be cleaned as much as possible after this point. For convenience, this process step can happen in the programming language of your choice. Upload your data wrangling code as part of your code submission.

3. **Data Understanding (5 points):** Understand your data and its complexity. For this step it may be beneficial to use a data visualization tool of your choice, e.g., Tableau, Spotfire, MS PowerBI. Upload screenshots of this step as part of your submission.

4. **Sketches (5 points):** Each team member should create at least three visualization sketch alternatives for one of the data aspects. Upload photos of sketches as part of your final project submission.

5. **Interface Design (5 points):** As a team, you will then decide which of these visualization sketches and construct a plan how all of those visualizations together support a particular decision making problem. Finally, you will create an initial interface design supporting the decision making problem. Please note, we expect you to have at least one novel visualization in your final implementation (anything beyond you implemented in lab sessions). Check the "Technical Requirements" in the grading rubric for details. Submit also a photo

of your interface with interaction specifications, depicting the planned website design, as part of your submission.

Task 3: Evaluation (10 points)

You will prove that you are capable of conducting informal user-tests to evaluate your design.

1. **Think-Aloud study (10 points):** Prepare your sketches/mockups/wireframes, and interaction design together with a set of questions to test how your interface and interaction design support the persona of your choice in their task. Conduct a think-aloud study with two or more people from another team during the feedback session on 12.12.2025. Document the results of the study and use them to make improvements to your prototype for your final submission. Upload photos of your notes, transcripts, or similar materials as part of your final submission.

For this task it is mandatory that the full group will be physically present.

Phase 2 (12.12.2025 – 23.01.2026)

Task 4: A web-based visualization tool for the Naturvation Atlas that supports decision-making implementation (10 + 20 + 10 + 10 = 50 points)

You will implement a functional web-based decision making interface following these technical requirements:

1. **Two distinct standard visualizations (10 points):** Your interface should feature at least two standard visualizations, e.g., bar chart, line chart, area chart that contribute to the decision making problem at hand. You may reuse and adapt code from the labs/homeworks.

2. **One interactive map (20 points):** This view will be the main point of interaction, where your persona will explore different nature-based solutions around the world to gain insight into the range of possible solutions.

3. **Coordinated/Linked Views (10 points):** Connect the visualizations for an interactive exploration experience.

4. **Interactions (10 points):** Add further interactions, such as filtering, highlighting, details-on-demand, to support the decision making task.

You will submit your fully functional code along with a README.md giving an overview of what you are handing in and how to get your code running.

Task 5: Presentation and Design Critique (20 points)

You will demonstrate that you are able to support a particular decision-making problem of your persona of choice and are capable of defending your visualization choices. One word regarding expectation management: The presentation quality should be sufficient for us to clearly understand what you have done. We do not expect a commercial-

grade pitch, but rather a logically structured and well-explained presentation with a strong focus on lessons learned and clear links to the lecture material and study concepts.

In-Class Presentation (20 points)

Deliver an approximately **20-minute in-class presentation (15 + 5 Q&A)**. Your presentation must address the following mandatory points:

- **Explain WHAT you implemented**
  (e.g., visual encodings, interactions, website layout, data processing steps, design critique).

- **Justify your design decisions**
  (WHY each choice was made, how it supports decision making, alternatives you considered, and insights gained from user feedback).

- **Demonstrate the Decision-Making Flow**
  Walk through a realistic use case that shows how a decision maker would use your interface and how your system supports making informed decisions.

Bonus Points: Exceptional Work! (10 points)

You have the chance to earn extra points that can be used to reach the 100 point maximum for this practical assignment and make up for otherwise deducted points. The category serves the purpose to value contributions beyond the outlined and described (Task 1-5) requirements. Surprise us! Examples qualifying here are (only for illustration purposes, partial points possible, max 10 points can be given for several contributions)

- Extension of the existing dataset with publishable quality with description.
- Exceptional visualizations from a technical point of view.
- Elaborate user study executed (beyond what is done in the classroom with peers).

Deliverables: What to submit and where.

At the end of the final project, your team will submit the following items in a single .zip file on Brightspace:
- **Data:** Submit the cleaned data with your extension (if applicable) that you used in your project. If the data is too large to upload contact us.
- **Process and Evaluation Documentation:** A document that describe the think-aloud session that you conducted with your peers (i.e., the task the participants executed, observations and feedback, lesson learned)
- **Tableau Packaged Workbook (.twbx) file (or files from another data exploration software or screenshots if there is not available file format from the software):** A package of files that includes your data source file, the Tableau workbook (.twb), and any other files used to produce the workbook (including images).
- **Code:** All web site files and libraries assuming they are not too big to include.
- **Final Project Presentation:** An approximately **20-minute (15 + 5 Q&A) in-class presentation** focused on the decision-support aspects of your system, including any non-obvious features of your interface (for more details, refer to "Task 5: **Presentation and Design Critique (20 points)**" the description above). Your presentation should clearly highlight how your design supports decision making and demonstrate the key interactions and visual encodings that enable this.
- **README:** The README file must give an overview of what you are handing in:
    - which parts are your code, which parts are libraries, and so on.
    - How to start your code (any specifics?);
    - The README must list your team member names.
    - An abstract/intro which can be used to distribute successful projects in the Naturevation Atlas Community
- **Teaser image:** Should show your tool or cool feature.

```
my-project_yourname1_name2_name3_name4/
|-- data/
|-- code/
|   |-- webapp/
|   |-- data wrangling scripts/
|-- documentation/
|   |-- data understanding/
|   |-- sketches/
|   |-- interface design/
|   |-- evaluation/
README.md
Teaser image
```

Grading Rubric: How to gain and lose points.

When grading the final projects, we will evaluate the following properties:

- Completeness
  - Submission of all required files, including README.md.
  - Follows the outlined folder structure.
  - Final project video exists.
  - Complete and cleaned data submitted.
  - At least 3 sketches per team member of visualizations.
  - An external software or dashboard used for data understanding.
  - Good interface sketch for your decision making problem, including the showcase of interactions supporting decision making.

- Effectiveness of Visualization and Interaction Designs:
  - Proper use of colors.
  - Effective charts and visual encodings.
  - Useful interactions for the visualizations.
  - Follows the design guidelines and principles you learned in theory classes.

- Technical Requirements
  - Implemented two standard visualizations.
  - Implement a map (potentially with extensions, e.g., climate zones)
  - Implemented multiple coordinated (linked) views.
  - Implemented at least one innovative visualization that is either
    - an extension of an existing visualization type, or
    - a novel visualization type.
  - Your final website should be robust, reliable, and polished.

- Decision Support:
  - Clear titles, labels, and captions to guide decision makers in their particular decision making problem.
  - Visualizations and interactions should enable users to get insights on data to support their informed decisions.

- Test:
  - Complete think-aloud study notes by your team.
  - The main findings and comments of your think-aloud study are well documented in your notes. Deliver photos/screenshots to document this step.
  - Mention ideas on how to improve your final project to address the comments.

- Final Presentation:
  - Needs to be in specified time limits, roughly ~20 minutes (15 + 5 Q&A).
  - It should present your decision making problem and interactive visualization solution to it.