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A 3x3 grid of colored squares. The center square is highlighted with blue radiating lines. The colors of the squares are: top row (red, orange, yellow), middle row (green, blue, red), and bottom row (yellow, green, red).


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1001	1011
1011	1001
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Analysis of visual variables

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Introduction to visual variables

Deconstruct a visualization

Create visualization variations

Apply visual variables

Introduction to InfoVis

WHAT

Input: lecture slides that follow the what-why-how approach

Output: foundations about information visualization principles and techniques

WHY

Remember / Facutal

WHO

whole course (graduate level)

WHERE

Online & Offline

TIME

approx. 180 min

HOW

Basic InfoVis terminology and important key concepts of an information visualization are introduced. The lecture follows the what-why-how approach and covers data types and attributes, typical visualization tasks, a brief introduction to marks, channels, visualization and interaction types, and important visualization tools and frameworks.

Team Building

WHAT

Input: icebreaker template and different skills categorized by colored dots

Output: interdisciplinary teams of 2-3 students

WHY

Understand / Meta-cognitive

WHO

whole group(graduate level)

WHERE

Online

TIME

10 min

HOW

Participants get acquainted by forming small teams of 2-3 students with different interdisciplinary backgrounds. An introductory activity involves a quick construction of an avatar using a miro icebreaker template to create an online representative. The participants are asked to stick colored dots on their avatar to assess and indicate their background knowledge (e.g. design disciplines, programming skills)

Data Abstraction

WHAT

Input: worksheets in the miro board that document the identified data structures, types, and web source.

Output: an analyzed data with data structures and attributes types

WHY

Apply / Conceptual

WHO

team (2-3 members)

WHERE

Online & Offline

TIME

homework

HOW

Each team searches for interesting data sets they would like to visualize during the semester project and websites with freely usable data sets are provided by the advisor. The team should analyze their data sets and by assigning attribute types (e.g., nominal, ordinal) and by identifying data structures such as temporal or spatial structures.

Search visualization example

WHAT

Input: blogs and websites with visualization examples as inspiration

Output: two different visualizations per team member

WHY

Evaluate / Meta-cognitive

WHO

Individual(graduate level)

WHERE

Online

TIME

homework

HOW

Based on the identified data structures and tasks, students are asked to search for visualization examples that serve as personal inspiration for their project. The activity is performed by each team member individually as homework and the advisor provides different visualization online collections and websites.

Creation of visualization sheet

WHAT **Input:** visualization examples and worksheet with WHAT-WHY-HOW structure

Output: visualization sheet

WHY Apply / Conceptual

WHO Individual(graduate level)

WHERE Online & Offline

TIME homework (approx. 20 min)

HOW The student is asked to fill out the worksheet to describe the chosen visualization in his/her own words. This worksheet included the data structures and types (WHAT), the task that can be solved with the visualization (WHY) and the description of the visualization and interaction technique (HOW). Furthermore a link to the original source of the visualization and a screenshot is required.

Introduction to construction kit

WHAT

Input: explanation of the construction kit structure and visualization examples

Output: collectively deconstructed visualization examples

WHY

Understand / Conceptual

WHO

Group (graduate level)

WHERE

Online & Offline

TIME

30 min

HOW

The structure of the construction kit is explained in a short presentation. Afterwards some examples are deconstructed by asking the students for building blocks used in this visualization. Feedback is given by the advisor to practice the deconstructing process.

Reverse-Engineering

WHAT

Input: visualization sheet and construction kit templates

Output: pattern with building blocks

WHY

Analyze / Conceptual

WHO

Individual(graduate level)

WHERE

Online & Offline

TIME

10 min

HOW

The students are asked to deconstruct their visualization sheet example using the building blocks of the construction kit.

Morphological Analysis

WHAT

Input: template with combination table and deconstructed pattern with building blocks

Output: different variations as sketches

WHY

Analyze / Procedural

WHO

Individual(graduate level)

WHERE

Online & Offline

TIME

homework (approx. 40 min)

HOW

The design space is explored systematically by combining different building blocks in a combination table and sketching a quick solution for each combination.

Selection of three solutions

WHAT

Input: various sketches with visualization ideas

Output: three favorite solutions

WHY

Evaluate / Procedural

WHO

Individual(graduate level)

WHERE

Online & Offline

TIME

15 min

HOW

Each student selects three promising solutions. The decision for which sketch is best is obtained by re-evaluating the data and task types and judging which solutions fits best to the given problem.

Pattern creation

WHAT **Input:** selected solution of the sketching task

Output: idea described with building blocks, sketch, data and task type in a pattern template

WHY Understand / Procedural

WHO Individual(graduate level)

WHERE Online & Offline

TIME 15 min

HOW An empty pattern template is filled out with name, building blocks, suitable data structure and task to describe the visualization idea.

Fusion to construction plan

WHAT **Input:** three patterns of each group member

WHY Create / Procedural

WHERE Online & Offline

HOW The created patterns are discussed in the team and promising solutions are fused to an interface concept. The concept is described as construction plan using the pattern templates and connectors.

Output: a visualization idea presented as a sketch and as a construction plan

WHO Group(team)

TIME homework (approx. 30 min)

Introduction to visual variables

WHAT

Input: introduction slides to explain the efficiency and limitations of visual variables

Output: examples that show the application of different visual variables and discussion about their limitations

WHY

Remember / Factual

WHO

whole group (graduate level)

WHERE

Online & Offline

TIME

approx. 45 min

HOW

A short introduction on visual encodings and their limitations and their ranking for different data types are explained. An focus is on the application and pitfalls of color and various tools are presented to support the color selection.

Analysis of visual variables

WHAT

Input: template with the ranking of visual variables

Output: identified visual variables that is used already in the visualization sketch

WHY

Analyze / Procedural

WHO

Individual(graduate level)

WHERE

Online & Offline

TIME

approx. 15 min

HOW

Since the concept developed in the previous activities has only been described as a rough sketch, only some visual variables are “occupied” already by the chosen layout structure, such as position or size.
The aim of the next activity is to consequently analyze the concept and identify the visual variables.

Visual variables sketches

WHAT

Input: template with visual variables and their ranking

Output: sketches that apply different visual variables and a range of solution for further discussion

WHY

Create / Procedural

WHO

Individual(graduate level)

WHERE

Online & Offline

TIME

approx. 30 min

HOW

The students are asked to apply further visual variables through a quick sketch. The activity includes the judgement of which visual variables are most suitable for their concept and the revised concept, which includes the final design decisions on the visual variables.

Develop prototype

WHAT

Input: a list of possible visualization tools

Output: an interactive prototype

WHY

Create / Procedural

WHO

Team (graduate level)

WHERE

Online

TIME

homework

HOW

Each team develops their concept with a tool of their choice.

Document project

WHAT

Input: intermediate steps from the miro board, screenshots, prototype

Output: a documentation that presents the design process and explains design decisions

WHY

Evaluate / Meta-cognitive

WHO

Team (graduate level)

WHERE

Online & Offline

TIME

homework

HOW

The students are asked to document their project by using the intermediate steps from the miro board. In this learning activity, personal design decisions must be justified and explained.