Technologies and the Transformation of Learning: from Rock Paintings to Digital Tools

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My theme

- The relationships between learning (or thinking more in general) and material culture (technologies)
- Argument:
  - 1. all human knowing is at some stage dependent on materiality and on the co-ordination between minds, communication and artefacts.
  - 2. what we call learning changes over time and, thus, is a moving target
  - 2. this has profound implications for how we understand learning; we have to turn to history to learn how minds have been shaped by the resources for communication that we have available
Reductionism inherent to

- Behaviourism
  - Mindless body

- Mentalism/cognitivism
  - Bodiless mind

- Neuroscience
  - Nativism/Puts thinking into the brain
The presence of artefacts and technologies in human activities

- Texts and books
- Pen and paper
- Measuring devices
- Calculators
- Computers and databases
- .....

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Our capacities for interacting with others and for sharing experiences and insights in novel manners. The continuous development of conceptual worlds and social languages that allow us understand and structure in linguistic terms increasingly complex features of the world.
The consequences for human meaning-making of the marriage of

- Intellectual artefacts (concepts, formulae, systems of classification, social languages, etc.)

with

- Material artefacts (physical instruments, documents, databases, registers etc.)
A long-term perspective on the evolution of knowledge and knowledge sharing

- The making of images
- The invention of writing, number systems and other symbolic resources
- Book printing
- Mass-media
- Digital technology
- ……
A key process in the development of human knowledge is the process of externalisation or objectification of experiences and insights.

- Inscriptions implemented into material objects.
The evolution of cultural tools
Invention of number systems
Invention of number systems

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Mayan positional number system
[\text{LinCS}]
But ….

- Our understanding of cognitive phenomena (learning, thinking, perception etc.) are heavily biassed towards what we conceive of as mental entities/processes
- ’Brain (or ’mind’)-centered’ conception of what it means to know something
- Model for the institutional interpretation of learning
Cultural tools …

- Many, if not most, externalisations are simultaneously physical and discursive (intellectual). That is, it is impossible to maintain a distinction between the two dimensions. All cultural tools at some stage rely on materiality.
What artefacts do:

- Serve as tools for mediation in social practices.
- Stabilise human practices.
- Facilitate continuities across generations.
- Co-ordinate and discipline human reasoning by suggesting how to do things. Artifacts are *in*-structive and *in*-formative (affordances).
- Reorganise the relationship between mental, communicative and physical elements of human action.
The ’cognitive’

So, if our interest is in learning, rather than presupposing that these two entities are distinctly separated, we must consider how they interact.

This is one key to understanding how human learning has changed through history and how it is currently changing in the wake of digital technology.

The ’material’
Question: how do people and tools shape each other?

- The interaction between
  - The social organization of information/experiences
- Learning by individuals
- Mental arithmetic
- Paper and pencil
- Minicalculator

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- External symbolic storages (ESS) (Donald, 1991)
- Artificial memory systems (AMS)
External symbolic storages (ESS)

- Books
- Libraries
- Maps and charts
- Registers
- Databases
- Instruments (clocks, compasses, etc.)
- ..................
AMS/ESS

- Through such Artificial Memory Systems we build up a gigantic Collective (or Social) Memory (which is also becoming increasingly globalized)

- Digital technology in many respects solves the 'storage part' of the information built up in society, in this sense it transforms learning
Characteristics of AMS/ESS

- Exist in public space
- Are relatively permanent
- Can be returned to repeatedly
- Unlimited in capacity
- Can be organised on the basis of explicit and public rules
Externalization of

- Information (texts, spoken narratives etc.)
  - Human experiences and knowing converted into information by means of inscriptions in ESS and then reconverted into knowing by someone who masters the code (Wenger, 1998)
Externalization of

- Cognitive processes
  - Book-keeping soft-ware
  - Spell and grammar checks
  - Navigation instruments
  - Calculators
  - .......

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Transformations of learning

- We master complex tasks without understanding the sequential steps (calculations, book-keeping, projections of visual information, grammar etc.)
- Technology functions as a 'black box' (trust)
- We increasingly learn from the 'complex' to the 'elementary'
- We 'understand' as part of practices, we do not necessarily 'understand' as part of hierarchically organized knowledge (such as in the disciplines)
Interpretations of learning in the digital age

- Learning becomes conceptually orientated
- Meta-communicative and meta-cognitive skills (modelling)
- Learning is knowing what is relevant to know
- Learning becomes increasingly ’procedural’
The new metaphor for learning

- Learning is creating 'the new' rather than giving back what is already given
- Learning is in the performative
Implications for research:

- Learning is tool-dependent
  - Where is the knowing?

- Requires a new object of study and a new unit of analysis in which the powers of the ’hybrid mind’ (Donald, 1991) are taken into account