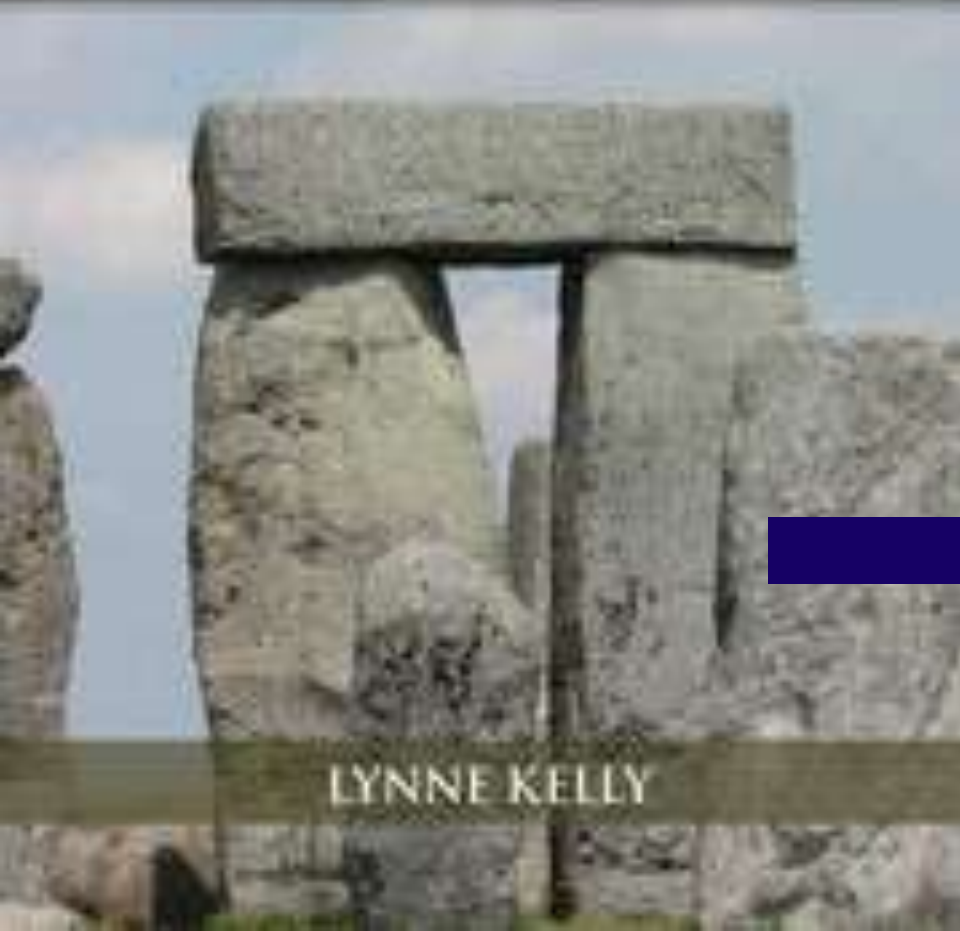


KNOWLEDGE AND
POWER IN
PREHISTORIC
SOCIETIES



LYNNE KELLY

Discussing the
emergence of formal
knowledge
management systems
in prehistory

—

Bill Hall & Tony Smith

Melbourne Emergence Meetup
Thursday, July 9, 2015

Tonight

- Tonight we review a book about knowledge management systems that we both believe will revolutionize the way we understand the Aboriginal Dreaming and ancient monuments like the henges of western Europe and the British Isles, and Göbekli Tepe in south-eastern Turkey.

INVITATION



You are invited to the book launch of

Knowledge and Power in Prehistoric Societies

Orality, Memory, and the Transmission of Culture

by Lynne Kelly

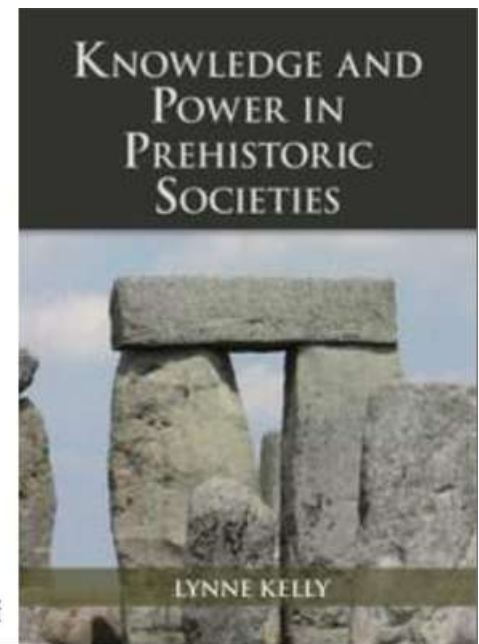
In this book, Lynne Kelly explores the role of formal knowledge systems in small-scale oral cultures in both historic and archaeological contexts. This book demonstrates how an understanding of rational intellect, pragmatic knowledge and mnemonic technologies in prehistoric societies offers a new tool for analysis of monumental structures built by non-literature cultures.

WHEN: 12pm – 2pm, Friday 3rd July, 2015

WHERE: Co-op Bookshop, La Trobe University Melbourne Campus

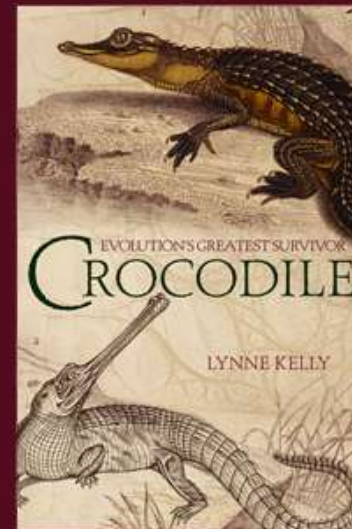
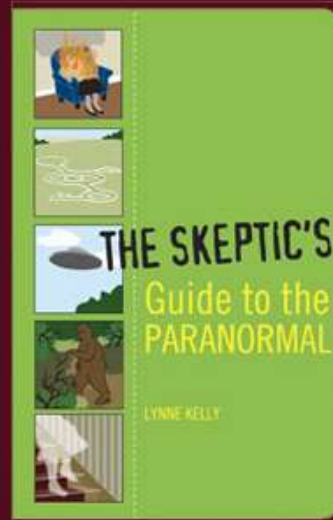
Light refreshments will be provided

For further details please contact sm3090@coop.com.au

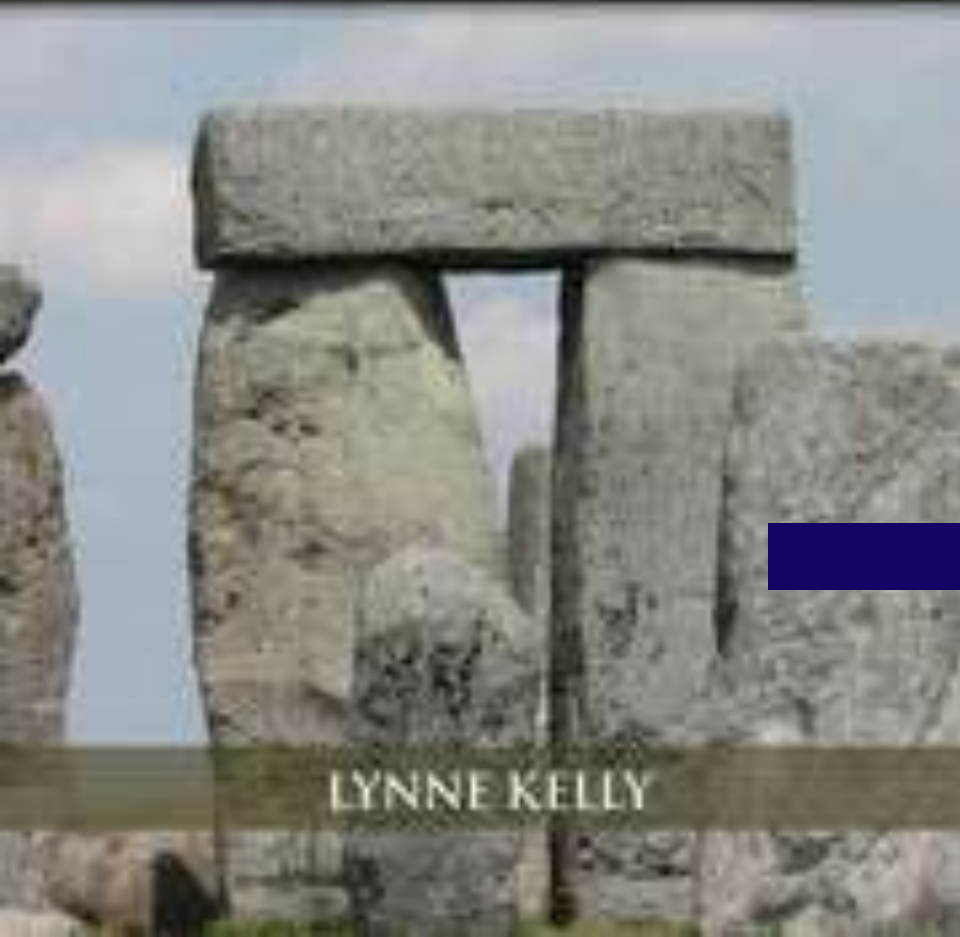


The Author - Lynne Kelly, PhD La Trobe 2012

- Bachelor of Engineering, naturalist, high school science teacher, science writer, amateur magician & story teller from Castlemaine
- Had explored Aboriginal knowledge of natural history for her popular science books on crocodiles and spiders.
- Visited Stonehenge on a holiday with her archaeologist husband



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Lynne's thesis (heavily paraphrased)

—

Ancient monuments such as Stonehenge are mnemonic devices forming part of formal knowledge management systems that helped prehistoric cultures accumulate and transmit the great increases in new knowledge required to make the transition from hunting and gathering to specialized trades and roles in settled agricultural communities and city-states

Primary oral cultures

- Oral vs literate cultures
 - Primary oral cultures have had no contact with written language and thus no means to record knowledge explicitly
 - Except for manufactured tools and modifications to the environment, primary oral cultures have no world 3 in Popper's sense
 - Such cultures live entirely within world 2
 - No choice but to preserve culturally accumulated knowledge and living memory
 - Only way to transmit such knowledge is via speech and demonstration
- A few primary cultures still exist that have had only recent or very limited contacts with literate cultures
 - Caveat: anthropologists with European backgrounds have considerable conceptual difficulties understanding their stories unless they understand their multi-layered mnemonic functions
 - It is clear that many cultures do use a number of mnemonic techniques to make their stories memorable and transmissible

Indicators that primary oral cultures made monuments for mnemonic use

- 10 indicators that may be identified in the archaeological record
 - Stratified society with no sign of individual wealth or coercion
 - Public and restricted ceremonial sites
 - Large investment of labour for no obvious [utilitarian] reason
 - Signs of a prescribed order - the Method of Loci
 - Enigmatic decorated objects
 - An imbalance in trade
 - Astronomical observatories and calendrical devices
 - Monuments that reference the landscape
 - Acoustic enhancement
 - Rock art as mnemonic
- Where most of these indicators are present in association with complex monumental structures serving no obvious residential or utilitarian function, it is likely that the structures served as "palaces of the mind" for rehearsing & transferring knowledge using the method of loci

Method of Loci

- Mnemonic tool known to ancient Greeks and Romans
- Today mainly used as a tool by quiz champions and magicians to recall arbitrary facts and lists of information
- Uses "Theatres of Memory"
 - Well remembered complex space (i.e., house, theatre, town, etc. with many memorable locations)
 - Think about walking a familiar path through that space
 - Index things you want to remember against specific locations in that space as you pass them on an imaginary or actual walk along that path
- Enhance each memory by making the memory more memorable
 - Story
 - Rhyme and rhythm
 - Singing
 - Dancing
 - Acting out
 - Recall, rehearse, and test

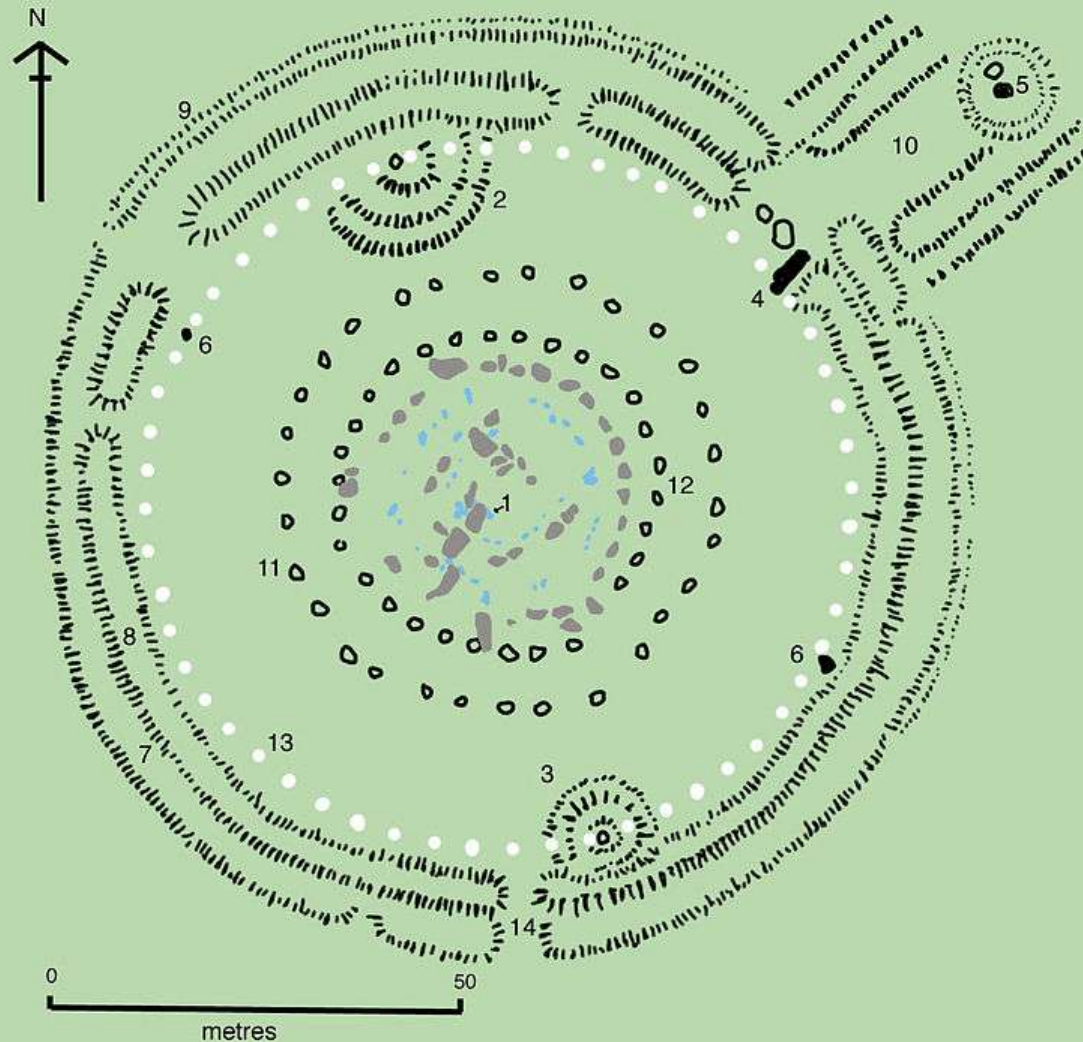
Aboriginal dreaming

- Nomadic hunters and gatherers moving through landscapes would naturally associate memories of events (observations, actions, etc.) with features of the landscape where they occurred
 - Provided the loci against which knowledge associated with the location was recalled
 - Critical knowledge associated with location: food, water, dangers, resources for tool making, shelter, etc.
 - Knowledge may need to be preserved for generations before it is again needed
- The Aboriginal Dreamings are oral repositories of accumulated cultural and scientific knowledge of the natural world
 - Critical knowledge required to support survival in a harsh world
 - Natural history lore
 - Technology handbooks
 - Social law
 - Song lines are imagined or actual paths through the landscape
 - Indexing essential knowledge retained in living memory
 - Preserved knowledge is transmitted across generations by periodic rehearsal in song, dance and ritual (Method of loci)

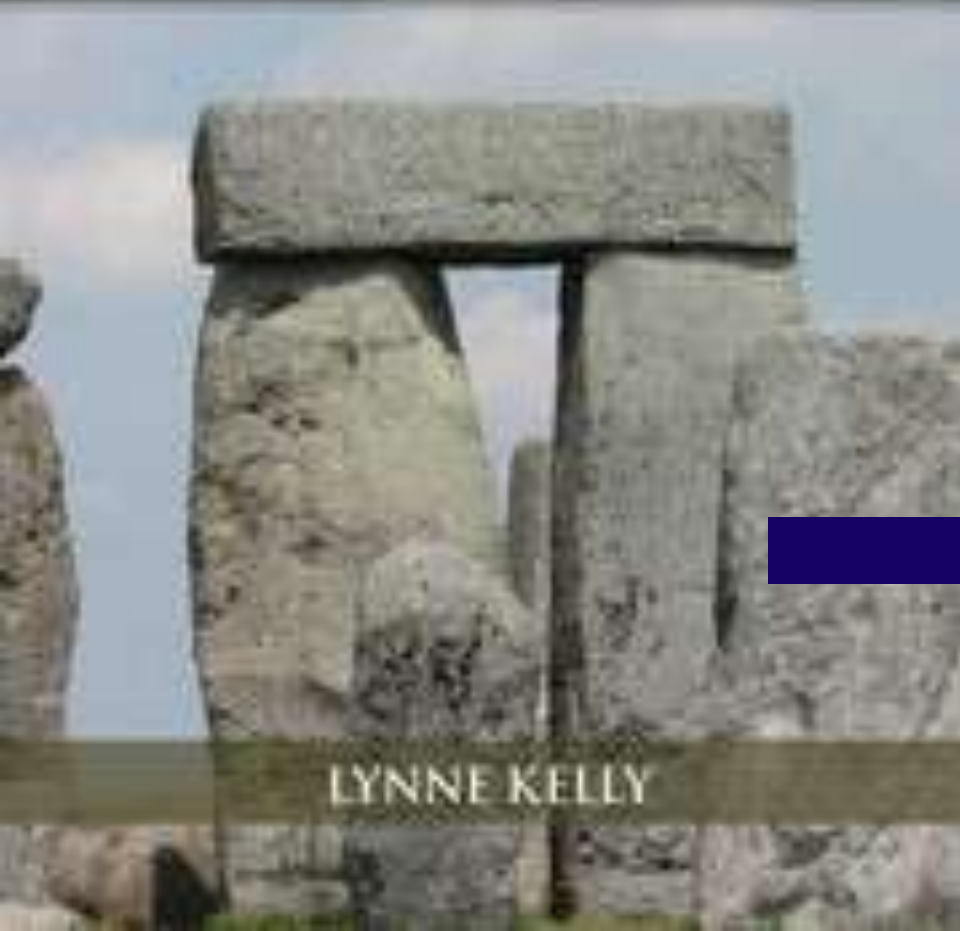
Comparison of the mnemonic practices of three primary oral cultures

- Yolngu Aboriginals in NE Arnhem Land (Nhulunbuy)
 - Nomadic hunters and gatherers
 - Very little European contact before late 1800s, with further contact minimized by permit system after 1918
 - Extensive natural history, geographic and geneological knowledge
 - Demonstrate operation of most of the 10 indicators.
- Pueblo Indians in the US south-west
 - Settled with small-scale agriculture and hunting
 - Kachina cults maintain detailed botanical & zoological knowledge
 - Practical agricultural knowledge
 - Knowledge for the sake of knowledge
 - Associations with Chaco Canyon cultures
- Poverty Point (Mississippi delta) in the North American Archaic
 - Thousands of years of mound building by hunters and gatherers
 - Poverty Point ceremonial site built/used 1650 and 700 BCE
 - Probably a meeting place for periodic ceremonial events
 - Trade goods from a large area of eastern US

Passage tombs, henges, & Stonehenge



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Lynne's work is
revolutionary in the
context of the history
of science

—

Bill Hall's commentary

Karl Popper and Thomas Kuhn on the growth of knowledge

- Popper: science advances with "bold hypotheses" followed by criticism & attempts to refute
 - If true, would be able to a broader understanding of reality
 - Boldness
 - Degree of applicability, or scope
 - Novelty (i.e. a genuinely *new* departure from the received views)
 - Makes novel predictions, or stimulates research (heuristic power)
- Kuhn: "normal science" vs "revolution" (paradigm shift)
 - Paradigms and incommensurability
 - Revolutionary ideas are those that when accepted reorganize worldviews of those who accept the new idea.
 - See evidence in new frameworks
 - Cf Popper's bold hypothesis
 - E.g. Plate Tectonics in geology/geography

HIPPOCAMPUS

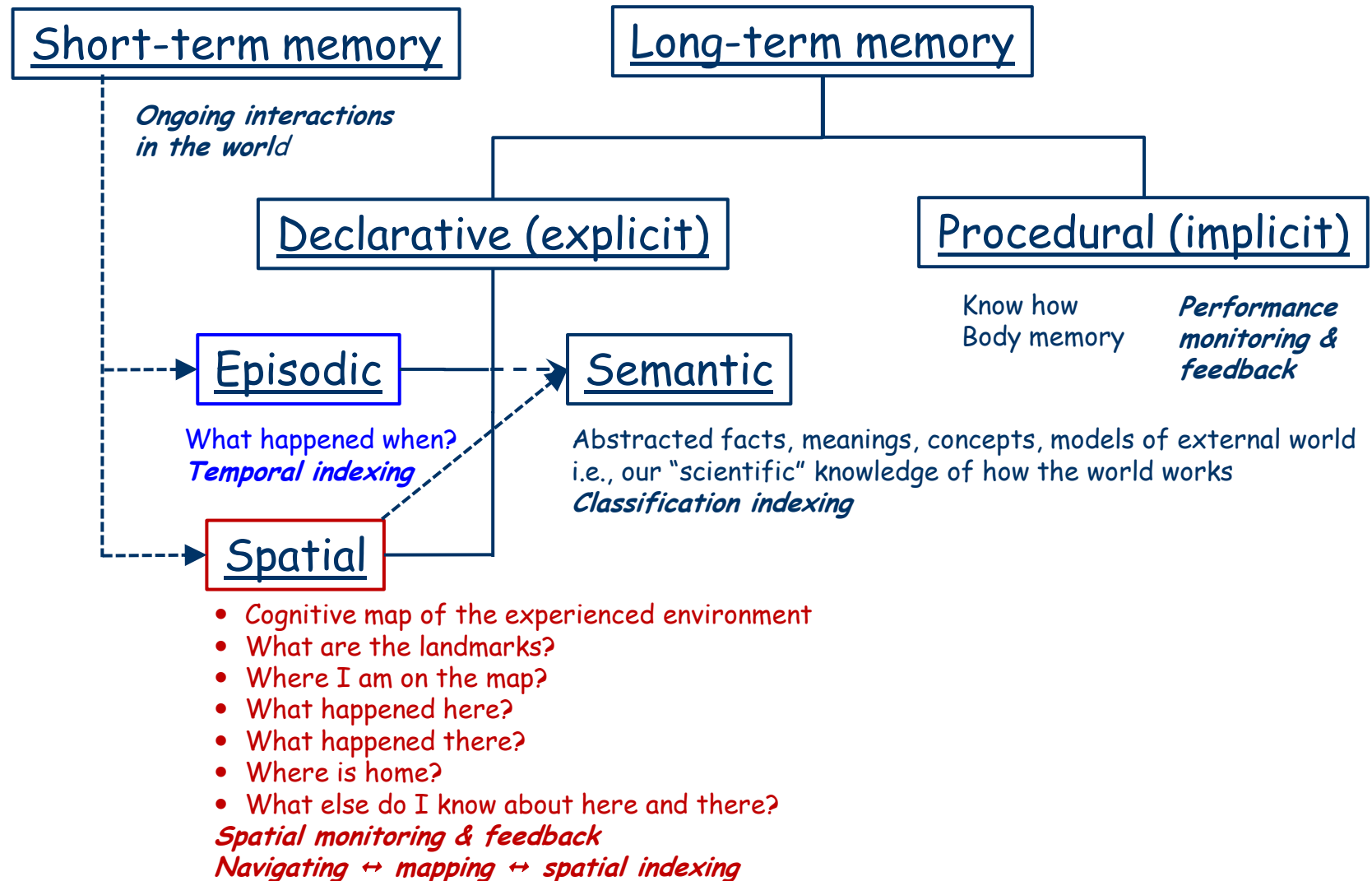


Neurological context for the Method of Loci

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The hippocampus, grid cells, place
cells, and episodic memory
(Nobel Prize in Physiology or
Medicine 2014)

Functional organization of long-term memory



The hippocampus indexes declarative memory

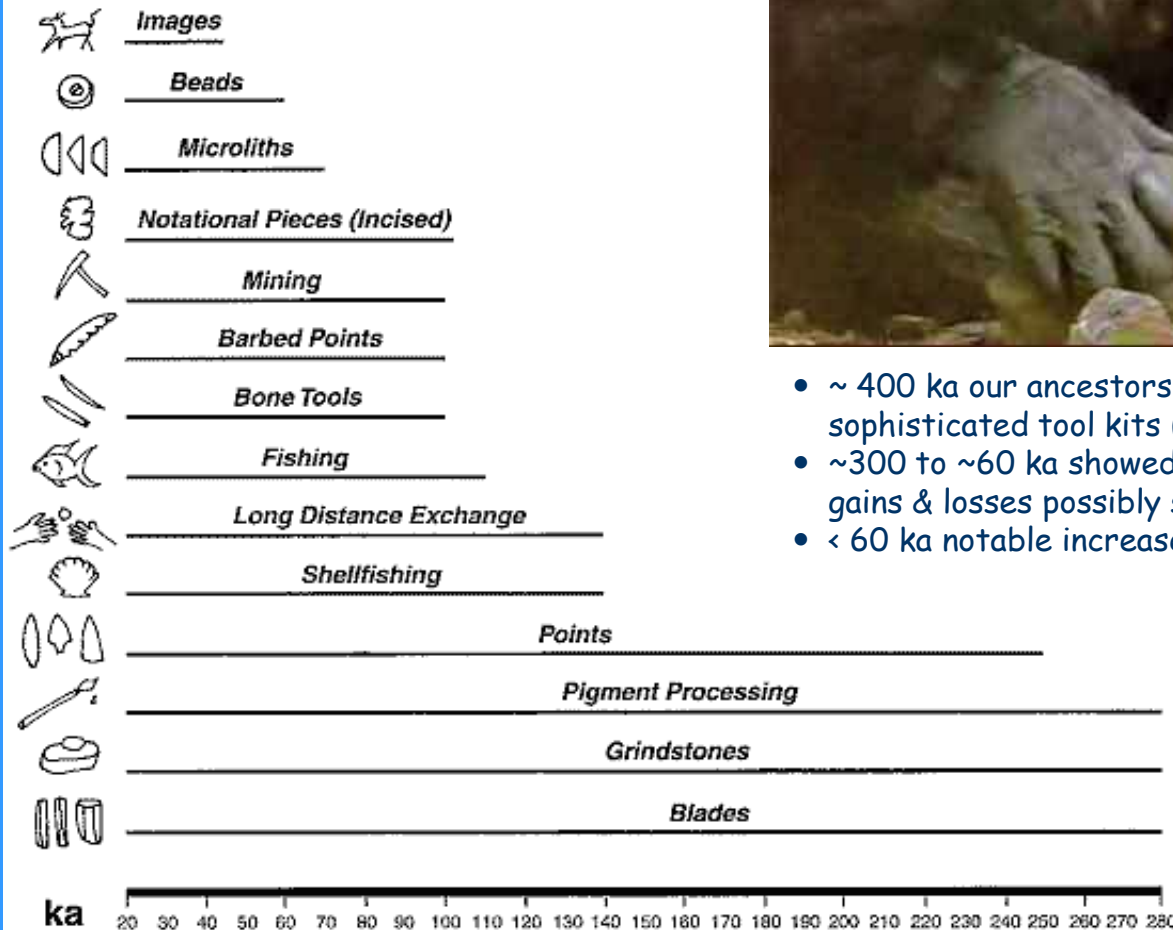
- Spatial memory → cognitive map (CM)
 - CMs construct, accumulate and organize knowledge along spatial coordinates
 - Uses visualization to enhance recall and learning of information
- Neural correlates
 - Spatial & episodic memory affected by lesions to the hippocampus
 - Identification and location of special cell types playing central roles in indexing system (2014 Nobel Prize in Physiology or Medicine)
 - John O'Keefe - identified 'place' and 'boundary' cells in hippocampus
 - Edvard and May-Brit Moser - identified grid cells in entorhinal cortex adjacent to hippocampus
 - Also 'time' cells to track & record temporal sequence and place in time
 - Connects to visual processing
 - Has all the features to be the master system for relationally indexing all long-term knowledge.
 - Explains how Method of Loci can help users consciously enhance and organize for easy retrieval items of knowledge deemed to be important
 - Remember the story
 - Index other memories to places in the remembered story

Environmental mapping essential for all self-mobile animals

- Basic knowledge requirement for survival
 - Model/map of the essential environment
 - Landmarks & coordinates
 - Know where shelter is
 - Know where resources can be found
 - Know where dangers lurk
 - Know where I am relative to the above
- Neurosensory capabilities
 - Sensory capabilities to determine spatial relations to landmarks
 - Processing capabilities
 - Recognize landmarks & relate these to map
 - Determine my location on map relative to shelter and needs
 - Access and evaluate memories relating to my location on map
- Hippocampal region known to provide the indexing system for this kind of knowledge in mammals and birds

Phenomenal changes in the rates in the cultural accumulation of technical & natural history knowledge

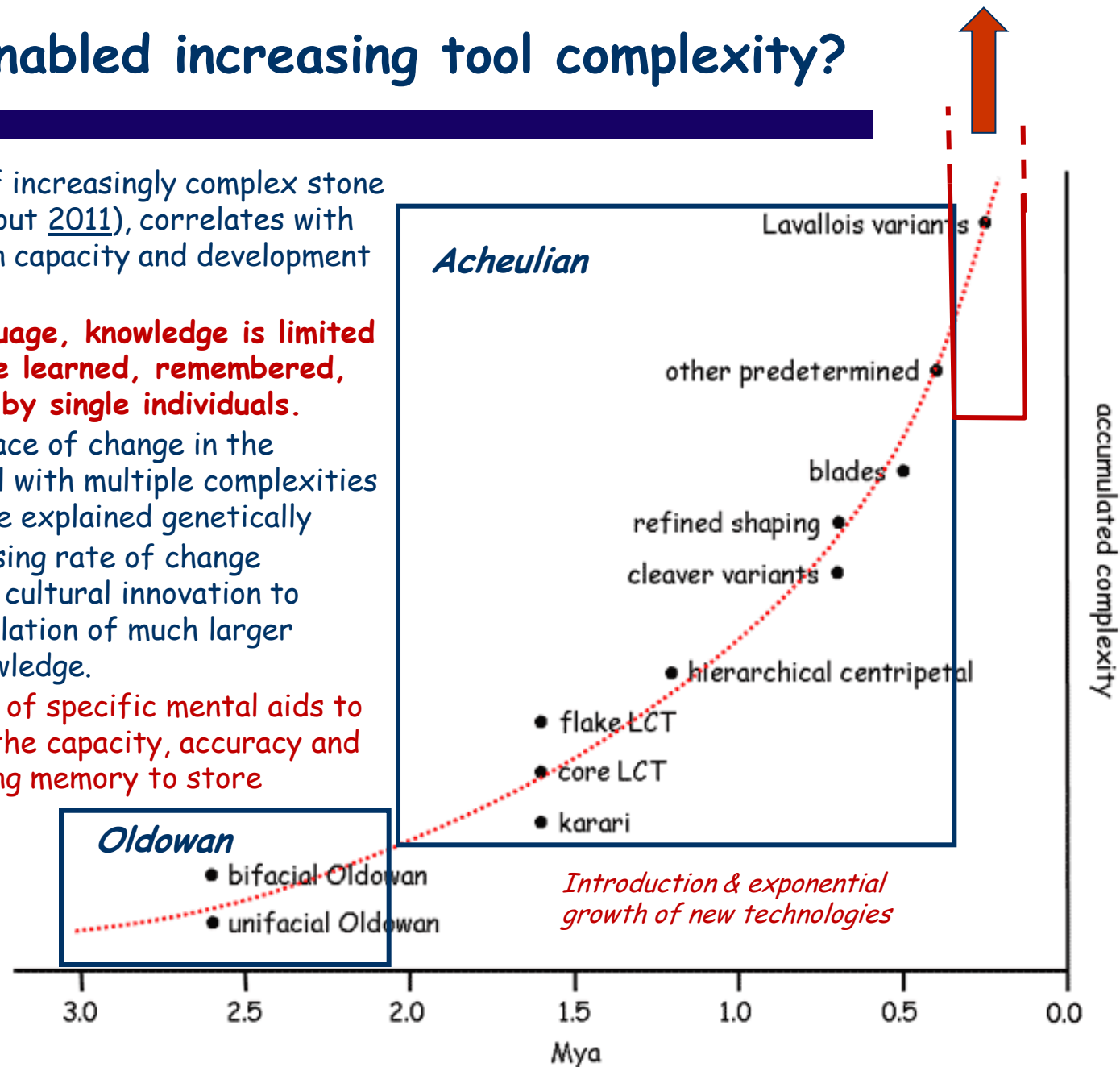
- ~ 5 ma our common ancestors with chimps knew enough to use simple stone tools
- ~2.5 ma early *Homo* knew enough to be top carnivore on the savanna



- ~ 400 ka our ancestors began developing more complex, sophisticated tool kits (acquisition of speech?)
- ~300 to ~60 ka showed technological quasi stability with gains & losses possibly showing a capacity limit was reached
- < 60 ka notable increase in development of complex tech
 - ~60 ka hunter-gatherers invaded Eurasia as top carnivores
 - ~12 ka beginning Neolithic (Agricultural) Revolution
 - ~9.5 ka complex urban townships, e.g., Çatalhöyük

What enabled increasing tool complexity?

- Development of increasingly complex stone tools (after Stout 2011), correlates with increasing brain capacity and development of language.
- **Even with language, knowledge is limited by what can be learned, remembered, and passed on by single individuals.**
- By < 500 kya, pace of change in the capacity to deal with multiple complexities is too fast to be explained genetically
- < 50 kya increasing rate of change suggests major cultural innovation to support accumulation of much larger volumes of knowledge.
- **mnemonics: use of specific mental aids to again increase the capacity, accuracy and duration of living memory to store knowledge**
 - Storage
 - Indexing
 - Recall
 - Transmission



Becoming settled - surmounting the limitations of nomadic life

- Nomads limited to technology they can carry with them or fabricate on demand
- Accumulating knowledge for more, and more effective technologies enables more effective harvesting of resources over smaller geographic areas
 - Increased population size adds capacity for further accumulation of specialized cultural knowledge
- Becomes practical to establish core living areas
 - Permanent shelters (i.e., houses)
 - Accumulation of tools and construction of specialized processing areas
 - Specialized structures for the long-term, safe storage of food, other resources and cultural activity
- Reduced contact with the broad landscape combined with need to manage more and more specialized technology related knowledge
 - Paths in the landscape no longer provide useful indexes for those trades & guilds that don't traverse them
 - Need to make new mnemonic paths in compactly constructed landscapes
- Solution: Kelly (2012). *When Knowledge was Power: Build compact monumental landscapes that can be traversed sequentially* (e.g., Göbekli Tepe, Stonehenge, Poverty Point, Chaco Canyon Kivas, etc.)
 - Göbekli Tepe (not fully excavated) dated ~ 11 ka southern Turkey 3 ka before the agricultural revolution
 - No habitations in immediate vicinity
 - Several circular structures containing iconic monuments
 - Suggestion: each specialization has its own guild-hall for the rehearsal and transmission of its secret and arcane knowledge
 - Sequence of memorable markers used as mnemonic index loci organized to be traversed in ritual procession & dance
 - May be a number of levels of recognized expertise where initiates must demonstrate accuracy and completeness of their memory
 - Other sites from primary oral cultures have similar features



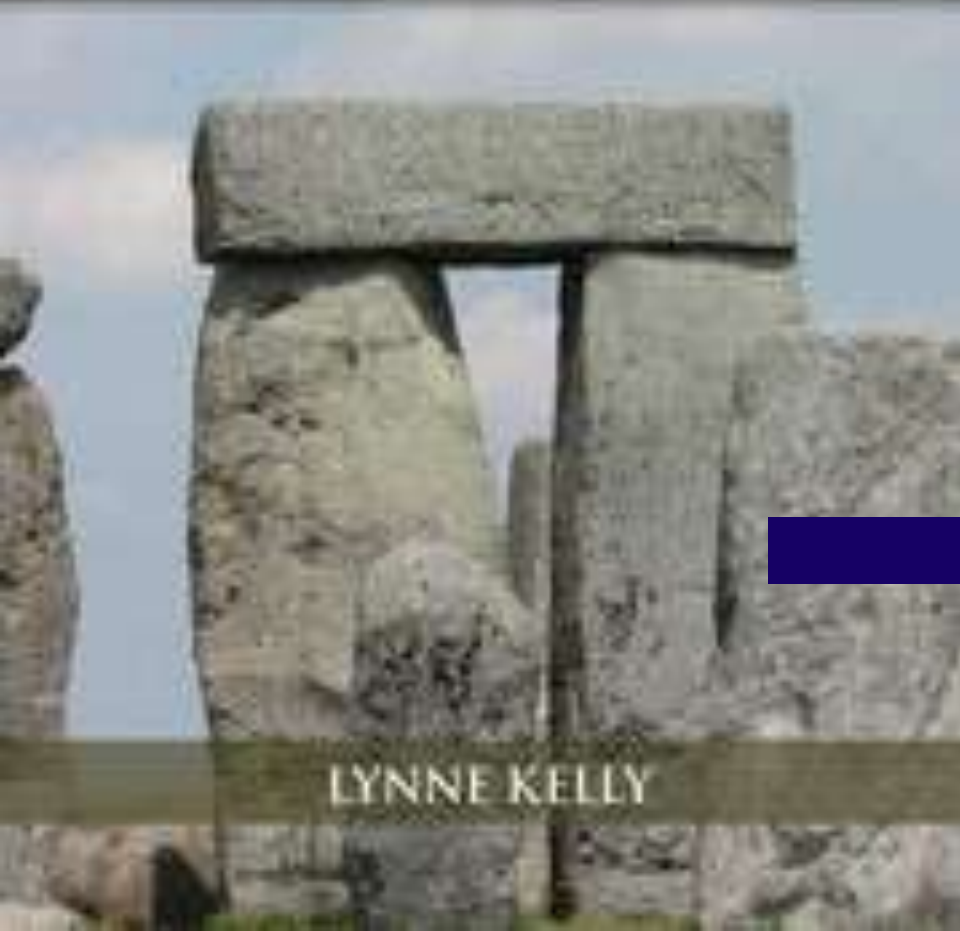
Mnemonics, settlement, the agricultural revolution and increasing cultural complexity

- With settlement, nomadic groups become territorial and build villages
- Positive feedback drives ever-increasing growth rate of cultural knowledge accumulation for ever-increasing ecological hegemony over environmental resources
 - Culturally accumulating knowledge enables more efficient/effective control & of local resources
 - Surplus resources enables population growth providing more capacity for cultural memory
 - Development of ever more sophisticated mnemonic devices
 - Greater population allows more specialization of crafts, trades and guilds able to accumulate still more varied and detailed knowledge of the world'
- Cf Masonic ritual, craft guilds
- Tracking demographic and cultural transitions in the Near East from small nomadic groups of hunter-gathers, through settled groups of local foragers, to the formation of agricultural towns:
 - Bar-Yosef, O. 2011. Climatic fluctuations and early farming in West and East Asia. *Current Anthropology* 52(S4), S175-S193 - <http://tinyurl.com/lv5rhgn>.
 - Goring-Morris, A.N., Belfer-Cohen, A. 2011. Neolithization process in the Levant: the outer envelope. *Current Anthropology* 52(S4), S195-S208 - <http://tinyurl.com/kjgyu5d>.
 - Belfer-Cohen, A., Goring-Morris, A.N. 2011. Becoming farmers: the inside story. *Current Anthropology* 52(S4), S209-S220 - <http://tinyurl.com/lrttpv6>
 - Zeder, M.A. 2011. The origins of agriculture in the Near East. *Current Anthropology* 52(S4), S221-S235 - <http://tinyurl.com/mr8grhj>
 - Vigne, J.-D., Carrère, I., Briois, F., Guilaine, J. 2011. The early process of mammal domestication in the Near East: new evidence from the Pre-Neolithic and Pre-Pottery Neolithic in Cyprus. *Current Anthropology* 52(S4), S255-S271 - <http://tinyurl.com/kr4yvvyo>
 - Bocquet-Appel, J.-P. 2011. The agricultural demographic transition during and after the agriculture inventions. *Current Anthropology* 52(S4), S497-S510 - <http://tinyurl.com/kh2yhns>

Summing up

- The social construction of massively costly "memory palaces" provides tangible archaeological evidence that mnemonic technologies were consciously used to assist the accumulation, preservation, management and transmission of the orders of magnitude increase in specialized knowledge required for
 - Agricultural practices
 - Farming: land measurement, selection of crop varieties, sowing, tilling, fertilizing, irrigating, cultivating, harvesting, processing, preserving & milling
 - Animal husbandry: herding & corralling, milking & cheese-making, tanning, animal power & transport
 - Baking & brewing
 - Building
 - Masonry, roofing, brick-making, construction, structural engineering, etc.
 - Ceramics, pottery &
 - Metallurgy & tool-making
 - Medicine

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Tony's commentary