A Shifting Boundary:
the dynamics of internal cognition and
the web as external representation

Alan Dix
Talis and Lancaster University

embodiment

• traditional view:
  – perceive the world – think in the head – act on the world

• challenges
  – philosophy
    Heidegger – thrownness, breakdown
    Clark – external representation and parsimony
  – psychology
    Gibson – affordance, epistemic action
    distributed cognition vs display-based cognition
  – human–computer Interaction
    long time use of affordance, dist. cog., situated action
    often simplistic dichotomies: reductionist/holistic, positivist/interpretivist
embodiment and the web

embodiment = physical world ... ? digital

4E: enactive, extended, embodied, embedded

digital implications
not so obvious

• Halpin, Clark & Wheeler
  – web as representation, search as enactive, collective intelligence

• but ... Carr & Harnard:
  – web search not like human memory – alien intelligence
    ... but so is all collaboration!
internal representation

but let’s not forget the grey stuff

knowledge in the head
  – tacit not explicit
  – often hard/impossible to introspect
  – may not be ‘accurate’
  – not a facsimile

parsimony cuts two ways
  – if finding out is expensive, we remember
  – ... but not necessarily optimally (Gray and Fu)
the optimal fallacy

optimality often assumed:
   – in evolution and in learning

...but more often things are not optimal
   – path effects
   – feedback and self-reinforcing structures
   – rapidly changing environment
   – resource limits
   – optimal optimisers are not optimal
   the infinite regress
dynamic interplay

internal & external representation working as one
education

zone of proximal development
  – things near what you know, scaffolding
processing
  – integrating into existing knowledge

... but, the web is not like that

maybe OK – not what you know but how to find out
from knowledge to meta-knowledge
post-web cognition

<table>
<thead>
<tr>
<th>domain</th>
<th>what</th>
<th>how</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>concrete</strong></td>
<td>Everest is 29000 ft high</td>
<td>that an Everest web page exists</td>
</tr>
<tr>
<td></td>
<td></td>
<td>search &quot;Everest statistics&quot;</td>
</tr>
<tr>
<td><strong>generic</strong></td>
<td>airports have runways</td>
<td>airports have web sites</td>
</tr>
<tr>
<td></td>
<td></td>
<td>search for airport name, if that fails look at airport Wikipedia page</td>
</tr>
</tbody>
</table>

what we need to interpret concrete facts
meta-representation & meta-knowledge

MR is OLD

MK may be tacit, explicit, represented externally skilful and artful

... but neither ‘optimal’ nor perfect
e.g. Gray and Fu

... not even when skilled
e.g. Salmoni and Payne
Salmoni & Payne: search results

assessing relevance of search results

- title vs. snippet vs. title+snippet

results:

- title > snippet  
  snippet can be misleading

- ? title + snippet  
  more info than either, but ...

- title > title + snippet > snippet
  web experts not optimal!
breakdown and reflection

breakdown is not normal state ... but it is valuable
  – radical scepticism (Descartes)
  – reflection and design (Schon)
  – externalisation

breakdown feeds tacit skill
  – cardiology diagnosis

breakdown can be engineered
  – athletes and videos, reflection and well being

? aids for meta-learning and reflection
deeper changes

• plasticity and learning
  some changes temporary
  ... but some not

• individual cognition
  digital native may think differently  (e.g. Dundee medic’s thumbs)

• social cognition
  from small groups to global connections

• more of the same?
  language, built environment
rich dynamic of internal and external representation

not just augmentation, but change from knowledge to meta-knowledge

progress not inevitable

challenge for understanding

challenge for technology

http://tireetechwave.org/  3-7 Nov 2011