Knowledge Visualization

Hauptseminar "Information Visualization" – Wintersemester 2008/2009

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?.?.2009

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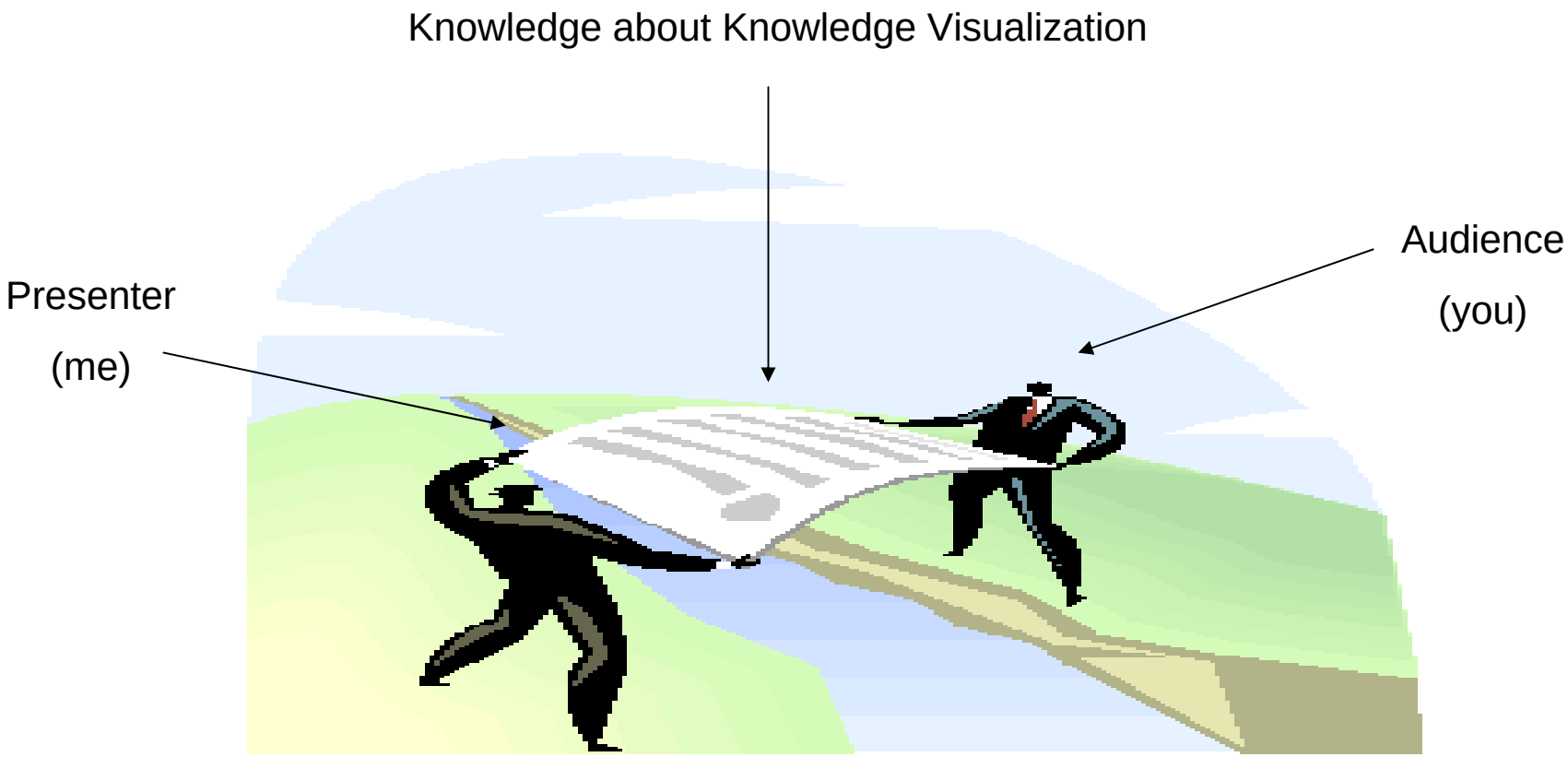
Bridging the knowledge-gap



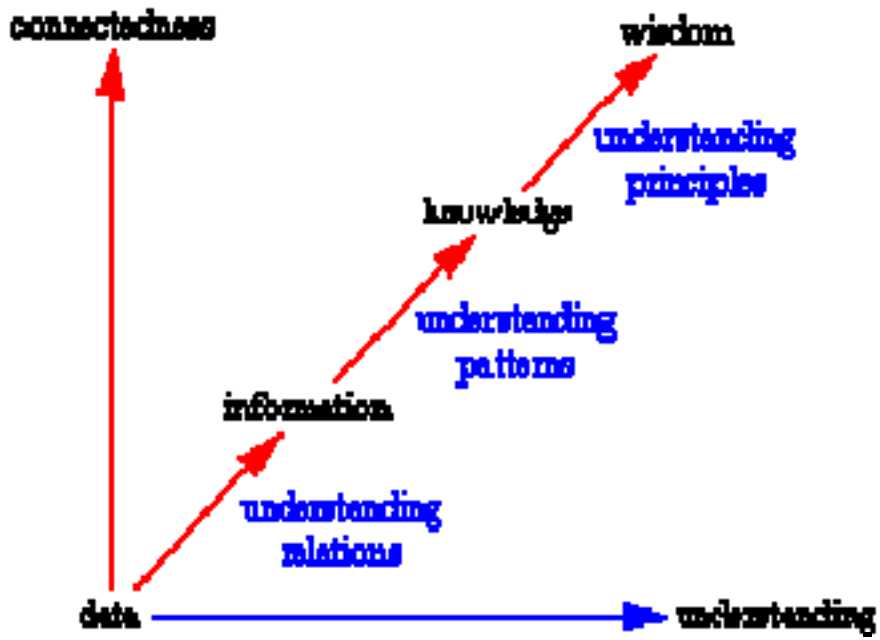
A Bridge - the visual metaphor for this presentation

(www.personal.psu.edu/als383/BridgeClipArt.gif)

Basic Definitions

What is knowledge?

- **Data:** Symbols and facts
- **Information:** Interpreted / processed data, gives meaning to data
- **Knowledge**: Cognitive processed information
- **Wisdom:** Highest level of consciousness



(http://www.systems-thinking.org/dikw/dikw.htm)

What is Knowledge Visualization?

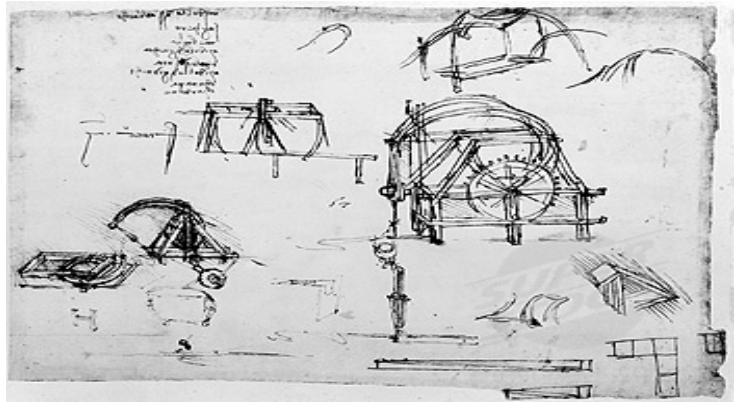
- Investigates the power of visual formats to represent knowledge
- Uses visual representations to
  - **create** knowledge
  - **transfer** knowledge
- Interdisciplinary field of research

  (Information Visualization, Communication Sciences, Learning Theories,...)

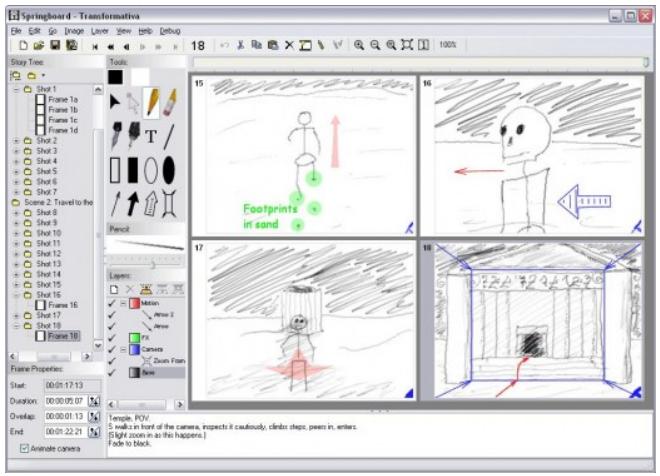
Types of Visualization

Sketches

- Rough drawings
- Very old visualization type
- Goals:
  - Illustrate main idea very quickly
  - Stimulate creativity



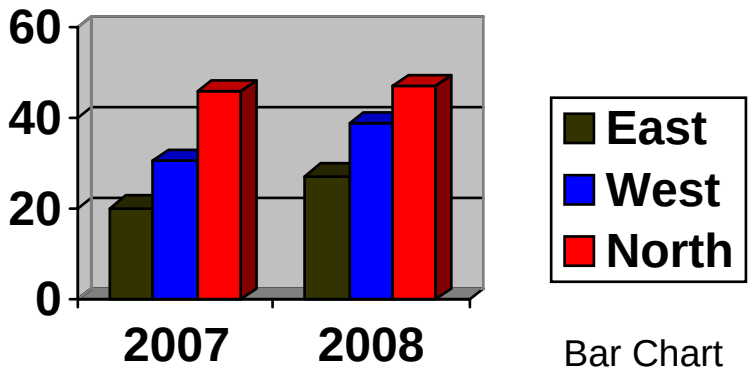
Sketch from Leonardo da Vinci
(http://wwwdelivery.superstock.com/WI/223/1746/PreviewComp/SuperStock_1746-1249.jpg)



Screenshot from Application “Springboard“
(http://www.newfreedownloads.com/imgs/1372-w520.jpg)

Diagrams

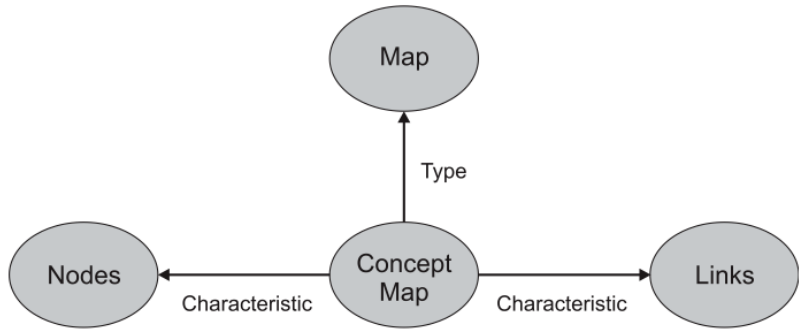
- Abstract, schematic representations
- Goals:
  - Make abstract concepts accessible
  - Display, explore and explain relationships



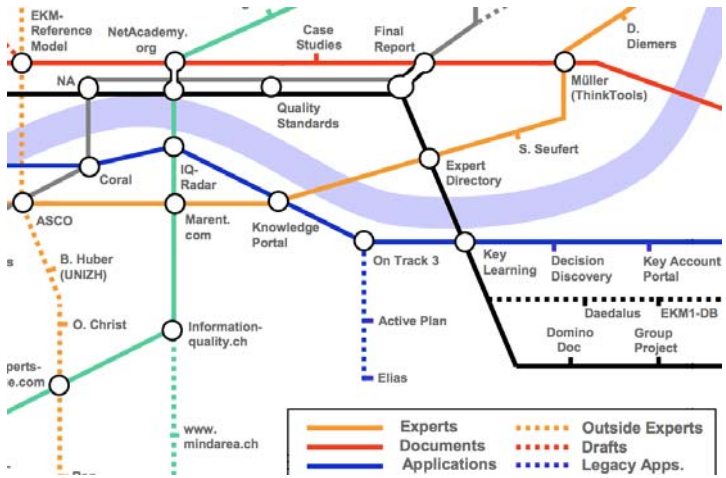
Bar Chart

Maps

- Present overview and detail at the same time
- Different types like concept maps or knowledge maps
- Goals
  - Structure and ease access to information
  - Show relationships between details



Concept Map (Tergan 2005)



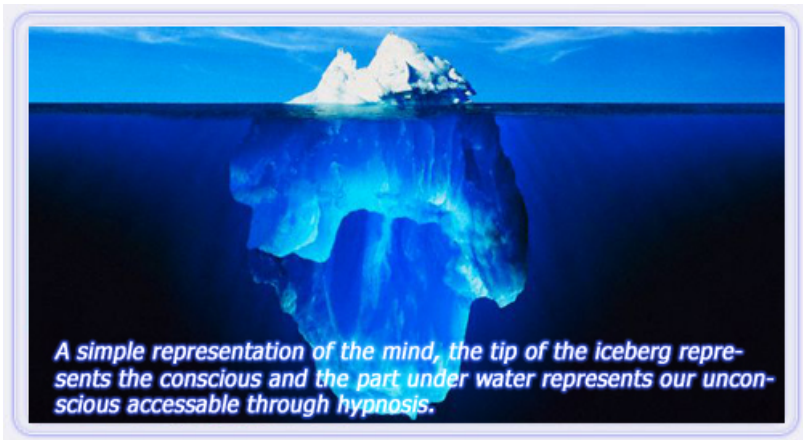
Tube Map (Eppler 2004)

Images

- Renderings, photographs or paintings
  - Address emotions
  - Inspire, motivate or energize the audience
  - Get Attention
- Special kind: visual metaphors
  - Powerful for transferring insights

Benetton-Ad

(http://linda03.wordpress.com/2008/01/08/united-colors-of-benetton-and-its-crazy-adverts/)



Iceberg visual metaphor

(http://www.anomalymagazine.com/wp-content/uploads/collectiveunconsciousiceberg.jpg)

Objects

- Touchable, physical Objects
- 3D on-screen models
- Goals
  - Allow to explore an object in the third dimension / from different perspectives
  - Attract recipients for example on exhibitions

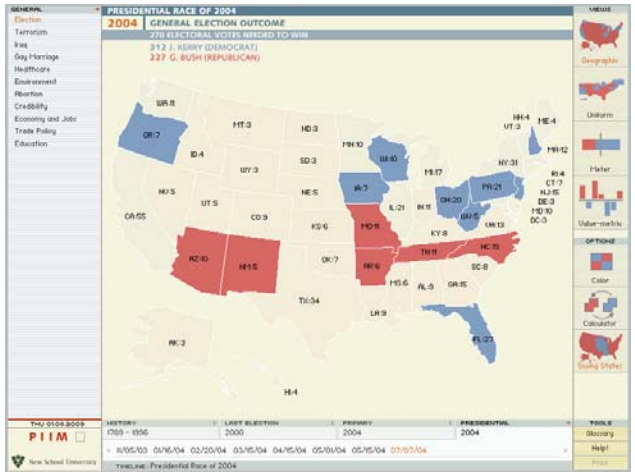
Real physical Object: Stapler

3D-model of an AUDI car

(http://www.audi.de/de/brand/de/neuwagen/a5/a5_cabriolet/360-grad-ansicht/360-grad-aussenansicht.html)

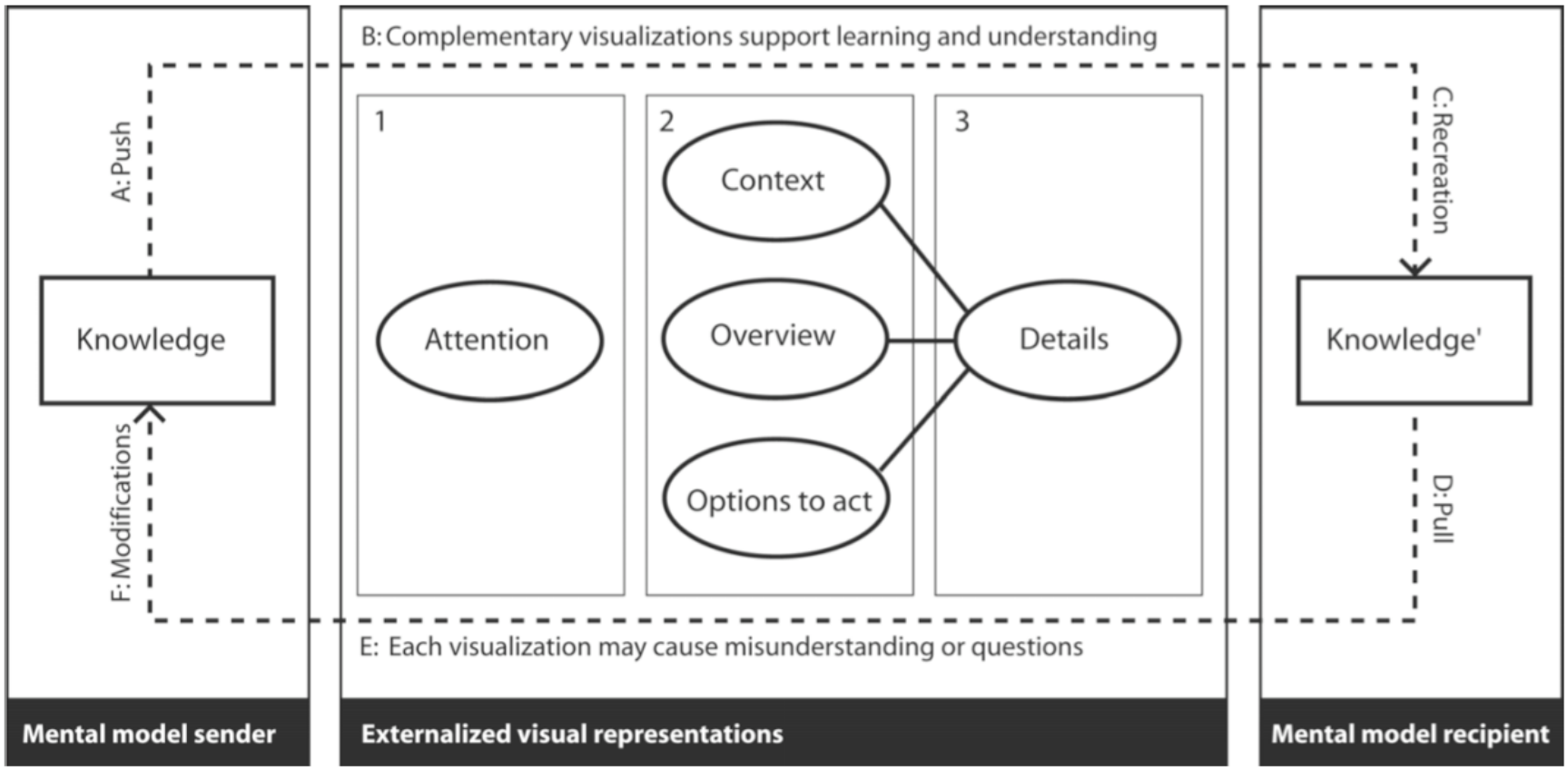
Interactive Visualizations

- Allow to access, control, explore, combine and manipulate different types of complex information
- Goals:
  - Fascinate the recipients
  - Create new insight



Results of US Elections
http://piim.newschool.edu/tools/votingtool/

The Knowledge Visualization Model



(Burkhard 2005)

Support for selecting the appropriate visualization for each visualization problem

The Knowledge Visualization Framework

FUNCTION TYPE
Coordination
Attention
Recall
Motivation
Elaboration
New Insight

KNOWLEDGE TYPE
Know-what
Know-how
Know-why
Know-where
Know-who

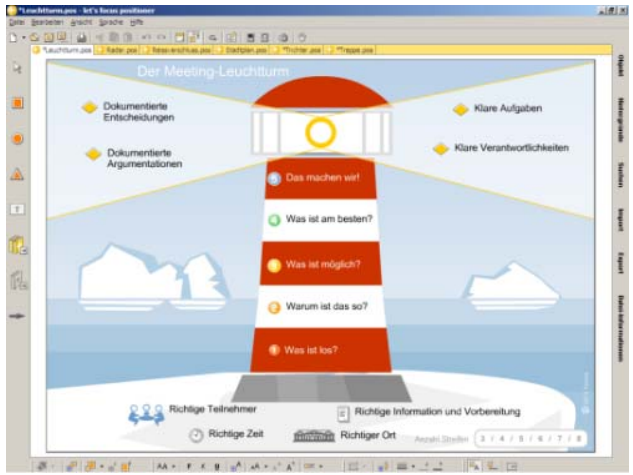
RECIPIENT TYPE
Individual
Group
Organization
Network

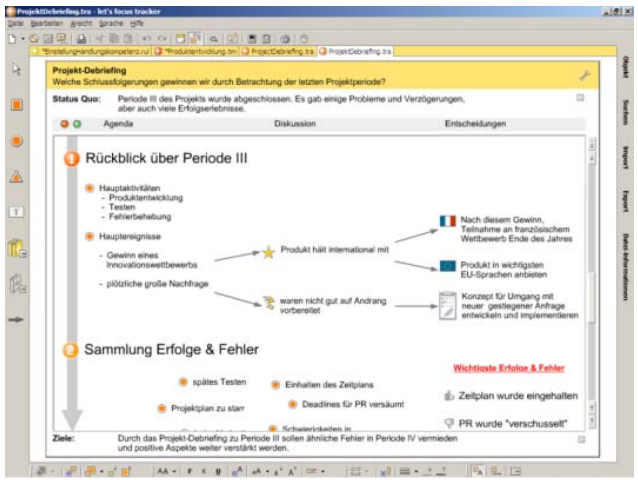
VISUALIZATION TYPE
Sketch
Diagram
Image
Map
Object
Interactive Visualization
Story

(Burkhard 2005)

Example software: “Let´s focus“

- Converts lengthy discussions into concise, insightful, and collaborative visualization sessions.
- Over 60 graphic templates and proven methods,.





(http://de.lets-focus.com/)

Periodic Table of Visualization Methods

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Data Visualization
Visual representations of quantitative data in schematic form (either with or without axes)

Information Visualization
The use of interactive visual representations of data to amplify cognition. This means that the data is transformed into an image, it is mapped to screen space. The image can be changed by users as they proceed working with it

Concept Visualization
Methods to elaborate (mostly) qualitative concepts, ideas, plans, and analyses.

Strategy Visualization
The systematic use of complementary visual representations in the analysis, development, formulation, communication, and implementation of strategies in organizations.

Metaphor Visualization
Visual Metaphors position information graphically to organize and structure information. They also convey an insight about the represented information through the key characteristics of the metaphor that is employed

Compound Visualization
The complementary use of different graphic representation formats in one single schema or frame

C continuum																G graphic facilitation
Tb table	Ca cartesian coordinates											Cs concept skeleton	Mm metro map	Tm temple	St story template	Tr tree	Ct cartoon
Pi pie chart	L line chart											Me meeting trace	Fp flight plan	Cf concept fan	Br bridge	Fu funnel	Ri rich picture
B bar chart	Hi histogram	T timeline	Pa parallel coordinates	Hy hyperbolic tree	Cy cycle diagram	Sa sankey diagram	Ve venn/euler diagram	Mi mindmap	Sq square of oppositions	Co concentric circles	Ar argument slide	Co communication diagram	Gc gantt chart	Pe perspectives diagram	D dilemma diagram	Pr parameter ruler	Kn knowledge map
Ar area chart	Sc scatterplot	R radar chart colweb	Ch chernoff faces	E entity relationship diagram	Fb feedback cycle diagram	Pa pareto chart	Cl clustering	L layer chart	Py minto pyramid technique	Ca cause-effect chains	Tl toulmin map	Dt decision tree	Cp cpm critical path method	Ev evocative knowledge maps	Co concept map	Ic iceberg	Cm cognitive mapping
Tk tukey box plot	Sp spectrogram	Te tensor diagram	Tr treemaps	N nassi shneiderman diagram	Se semantic network	Fl flow chart	Sy system dyn./ loop diagrams	So soft system modeling	Sm synergy map	Fo force field diagram	Ib ibis argumentation map	Pr process event chains	Pe pert chart	Sw swim lane diagram	V Vee diagram	Hh heaven 'n' hell chart	I informural

Cy Process Visualization

Hy Structure Visualization

☼ Overview

◎ Detail AND Overview

▫ Detail

< > Divergent thinking

> < Convergent thinking

Sd supply demand chain	Pr performance charting	St strategy map	Oc organisation chart	Ho house of quality	Fd feedback diagram	Ft failure tree	Mq magic quadrant	Sr stakeholder rating map	Po porter's five forces	S s-cycle	Sm stakeholder map	Ld life-cycle diagram	Tc technology roadmap
Ed edgeworth box	Pf portfolio diagram	Sg strategic game board	Mz mintzberg's organigraph	Z zwicky's morphological box	Ad affinity diagram	De decision discovery diagram	Bm bcg matrix	Stc strategy canvas	Vc value chain	Hy hype-cycle	Is ishikawa diagram	Ta taps	Sd spray diagram

(Lengler 2007)

Conclusion

- Knowledge Visualization
  - ... may improve the usage of visualization formats
  - ... may create synergetic effects between different scientific disciplines
  - ... may foster creation and transfer of knowledge
- Future trend:
  - New carrier of information (Mobile Computing, Ubiquitous Computing, Augmented Reality...)

Literature

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