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:


→ 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 an classification schema

Which dimensions / features can be used to classify visualizations?
Theory-guided approach

- Anderson & Kirkorian (2006)
- Höffler & Leutner (2007)
- Lohse et al. (1994)
- Scheiter et al. (in press)
- Ainsworth (1999)
- Levie & Lentz (1982)
- Levin et al. (1987)
- Magliano et al. (2001)
- Rothmund et al. (2001)
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

<table>
<thead>
<tr>
<th>1d) Dynamism</th>
<th><strong>Degree of Dynamism:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O single static</td>
</tr>
<tr>
<td></td>
<td>O static-simultaneous</td>
</tr>
<tr>
<td></td>
<td>O static-sequential</td>
</tr>
<tr>
<td></td>
<td>O static-dynamic mixtures</td>
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<tr>
<td></td>
<td>O dynamic segmented</td>
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<tr>
<td></td>
<td>O dynamic continuous</td>
</tr>
<tr>
<td></td>
<td>O multiple dynamic</td>
</tr>
<tr>
<td></td>
<td>O miscellaneous</td>
</tr>
</tbody>
</table>

**Complexity** (concurrent movements of several objects):
- O high
- O unobtrusive
- O low

**Duration of the presentation:**
- O determined: ________________
- O 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

<table>
<thead>
<tr>
<th>2c) (Text-/picture-) complementary functions</th>
<th>O decorative</th>
<th>O representational</th>
<th>O organisational</th>
<th>O interpretational</th>
<th>O transformational</th>
</tr>
</thead>
<tbody>
<tr>
<td>O yes</td>
<td>O redundant</td>
<td>O complementary</td>
<td>O contrary</td>
<td>O constraining</td>
<td></td>
</tr>
<tr>
<td>O no</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O unclear</td>
<td></td>
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</tbody>
</table>
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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<th>3. Content</th>
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<tbody>
<tr>
<td>3g) Domain</td>
</tr>
<tr>
<td>O natural sciences</td>
</tr>
<tr>
<td>O sports</td>
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<tr>
<td>O humanities</td>
</tr>
<tr>
<td>O art / culture</td>
</tr>
<tr>
<td>O politics / society</td>
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<tr>
<td>O entertainment</td>
</tr>
<tr>
<td>O advertisement / propaganda</td>
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<tr>
<td>O „cultural techniques“ (e.g. reading, writing, calculating, cooking, knot tying, …)</td>
</tr>
<tr>
<td>O miscellaneous</td>
</tr>
</tbody>
</table>
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:

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