

Stone-age brain meets programming

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Introduction

- Making the most of human cognitive resources
- What cognitive resources do people have?
- Organize programming to fit people

What cognitive resources?

- Environment in which brain/mind evolved
- Debunk some myths
- What experiments tell us

Human evolution

- Lots of guesswork
- Driven by competitive advantage
- Solving problems of daily life
- Preferential female selection of mates

Time scales

- 2 million years ago: H. habilis
- 1.6 million years ago: H. erectus
- 0.5-0.25 millions years ago: H. sapiens
- 30,000 years ago: fully modern man
- 40,000-5,000 years ago: middle stone age
- 1800's: compulsory education

Stone age life

- Stable
- Knowledge transmitted through traditions and folklore
- complete information rarely available

Language

- Brain has adapted to language and language has adapted to the brain
- Language use occurred in real-time
- The horse cat mouse eat chased raced

Myths of human cognition

- Man as Rational Being
- Mental muscle
- Education teaches people to think

The human brain/mind

- Most active when watching soaps
- Is an accountant
- Sophisticated memory subsystem
- Learning

Memory

- Short term/Long term
- Semantic/Episodic
- Recall/Remember
- Forgetting

Learning

- Practice makes permanent
- Enables action without conscious thought
- Learned information modifies an existing belief system

Programming to fit people

- What do we know about reading/writing code?
- A way forward
- Some examples

What is known?

- People find reading/writing code very difficult
- No significant body of proven knowledge

Accept that

- Cannot rewire existing brain functionality
- Cannot add new processing modules to brain
- Limited real-time cognitive resources
- Primary available resource is prior learning

Real-time cognitive resources

- Short term memory
- Contents of long term memory
- Associative lookup of LTM

Complexity

- How is complexity measured?
- Overload STM
- `ciairsibmstl`

Prior learning

- Fluency in a natural language
- Cultural conventions
- Domain expertise

Some proposals

- Reduce thinking required
- Visual issues -- another talk

Minimize conscious thought

- Frequent use of known constructs
- Require developers to use these constructs

Based on existing practice

- Existing code is not going to change
- No Holy Grail?

Examples

- Sentence level
- Episode level
- Story level

Sentence level memory requirements

- $(x > y) \ \&\& \ (y > z)$
- $x > z ?$
- $(z < y) \ \&\& \ (x > y)$
- $x > z ?$

Sentence level complexity

- How is complexity measured?
- Romulus, the legendary founder of Rome, took the women of Sabine by force.
- Cleopatra's downfall lay in her foolish trust in the fickle political figures of the Roman world.

Episode level

- Requires integration of information between sentences
- Performance affected by 'distance' between related items
- Reading span performance measure

Story level

- Subjects read stories
- Recall performance heavily influenced by plot expectations

Conclusion

- Little is known about reading/writing code
- Requiring lots of thinking sounds like a bad idea
- Use techniques that minimize conscious thought
- Profit and death

References

- The Red Queen by Matt Ridley
- The Symbolic Species by Terrence Deacon
- The Cultural Context of Learning and Thinking by M. Cole, J. Gay, J. Glick and D. Sharp