

# A picture amongst pictures: A classification system for instructional visualizations

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# A picture among pictures: A classification system for instructional visualizations

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Earli 2011

## Different dimensions of visualizations

These visualizations depict the same *content* (fish locomotion patterns), have the same *function* (conveying knowledge on f.l.p.), but still differ dramatically! And hence, so did their effects:

- Imhof, B., Scheiter, K., Edelmann, J., von Ulardt, J., & Gerjets, P. (2011). Is enriching static-simultaneous visualizations with motion-indicating arrows helpful for learning about locomotion patterns? In L. Carlson, C. Hölscher, & T. F. Shipley (Eds.), *Proceedings of the 33rd Annual Conference of the Cognitive Science Society* (pp. 1176-1181). Austin, TX: Cognitive Science Society.
- Imhof, B., Scheiter, K., & Gerjets, P. (2011). Learning about locomotion patterns from visualizations: Effects of presentation format and realism. *Computers & Education, 57*, 1961-1970.
- Jarodzka, H., Scheiter, K., Gerjets, P., Van Gog, T., & Dorr, M. (2009). How to convey perceptual skills by displaying experts' gaze data. In N. A. Taatgen, & H. van Rijn (Eds.), *Proceedings of the 31st Annual Conference of the Cognitive Science Society* (pp. 2920-2925). Austin, TX: Cognitive Science Society.
- Kühl, T., Scheiter, K., Gerjets, P., & Edelmann, J. (2011). The influence of text modality on learning with static and dynamic visualizations. *Computers in Human Behavior, 27*, 29-35.
- Kühl, T., Scheiter, K., Gerjets, P., & Gemballa, S. (2011). Can differences in learning strategies explain the benefits of learning from static and dynamic visualizations? *Computers & Education, 56*, 176-187.
- Pfeiffer, V. D. I., Gemballa, S., Jarodzka, H., Scheiter, K., & Gerjets, P. (2009). Situated learning in the mobile age: Mobile devices on a field trip to the sea. *Association for Learning Technologies Journal, 17*, 187-199.

→ generic classification system is needed

## Research questions

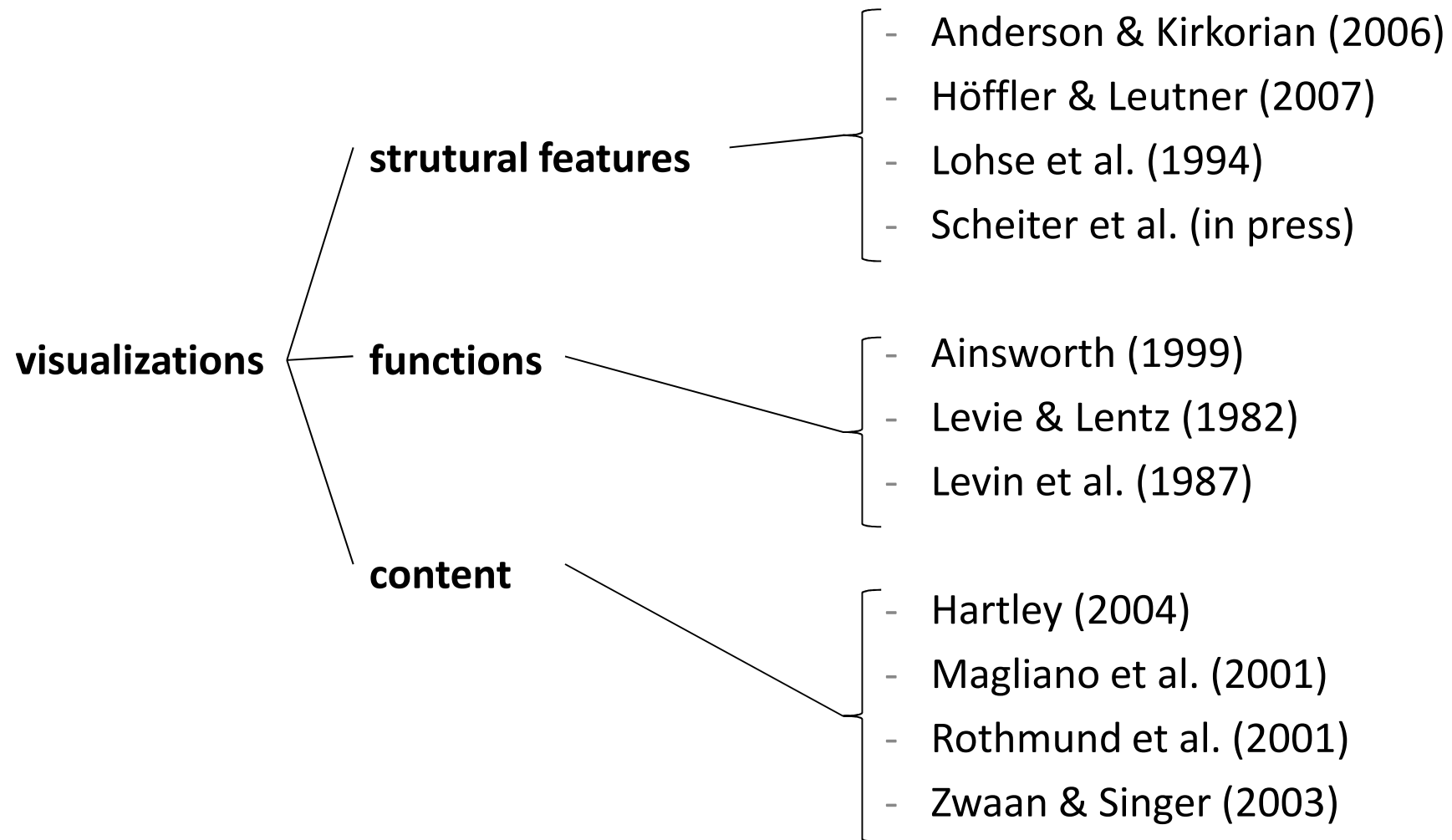
1. Which features are central for processing a visualization?
2. Which competences are required to benefit from the use of certain visualizations?
3. To which degree can effects on the use of certain visualizations be generalized?
4. Which type of information or knowledge can be best conveyed by means of which visualizations?
5. Are certain visualizations more similar, and thus more qualified to convey certain knowledge?

To answer these questions, you first need to objectively assess different types of visualizations.

→ Development of a classification schema

Which dimensions / features can be used to classify visualizations?

## Theory-guided approach



## 1. Structural features

- **Visualization production:** photography, movie, animation, drawing, painting, comic strip, etc.
- **Visualization type:** iconic, indexical, symbolic familiar, symbolic unfamiliar
- **Recording or processing technique:** lighting, camera perspective, camera position, camera panning, change of scene
- **Dynamism:** degree, complexity
- **Realism:** time, colour, contours, texture, spatial relations, voice, sound
- **Accompanying text:** no, modality, text type, language
- **Accompanying audio:** no, music, noise / sound
- **Cueing :** no, auditive, visual, colour, motion
- **Interactivity:** no, basic, display, flow, manipulations

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## 1. Structural features

1d) Dynamism

### Degree of Dynamism:

- |   |  |
|---|--|
| <input type="radio"/> single static           | <input type="radio"/> dynamic segmented  |
| <input type="radio"/> static-simultaneous     | <input type="radio"/> dynamic continuous |
| <input type="radio"/> static-sequential       | <input type="radio"/> multiple dynamic   |
| <input type="radio"/> static-dynamic mixtures | <input type="radio"/> miscellaneous      |

### Complexity (concurrent movements of several objects):

- |                            |                                   |                           |
|----------------------------|-----------------------------------|---------------------------|
| <input type="radio"/> high | <input type="radio"/> unobtrusive | <input type="radio"/> low |
|----------------------------|-----------------------------------|---------------------------|

### Duration of the presentation:

- |   |                                      |
|---|--------------------------------------|
| <input type="radio"/> determined: _____ | <input type="radio"/> not determined |
|---|--------------------------------------|



## 2. Functional features

- **Affective:** influencing emotions, mood, motivation, attitudes
- **Complementary:** decorative, representational, organizing, interpreting, transforming, redundant vs. complementary vs. contrary, restricting
- **Attention controlling:** attracting, guiding, capturing
- **Working memory offloading:** perceptual chunking, off-loading, procedural fit
- **Long-term memory supporting:** facilitating recall, facilitating comprehension, fostering elaboration

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## 2. Functions

2c) (Text-/picture-)

complementary functions

yes

no

unclear

decorative

representational

organisational

interpretational

transformational

---

redundant

complementary

contrary

constraining

### 3. Depicted content

- **Genre:** expository, narrative, hybrid (inductive vs. deductive), visualization art
- **Striven target group:** age, expertise, specificity
- **Realism of content:** realistic vs. fictional, documentary vs. stage-managed, situation, event, plot
- **Object and degree of identification:** given vs. not given vs. changing vs. several, high vs. low
- **Coherence / continuity:** temporal, spatial, visual, content-wise, between representations
- **Difficulty of required inferences:** high vs. low
- **Detailedness of presentation in relation to complexity of content:** high vs. low
- **Type of conveyed knowledge:** facts vs. skills
- **Domain:** natural sciences, humanities, arts / culture, sports, politics / society, entertainment, ...

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### 3. Content

3g) Domain

- natural sciences
- sports
- humanities
- art / culture
- politics / society
- entertainment
- advertisement / propaganda
- „cultural techniques“ (e.g. reading, writing, calculating, cooking, knot tying, ...)
- miscellaneous

## Evaluation of the new classification system

N = 10 independent raters

six different visualizations:

1. a computer animation about cancer
2. an impressionistic painting
3. a static text-picture combination
4. an animated cartoon
5. a section from a silent film
6. a section from a television movie

## Conclusions and future directions

- First empirical testing of this classification system revealed good agreement among different raters. Still, further evaluations with more visualizations needed!



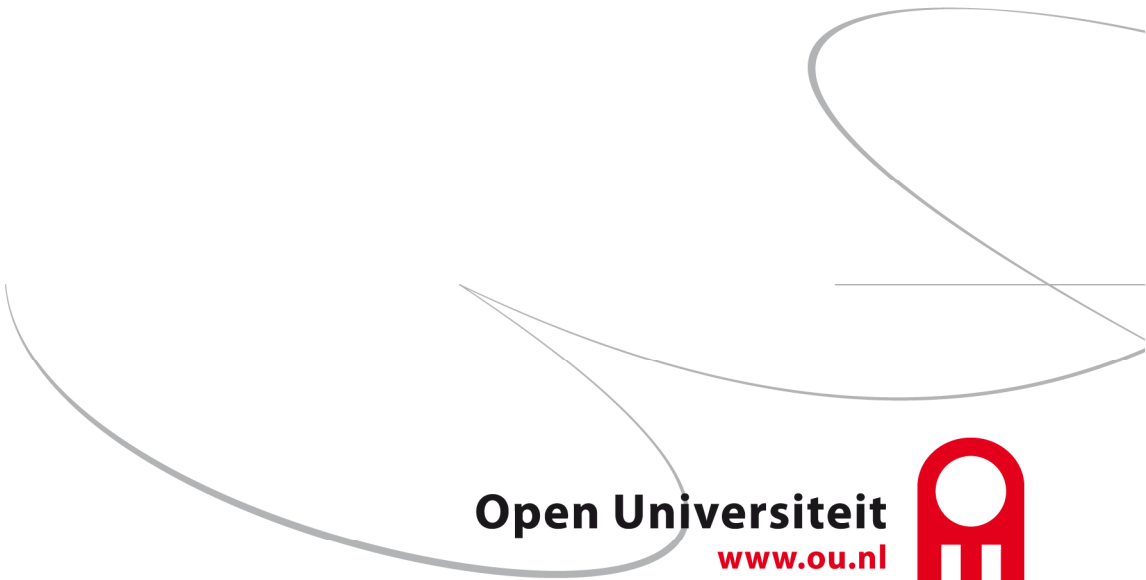
For questions on this talk , please  
contact me:

**Halszka.Jarodzka@OU.nl**

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P. (2009). Classifying  
instructional visualizations: A  
psychological approach.  
*IMAGE. Journal of  
Interdisciplinary Image  
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