Image schemas and their metaphorical extensions – New Patterns for intuitive interaction?

Jörn Hurtienne
07.11.2006
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Sensorimotor Experience
Sensorimotor Experience
Focus on Sensorimotor Experience

- Advantages
  - covers large and heterogenous user groups
  - provides general rules instead of suggesting analyses of knowledge
  - extremely frequent encoding & retrieval
  - with high workload & stress: Fall-Back on these stages → increased robustness
  - less workload through unconscious processing means more resources are available for solving the task
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Cognitive Linguistics: Image Schemas

- Abstract representation of recurring dynamic patterns of bodily interactions that structures the way we understand the world (Johnson, 1987)

- CONTAINER

- UP-DOWN
Image Schemas

• FORCE
  – ATTRACTION, BALANCE, BLOCKAGE, COMPULSION, COUNTERFORCE, DIVERSION, ENABLEMENT, MOMENTUM, RESISTANCE, RESTRAINT REMOVAL

• SPACE
  – UP-DOWN, LEFT-RIGHT, NEAR-FAR, FRONT-BACK, CENTER-PERIPHERY, STRAIGHT, CONTACT, PATH, SCALE, LOCATION

• CONTAINMENT
  – CONTAINER, IN-OUT, CONTENT, FULL-EMPTY, SURFACE

• MULTIPLICITY
  – MERGING, COLLECTION, SPLITTING, PART-WHOLE, COUNT-MASS, LINKAGE

• PROCESS
  – ITERATION, CYCLE

• IDENTITY
  – FACE, MATCHING
Literature about Image Schemas

• „Classics“

• Psychological Plausibility
  – Mandler (1992, 2005): Akquisition of IS by babies, Transition to language
  – Piaget (1952, 1954): sensorimotor + cognitive Development
  – Dodge & Lakoff (2005), Rohrer (2005): Neurological plausibility

• Single IS, beyond language
  – MOMENTUM: Hubbard (1999)
  – UP-DOWN, LEFT-RIGHT: Richardson et al. (2001), Richardson et al. (2003), Kaden, Wapner & Werner (1955), Zwaan & Yaxley (2003), Spivey & Geng (2001)
Image Schemas in UI
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Metaphorical Extensions of Image Schemas

- **MORE IS UP; LESS IS DOWN**
  - Speak *up* please. Keep your voice *down* please.

- **GOOD IS UP; BAD IS DOWN**
  - We hit a *peak* last year, but it’s been *downhill* ever since

- **VIRTUE IS UP; DEPRAVITY IS DOWN**
  - She is an *upstanding* citizen. That was a *low-down* thing to do.

- **HAPPY IS UP; SAD IS DOWN**
  - I’m feeling *up* today. He’s really *low* these days.

- **HAVING CONTROL / FORCE IS UP; BEING SUBJECT TO CONTROL / FORCE IS DOWN**
  - I’m *on top* of the situation. He is *under* my control.

- **HEALTH & LIFE ARE UP; SICKNESS & DEATH ARE DOWN**
  - Lazarus *rose* from the dead. He *fell* ill.
Literature on Metaphorical Extensions

• Examples in Language

• … in Gesture
  – Casasanto, Lozano & Garlock (2005)

• … transfer to non-speech phenomena
  – Langston & Kuban (2002): UP-DOWN Metaphors
  – Boroditsky & Ramscar (2002): space -> time mappings
  – Tversky (2000): children and metaphorical extensions
  – Meier & Robinson (2004a, b): metaphorical extensions for describing quality
Metaphorical Extensions in UI

MORE IS UP, LESS IS DOWN
Application in UI

- physical mapping
- cognitive mapping
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Focus on Sensorimotor Experience

**Image Schemas (IS)**

- **Experiments**
  - UP-DOWN
  - other IS

- **Explorations**
  - Analysis of IS in UI
  - Application of IS

```
Tool-Use
Expertise
Culture
Embodiment
Innate
```
Experiments: UP-DOWN

- Violation of metaphor (UP-DOWN)

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<tr>
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<th>DEPRAVITY</th>
<th>SAD</th>
<th>UNINFLUENTIAL</th>
<th>SICK</th>
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Experiments: UP-DOWN

- Respecting metaphor
- Measuring preference, response times, (errors) & compare

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Experiments: UP-DOWN

- Respecting metaphorical extensions gives up to 5% faster responses and is strongly preferred by users

- Cockroaches: quality vs quantity
Focus on Sensorimotor Experience

Image Schemas (IS)
- Experiments
  - UP-DOWN
  - other IS
- Explorations
  - Analysis of IS in UI
  - Application of IS

Tool-Use
Expertise
Culture
Embodiment
Innate
Image Schemas in UI today

- Image Schema <-> interaction elements

- Explorations
  - Automats: large heterogenous user group
  - Airplane cockpits: homogenous, highly trained users
  - Software-Styleguides: Standards across application software
# Software Styleguides

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<tr>
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<th>1</th>
<th>2</th>
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<tbody>
<tr>
<td><strong>Image Schema</strong></td>
<td>Spin button</td>
<td>vertical slider</td>
<td>...</td>
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<td><strong>UP-DOWN</strong></td>
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<td>...</td>
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<tr>
<td><strong>SPLITTING</strong></td>
<td>Split box</td>
<td>separator</td>
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<td>Text box</td>
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Ticket Machine
Ticket Machine

Fahrkarten
Tickets / Billets / Biglietti

Bitte vergessen Sie Ihre Karten und billete nicht.

LINK?
Cash Machine: Degrees of LINK
Airplane Cockpit: LINK
Airplane Cockpit: BLOCKAGE
IS in future UI: Semi-autonomous Vehicles

FORCE schemas: DIVERSION, COUNTERFORCE, RESTRAINT REMOVAL, RESISTANCE, ATTRACTION, COMPULSION, BLOCKAGE, BALANCE, MOMENTUM, ENABLEMENT
Explorations: Results

- IS are used for physical and metaphorical mappings
- IS provide a language for description and design - they inspire and sensitize for intuitivity issues and can be used to solve problems
- IS support UI evaluation
  - supporting, misleading, neutral, and missing IS
  - Can we build an index of „intuitiveness“ using IS?
- IS analyses reveal potential for innovation
  - IS underused
  - target domains of metaphorical extensions
- „Cognitive Design“ of new interaction problems
  - Tangible User Interfaces
  - Interaction with semi-autonomous vehicles
Summary & Outlook

• Image Schemas and their metaphorical extensions
  – are effective not only in language but also in User Interfaces
    • positive effects can be shown on a subjective and on the behavioural level
  – are used in today’s UIs
  – can be used as design patterns for designing future intuitive interaction

• Creating a catalogue of IS and their typical uses
  – How can I present IS in UI?
    • e.g. ATTRACTION by colour<light<blinking<sound
  – How can present abstract domains with IS?
    • e.g. Importance by CENTER-PERIPHERY
  – Which IS are seldomly used?
    • e.g. FORCE-schemas in software → A different kind of „Cognitive Engineering“?
Thank You!