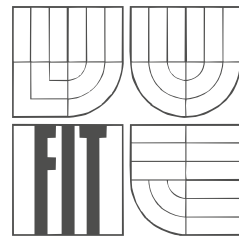


Automatic Evaluation of Information Dashboard Usability

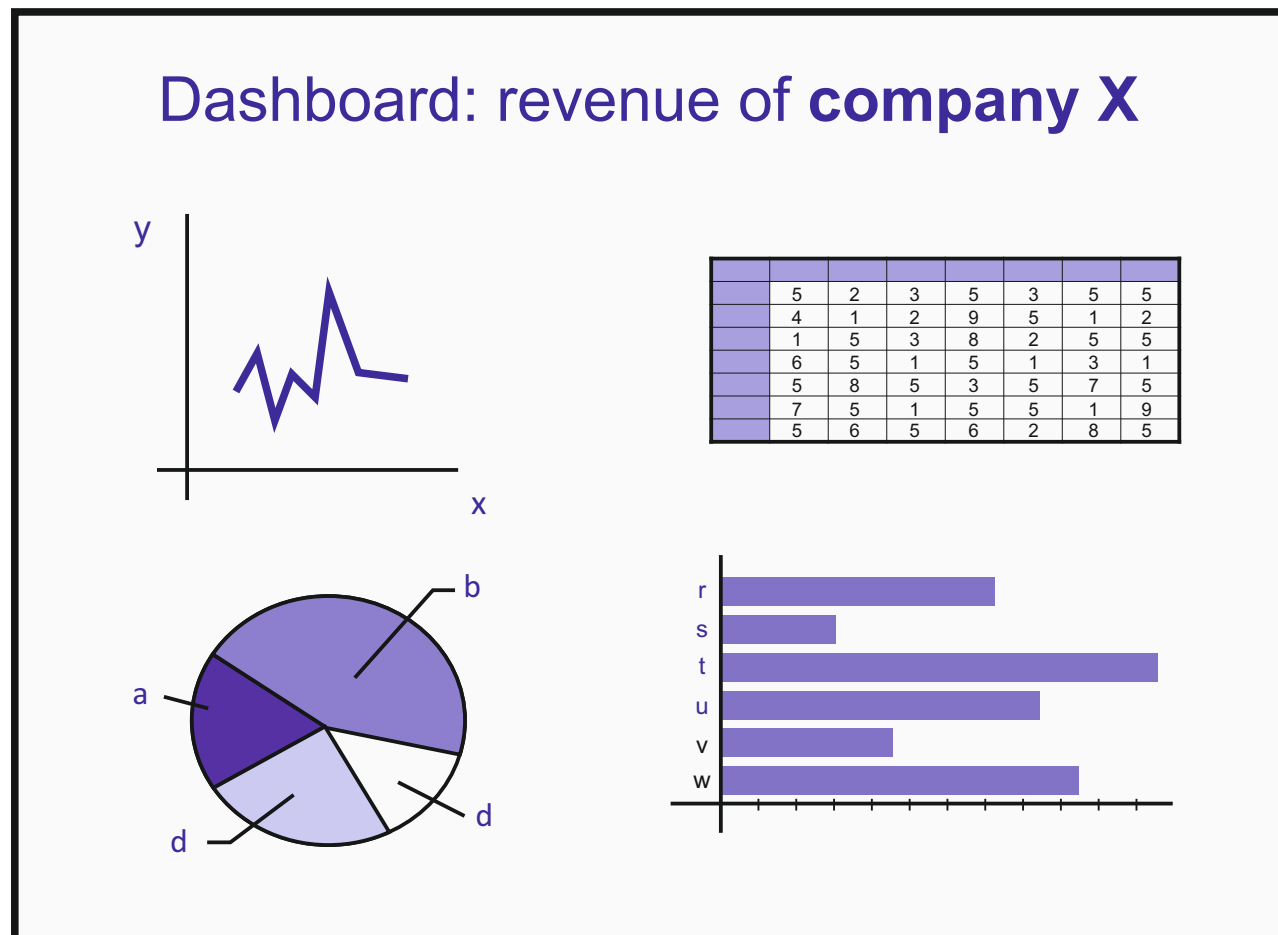
Jiří Hynek, Tomáš Hruška

Brno University of Technology
Faculty of Information Technology
Czech Republic



Information dashboard

- We want graphically **present some information** on a single screen.



charts
tables
statistics

...

Dashboard definition

*A dashboard is **a visual display** of **the most important** information needed to achieve one or more objectives; consolidated and arranged on **a single screen** so the information can be monitored **at a glance**.*

[Stephen Few]

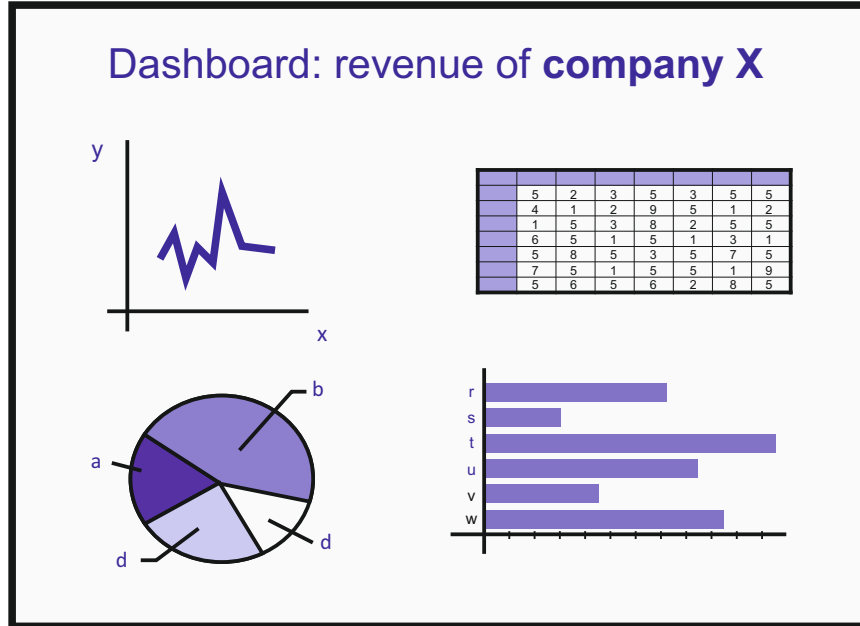
Let's ask Google...

The image shows a Google search for "dashboard". The search results include several thumbnail images of various dashboards. One prominent result is for "Project Dashboard - Project Manager.com", which is a screenshot of a web application. This dashboard features a navigation menu, a "Sign up NOW" button, and several data visualization components: a "Health" table with columns for Project, Time, Cost, Resource, Progress, and Efficiency; a "Cost" bar chart comparing actual, planned, and baseline costs; and several other charts including pie charts and scatter plots. Below the main dashboard image, there is a search result snippet with the text "Project Dashboard - Project Manage...", the URL "www.projectmanager.com - 920 x 576 - Vyhledávání pomocí obrázku", and a description: "This stylish dashboard gives you a graphical view of the status of your ...". There are also buttons for "Navštívit stránku" and "Zobrazit obrázek". At the bottom of the search results, there is a note: "Na obrázky se mohou vztahovat autorská práva. - Odeslat názor".

- *Are those results really dashboards?*

Core of the problem

- Is the dashboard **usable**?



- *simplicity, comprehensibility, few errors, easy to learn, ...*

usability models - [Jakob Nielsen: Usability Engineering]

- **subjective - depends on users**

Usability Evaluation

1. see

how user will react

- + easy to perform
- time
- expenses
- ethical code
- right sample

2. predict

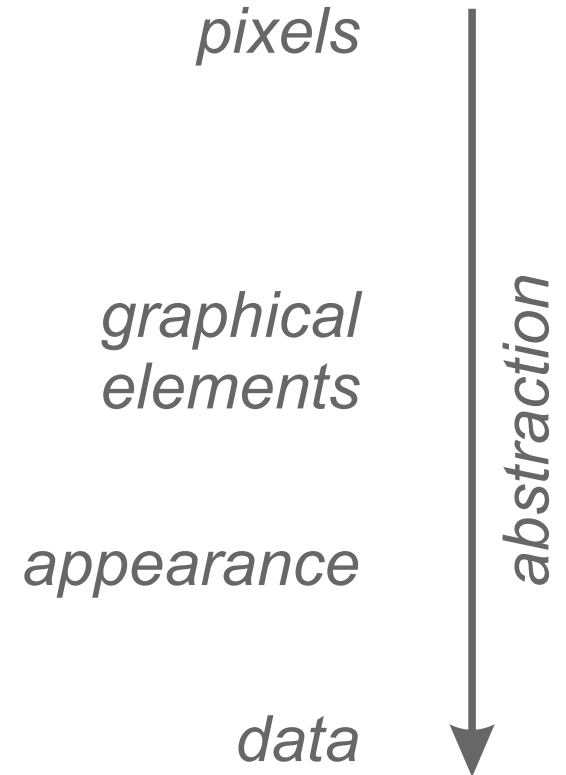
how user would react

- + no users needed
- + automation
- + cheap, quick
- difficult to perform

Our approach

1. Consider dashboard in different perspectives.

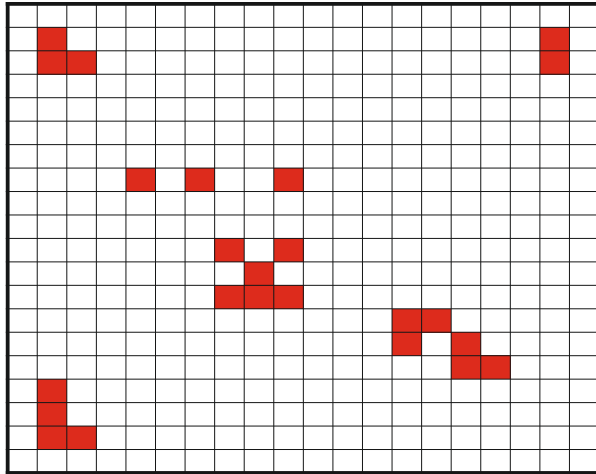
1. matrix of pixels
2. set of graphical elements
 - a. model of dashboard
 - b. template of dashboard
 - c. realization of dashboard



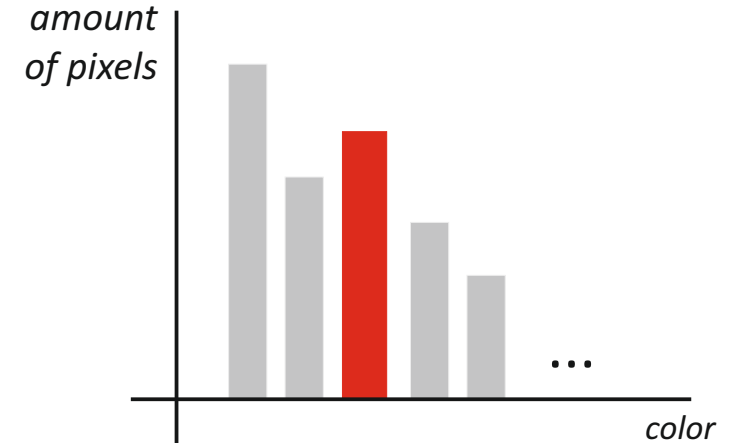
2. Do analyses of these perspectives.

1. Dashboard as matrix of pixels

Matrix of pixels



Histogram



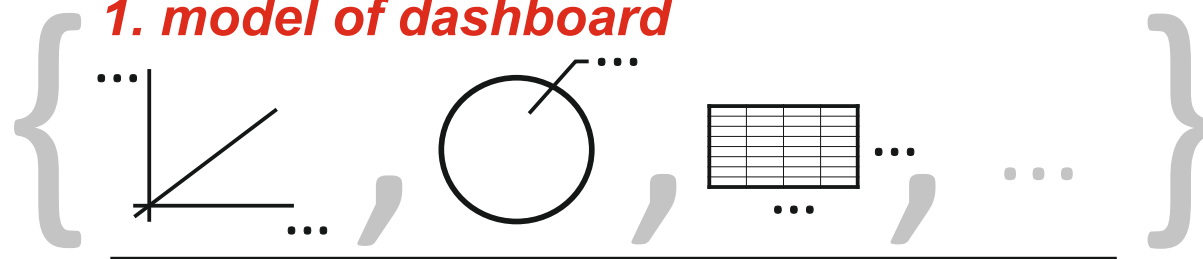
- frequency of color occurrence (histograms)
- amount of used colors
- amount of black pixels (thresholding)
- **doesn't reflect the principles of human perception**

2. Dashboard as a set of graphical elements

- consisted of 3 levels

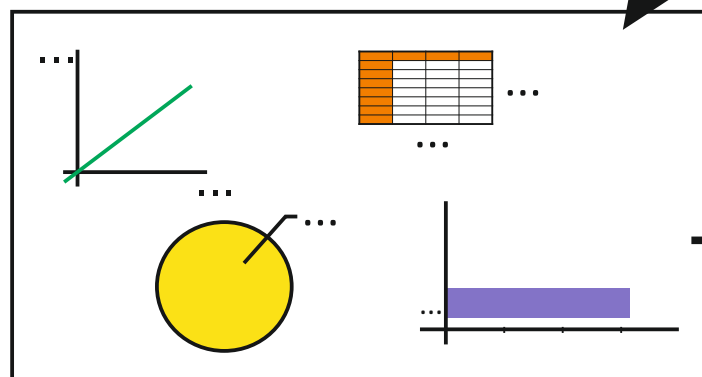
graphical elements

1. model of dashboard

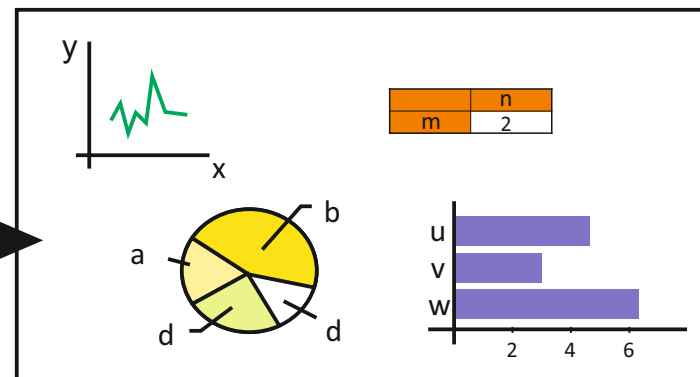


+ appearance

2. dashboard template

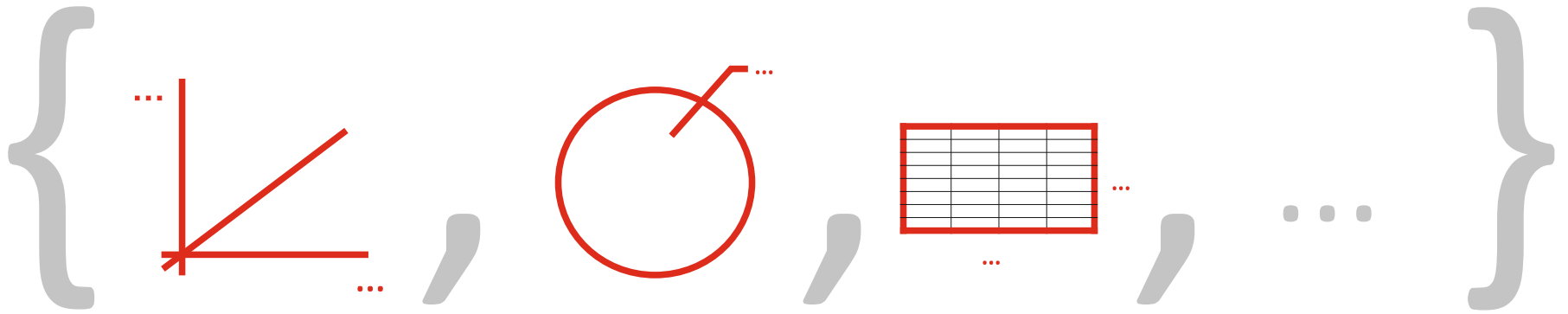


3. dashboard realization



+ data

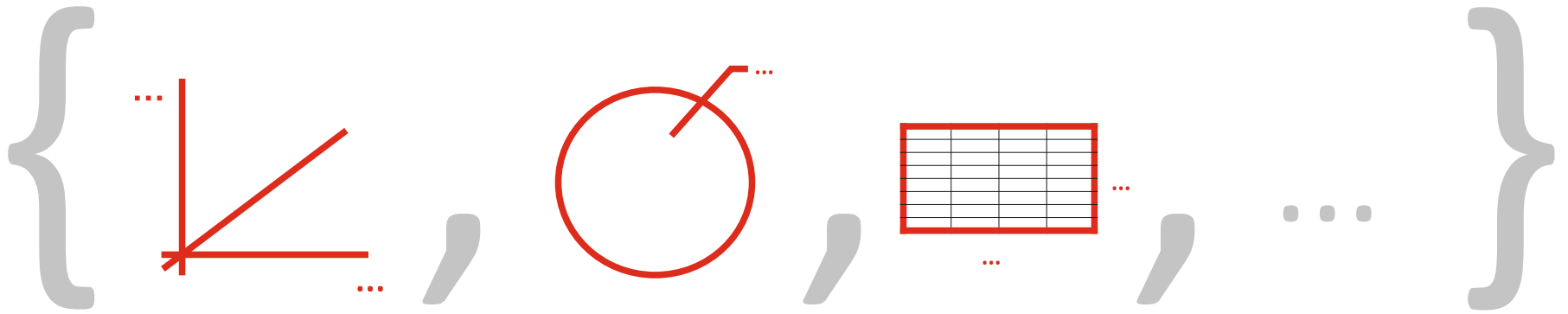
A. Model of dashboard



set of graphical elements $\{ e \}$ where e is quadruple:

- shape definition (geometrical shapes based on)
 - behavior definition
 - **set of attributes**
 - **set of data variables**
-

A. Model of dashboard



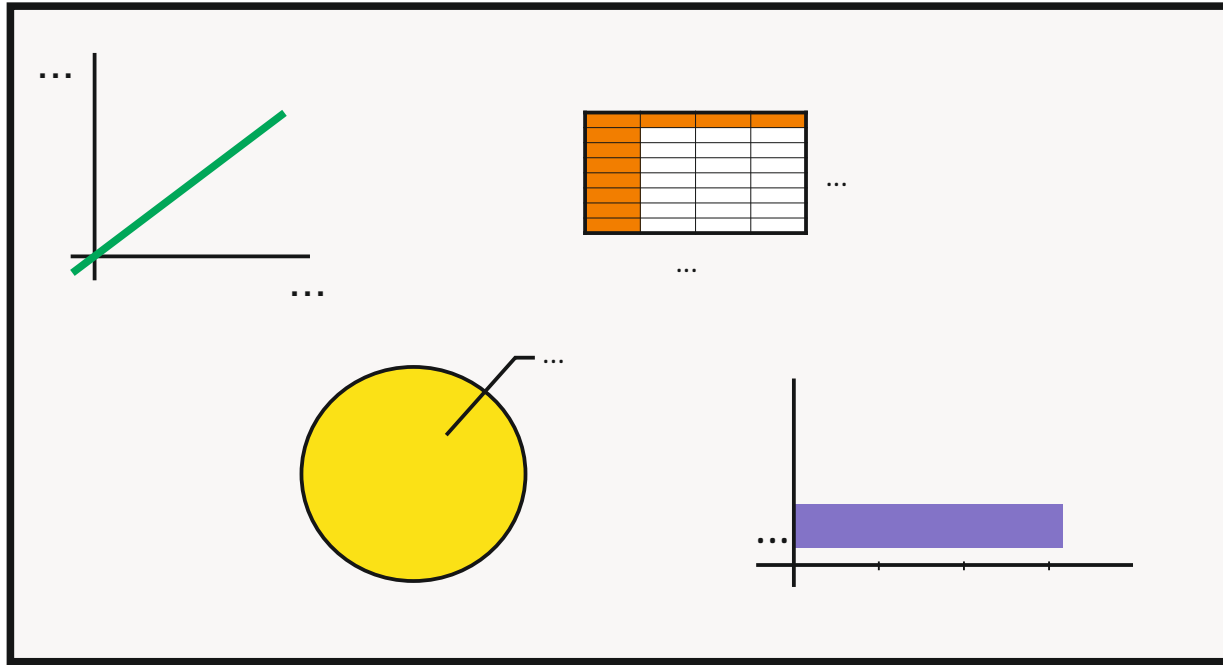
e' = line chart:

- shape definition (...)
- behavior definition \emptyset
- **set of attributes** { *position_x : int, foreground : Color, ...* }
- **set of data variables** { *values : [int:int], label_x String, ...* }

our types (sets of valid values)

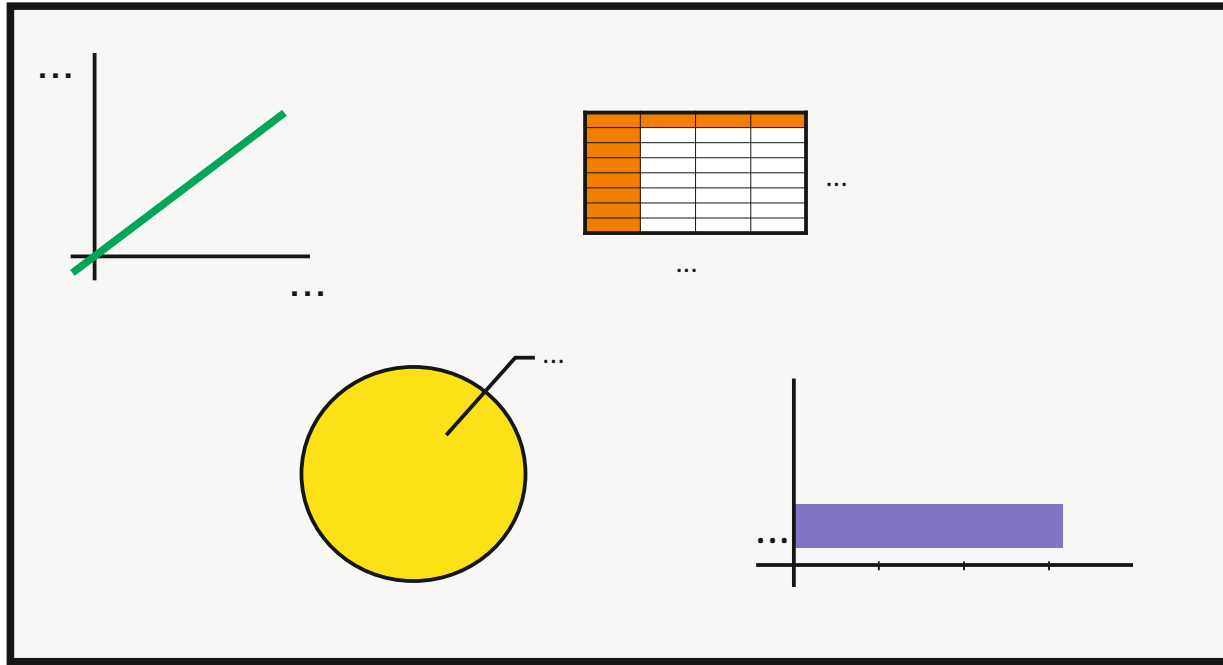


B. Dashboard template



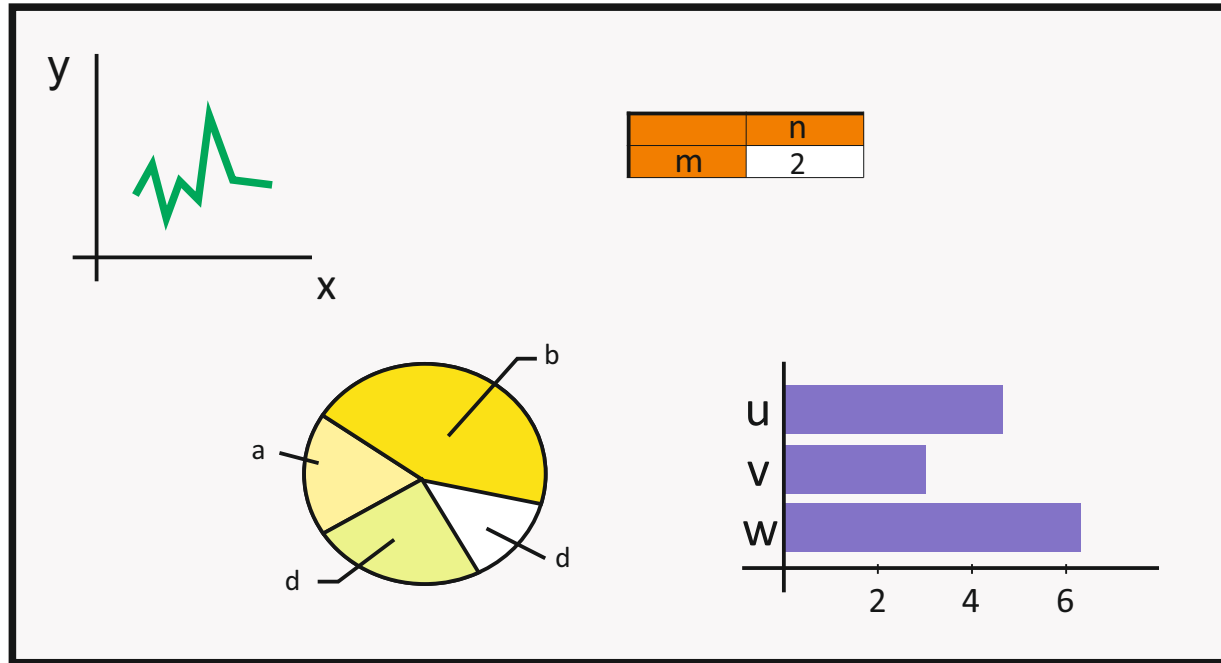
- **set of doubles** $\{ (e, A) \}$, where:
 - e is element from model of dashboard (*line chart*)
 - A is set of attribute assigns (doubles) - e. g.:
 - $position_x = 5$,
 - $foreground = GREEN$

B. Dashboard template



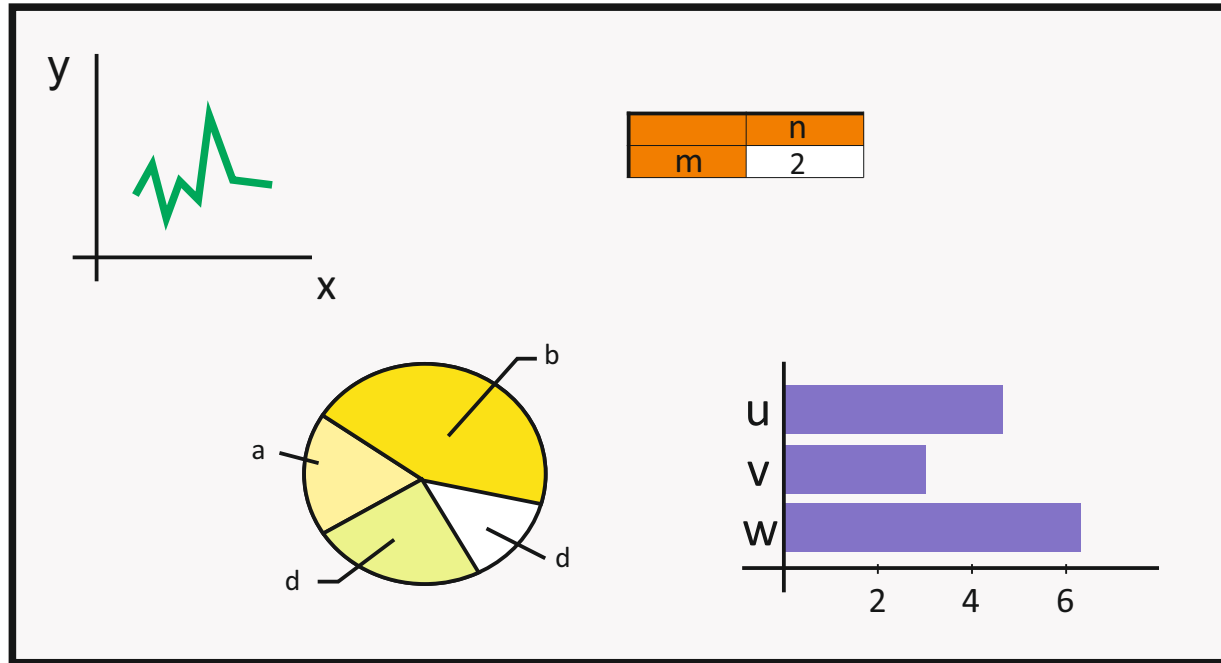
- values of attributes are analyzed - e. g.:
 - *style of graphical elements (layout, used colors, ...)*
 - *amount of used graphical elements*
 - *amount of used colors*
 - ...

C. Realization of dashboard



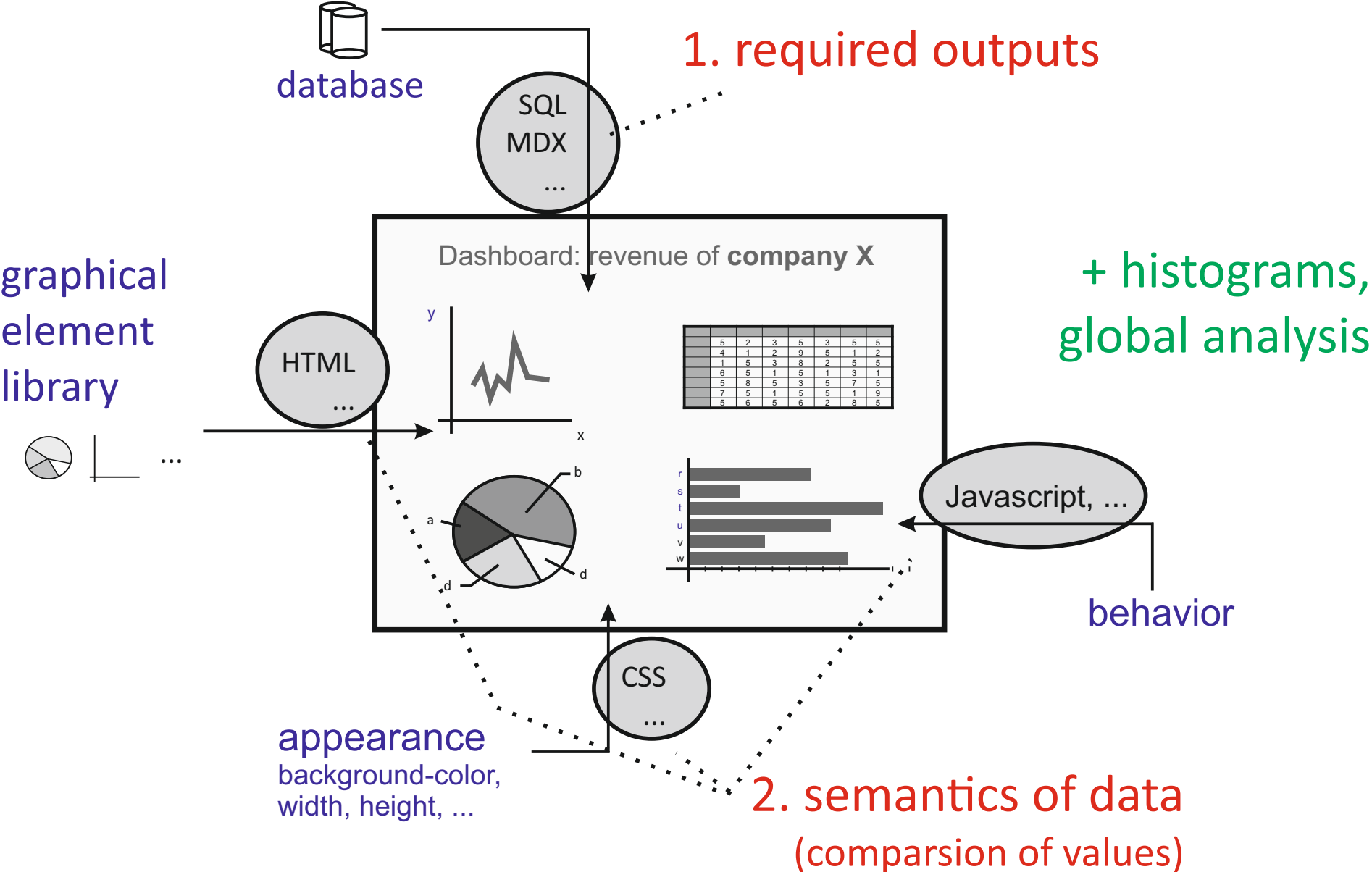
- **set of triples** $\{ (e, A, X) \}$, where:
 - e, A (dashboard template definition...)
 - X is set of data variables assigns (doubles) - e. g.:
 $values = [1:1, 2:2, 3:4, 4:16]$,
 $label_x = „x-axis”$

C. Realization of dashboard



- values of attributes are analyzed - e. g.:
 - missing values (axis names)
 - data-ink ratio, lie factor [defined by Tufte]
 - amount of visualized data
 - ...

Contributions



Future research

1. Consider dashboard in different perspectives.
2. Do analyses of these perspectives.

- dashboard requirements
 - *visual perception principles*
 - *dashboard design principles*
- design constraints

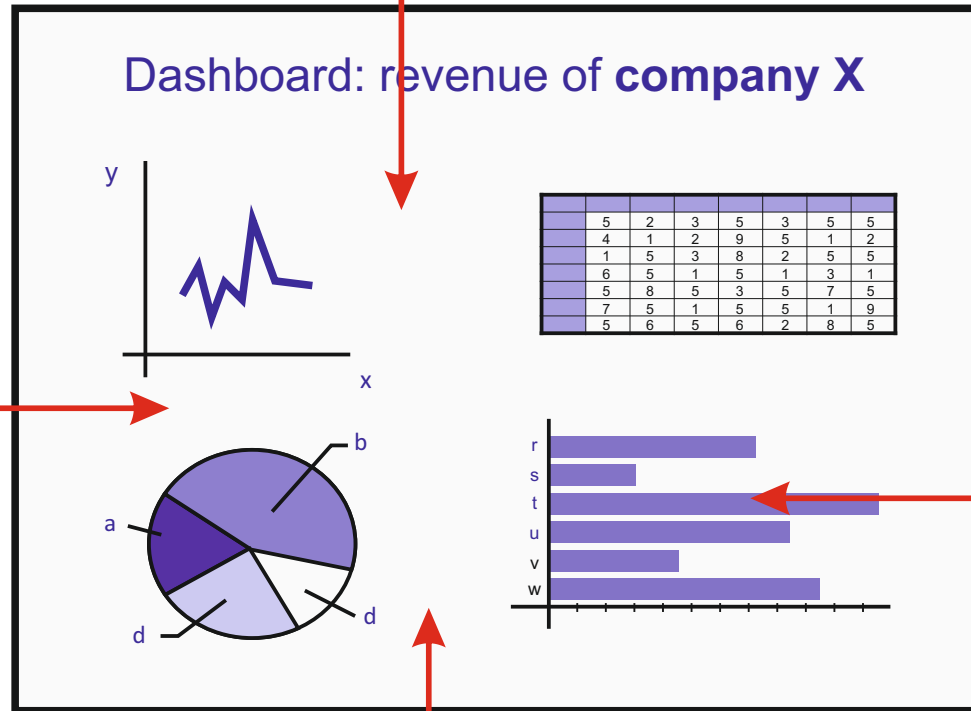
We need to formally define dashboard design constraints.

Thank you!

Our approach

- analyses of:

 **data**



**graphical
elements**

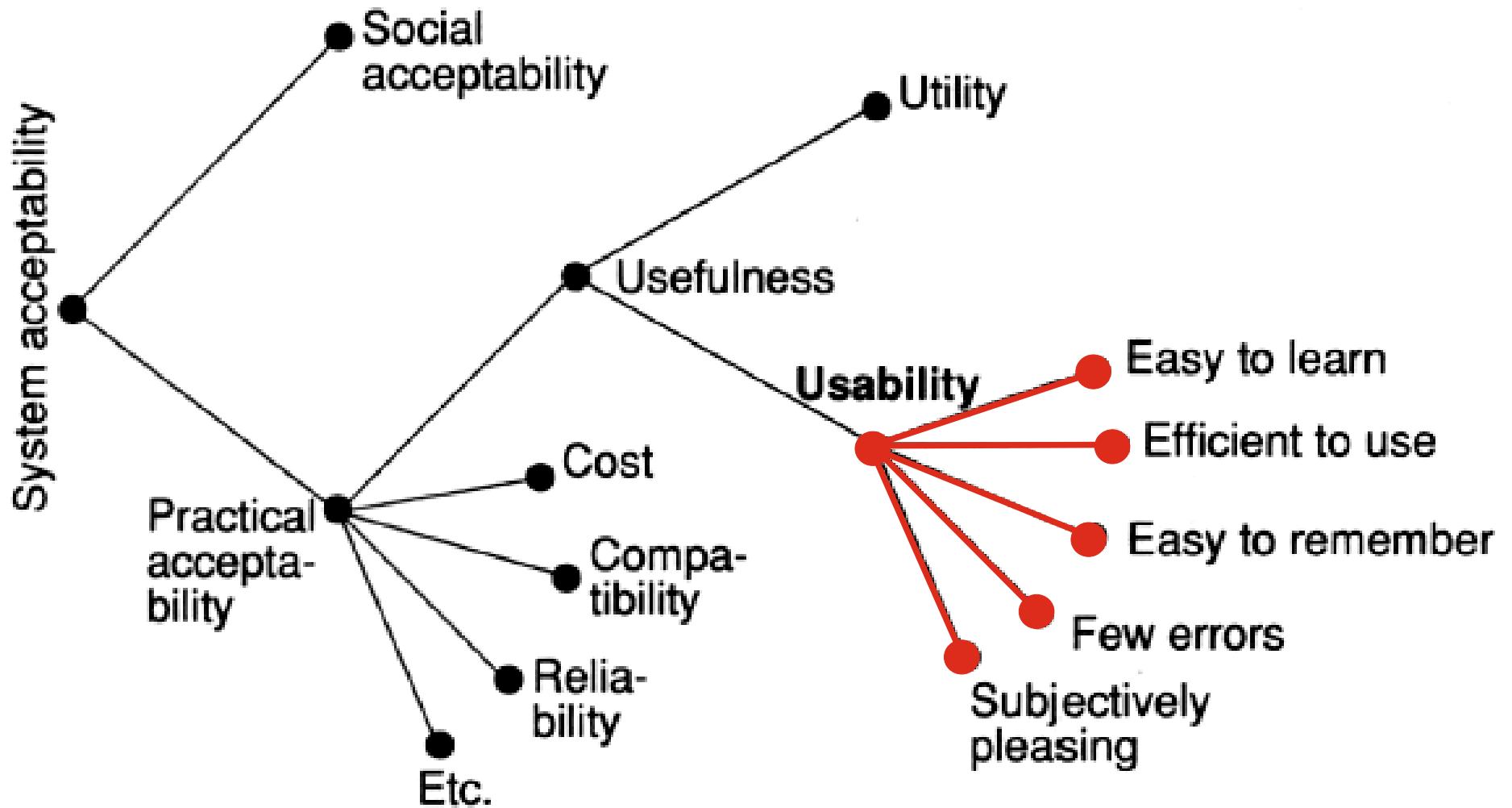


apperarance

bahavior

pixels

System acceptability



Jakob Nielsen: *Usability Engineering*.

Usability lifecycle

1. Know the user
 - a. Individual user characteristics
 - b. The user's current and desired tasks
 - c. Functional analysis
 - d. The evolution of the user and the job
2. Competitive analysis
3. Setting usability goals
 - a. Financial impact analysis
4. Parallel design
5. Participatory design
6. Coordinated design of the total interface
7. Apply guidelines and heuristic analysis
8. Prototyping
9. Empirical testing
10. Iterative design
 - a. Capture design rationale
11. Collect feedback from field use

Visual perception

- interpretation of data is done by brain

*depends on **knowledge/experience of user**:*

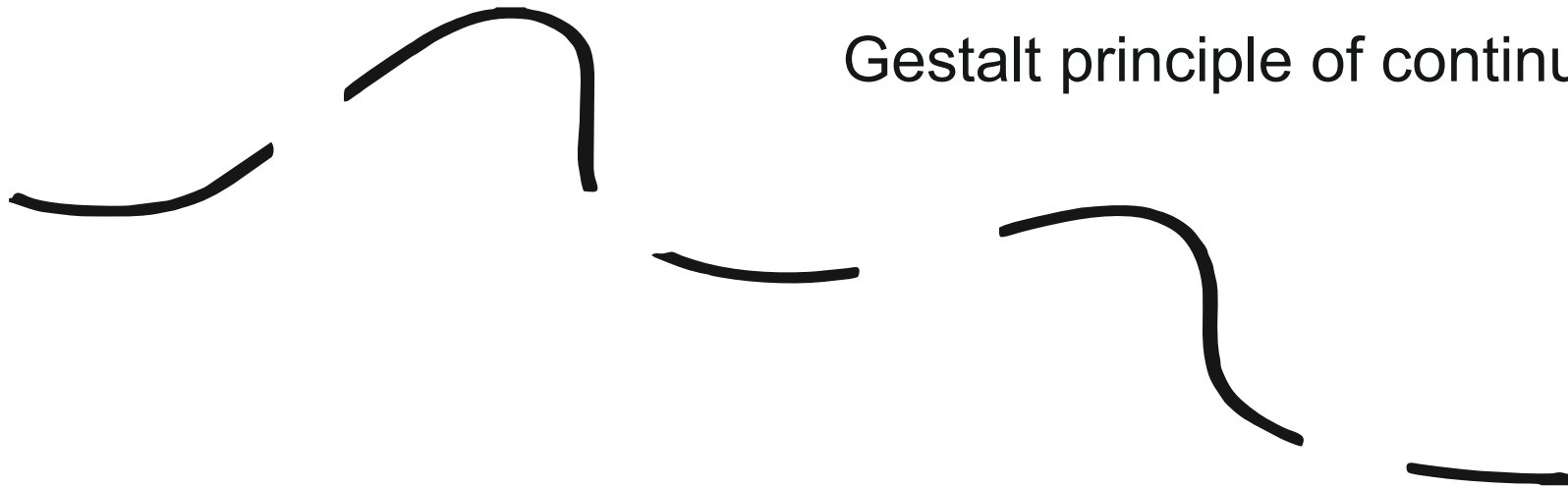


[Marr]

Visual perception

THE CHT

[Johnson]



Gestalt principle of continuity