

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

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www.hcibook.com/alan/papers/websci2011-int-ext-cog/

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


IO pipeline!



embodiment and the web

embodiment = physical world ... ? digital

4E: enactive, extended, embodied, embedded



The diagram shows the four components of the 4E framework: 'enactive, extended, embodied, embedded'. Two red brackets are drawn below the text. The first bracket spans under 'enactive, extended' and is labeled 'digital implications'. The second bracket spans under 'embodied, embedded' and is labeled 'not so obvious'.

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:

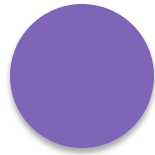
- in evolution and in learning

...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

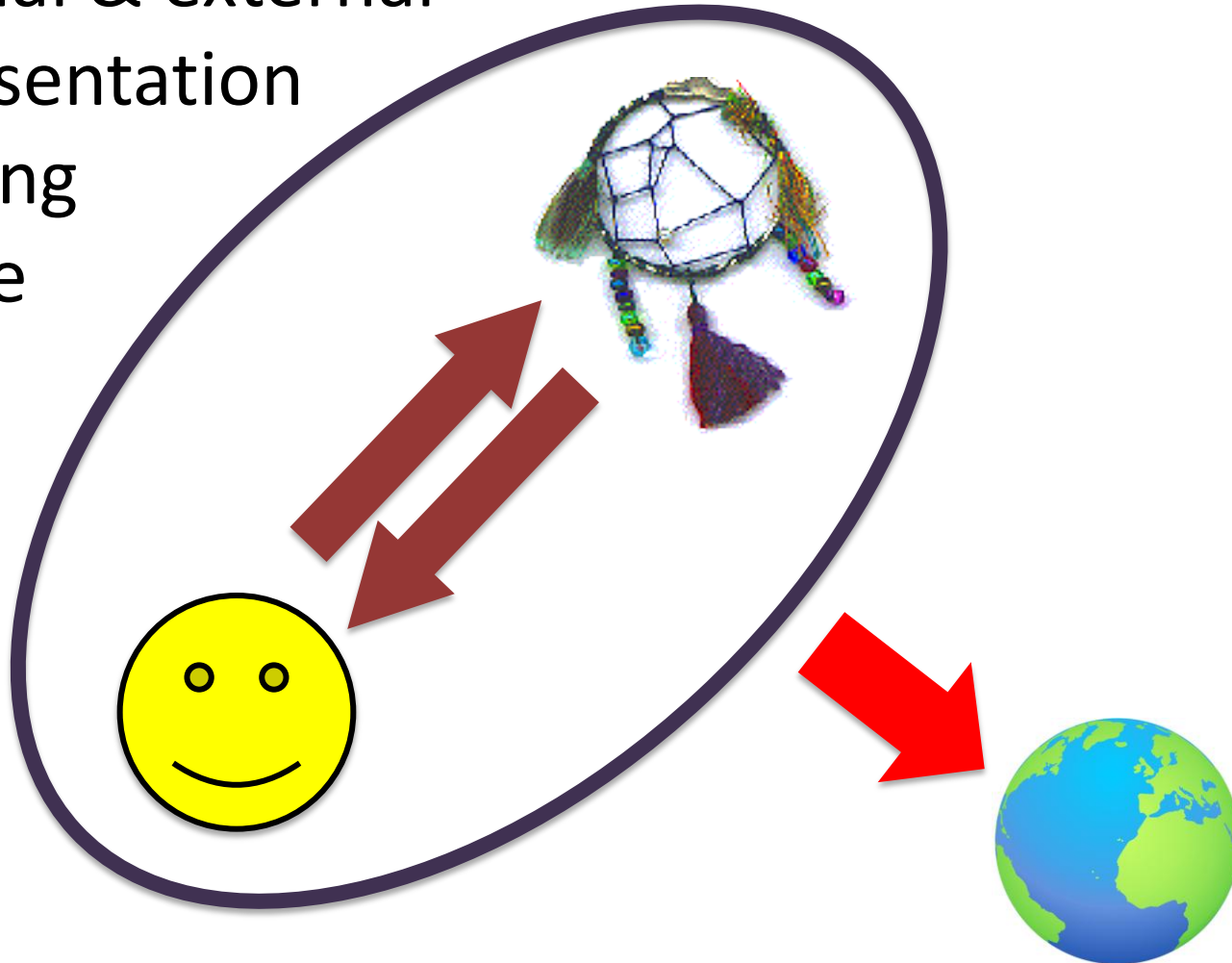
mulazimoglu @ flickr





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

96dpi @ flickr

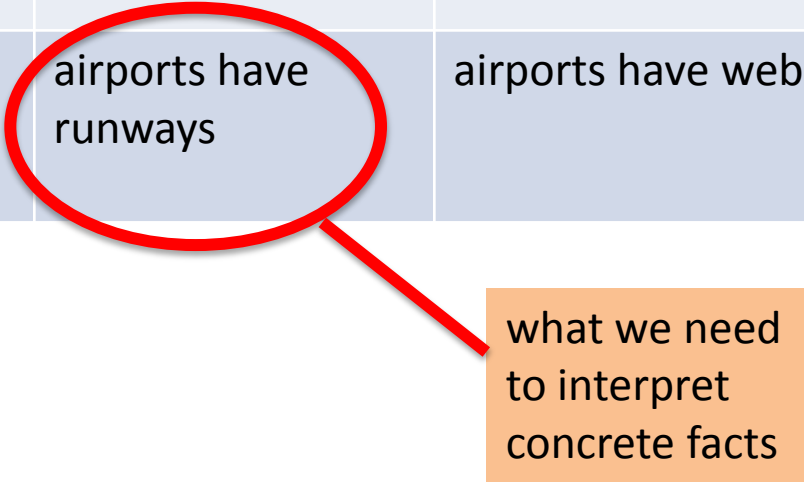


meta-representation

from knowledge to meta-knowledge

post-web cognition

		meta-knowledge	
	domain	what	how
concrete	Everest is 29000 ft high	that an Everest web page exists	search "Everest statistics"
generic	airports have runways	airports have web sites	search for airport name, if that fails look at airport Wikipedia page



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

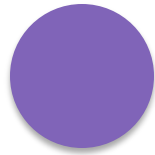
breakdown feeds tacit skill

- 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