


Externalization of Cognition: from local brains to the Global Brain



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Introduction

- Humans use tools.
 - create, use and refine tools.
 - extends the variety and power of our **senses, actions** and **information processing**.
- These externalizations of cognitive functions have produced major transitions in the history of culture.
 - **Writing**: externalization of memory
 - **Computer**: externalization of calculus

Body and cognition beyond the skin

- Are there other externalization possible?
- If our limit is not the skin, what is it?

- Two steps in the extensions of the self
 - direct externalization/extension,
 - connection to the internet.

- Understanding the mechanisms of the externalization of cognition is a way
 - To make sense,
 - to foresee
 - to promote
 - the emergence of the Global Brain, starting from our local brains.

Outline

- Know thou three-selves!
- Externalizing our Body
- Externalizing our Cognition
- Incubating our digital twin?
- Incubating a Global Brain?

Know thou three-selves!

- **1. Self**
- **2. Externalized Self**
 - Use of tools
 - Easy to share your extended self
- **3. Global Brain Self**

Externalized Self connected to the Internet

 - 3.1 **Social** aspect (crowd work)
 - 3.2 **Software** aspect (computer work; use of big data)
 - 3.3 Software first, then Social (or a **mix** of both!)



Externalizing our Cognition

- Memory
- Hearing
- Vision
- Computation
- Orientation
- Brainstorming
- Reasoning
- Emotions
- Actions

Memory

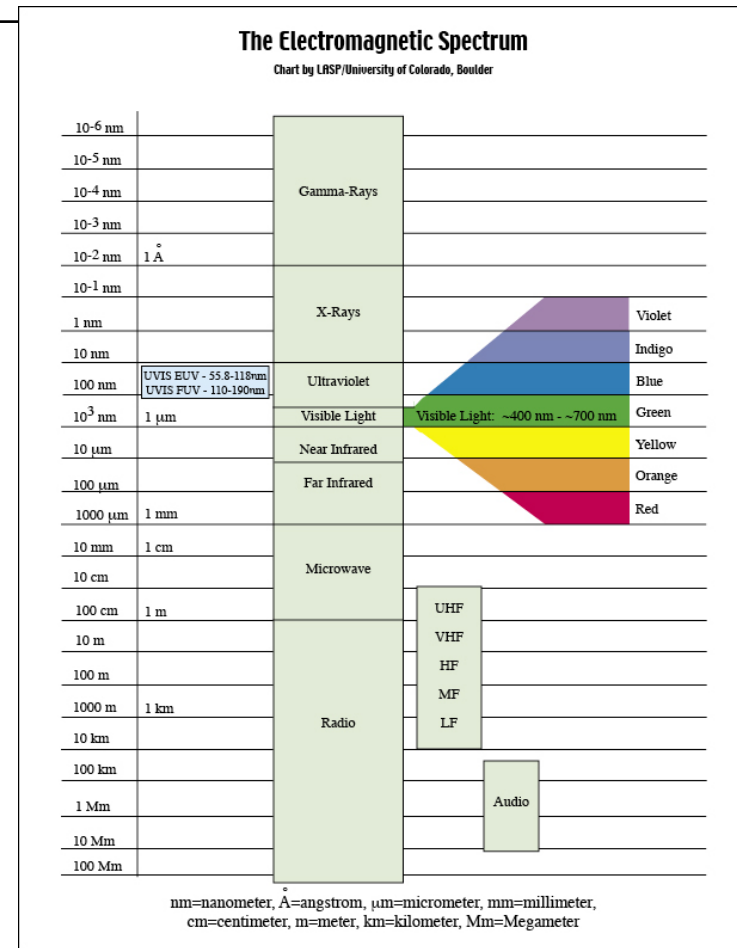
- 1. **Self:** Neuronal network
- 2. **Extended self:** writing: externalize on paper; store on computers
 - Applications: books, newspapers
- 3. **Global Brain self:** the web as a distributed memory.
 - The brain can link any arbitrary piece of information.
 - Computers could imitate this functioning (Berners-Lee 1999, p4 and p41).
 - The invention of hypertext, and later of the web 1.0 is an improvement on the invention of writing, and can be analyzed as a globally distributed, collective and dynamical memory.
 - Accessibility and retrievals: search engines

Hearing

- 1. **Self:** Ear
- 2. **Extended self:** Microphone
 - Application: radio, hearing aids devices
- 3. **Global Brain self:**
 - 3.1 Crowdsourceto humans (?)
 - 3.2 Shazam (smartphone application)
 - 3.3 Social Shazam? Crowdsourcethe guessing of a song when Shazam fails.

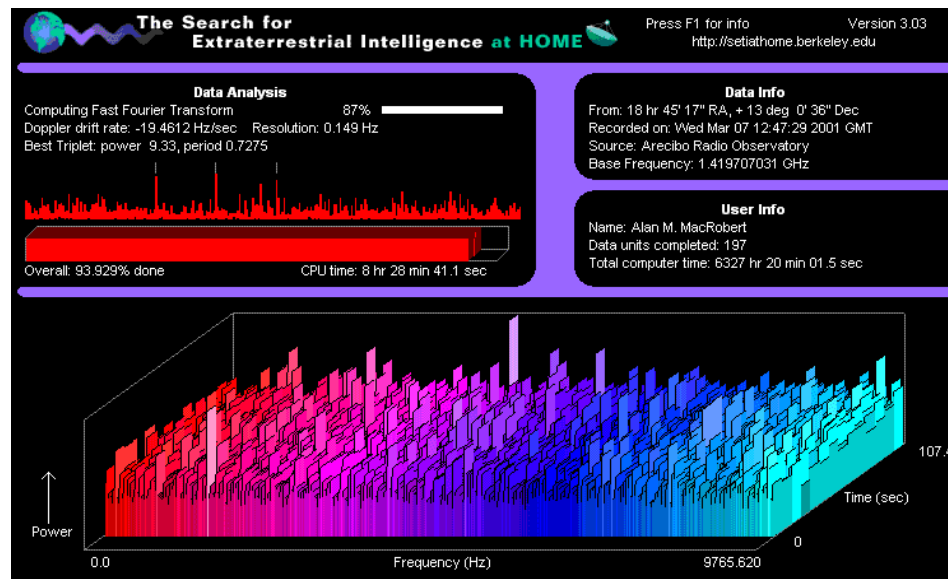
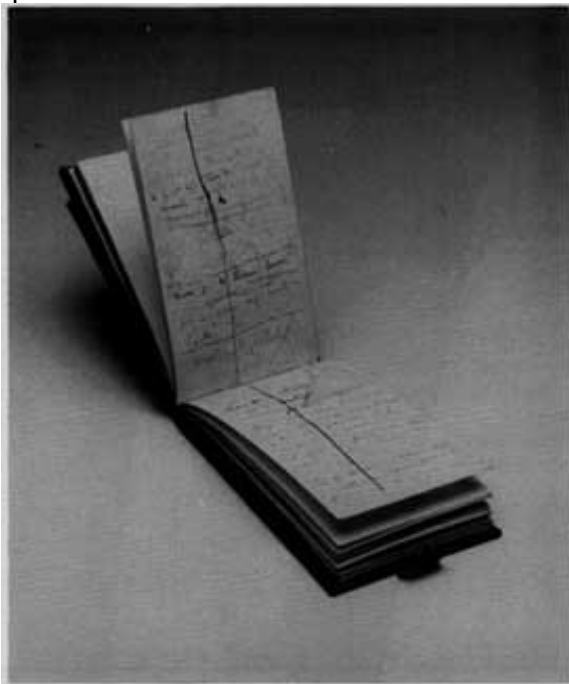
Vision

- 1. **Self:** Eye
- 2. **Extended self:** Vision tools
 - microscope / telescope (scale)
 - night vision (e.g. extension to infrared)
 - Applications: Camera, Television, Cinema
- 3. **Global Brain eye**
 - 3.1 Crowdfwork for the blind person ([Bigham et al. 2010](#))
 - 3.2 Google Goggles applications for smartphones
 - 3.3 Rely first on Software, and if it fails, ask the crowd... See also Wikitude smartphone application



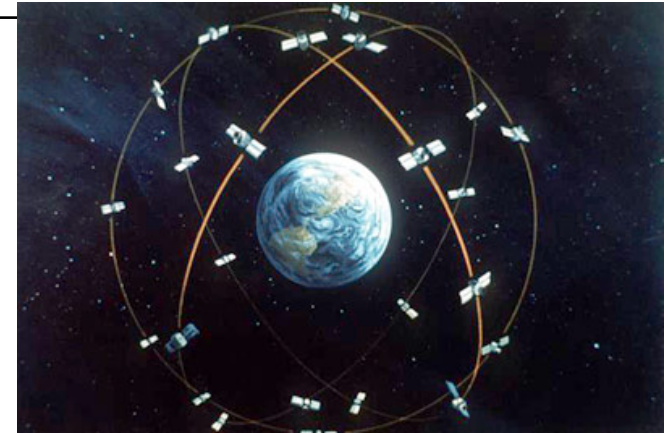
Computation

- 1. **Self:** Mental calculus
- 2. **Extended Self:**
 - Pen and paper;
 - Computers (**Turing, Church, Kleene**)
- 3. **Global Brain:** Grid computing/Distributed computation (e.g. SETI@Home project)



Orientation

- 1. No map (very hard to orient)
- 2. Map
- 3. Digital map
 - 3.1 Social: people add items on the maps, and correct the maps.
 - 3.2 GPS
 - 3.3 New applications
e.g. Facebook places: are there some of my friends around at this concert right now?

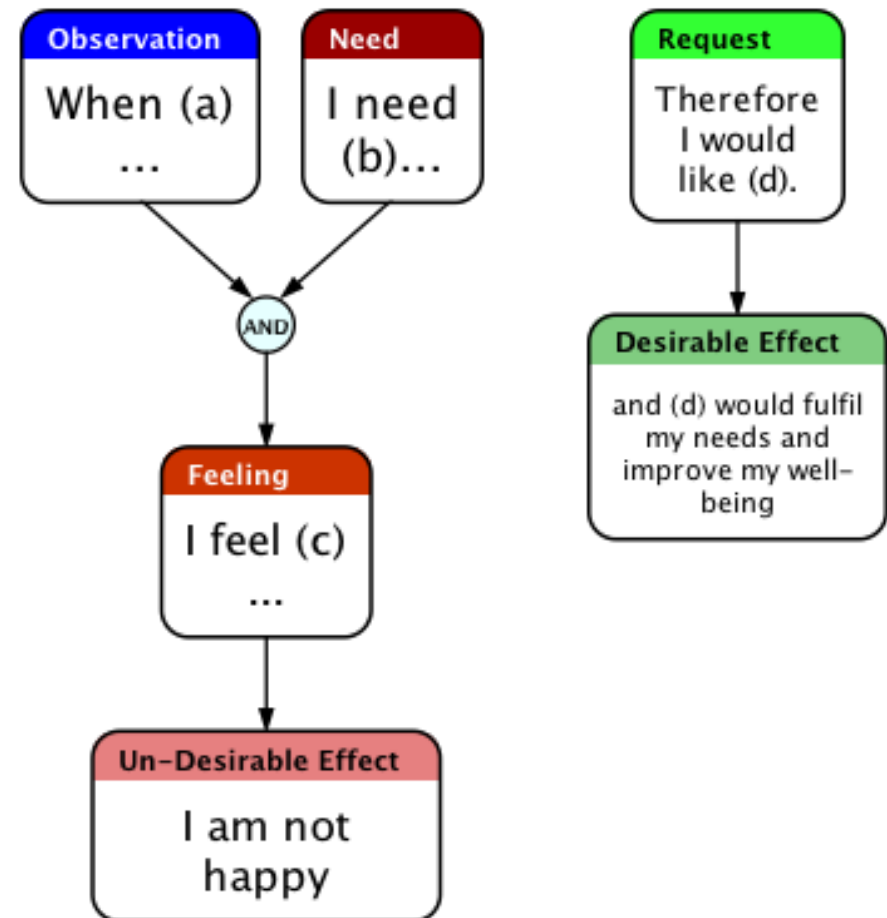


Reasoning (convergent thinking)

- 1. Stating an argument / Solving a problem
- 2. Mapping it with logical connections
 - (e.g. Theory of constraints)
 - Mathematical proving assistance with softwares (e.g. four color theorem)
- 3.1 Social: large-scale decision making;
 - E.g. debategraph, collaboratorium
- 3.2 Software to extract a logical argument from a paper? or to reason? (Prolog?)
- 3.3 Semi-automatic questioning of a reasoning?
 - Call for social criticism
 - Software assistance in criticizing one's own reasoning
 - Call the procedure "Socrates" (questions everything!).

Emotions (1/2)

- 1. Expressing our emotions (body language, sounds, words)
- 2. Structuring emotions with Theory of Constraints and Non Violent Communication (Rosenberg 2003)

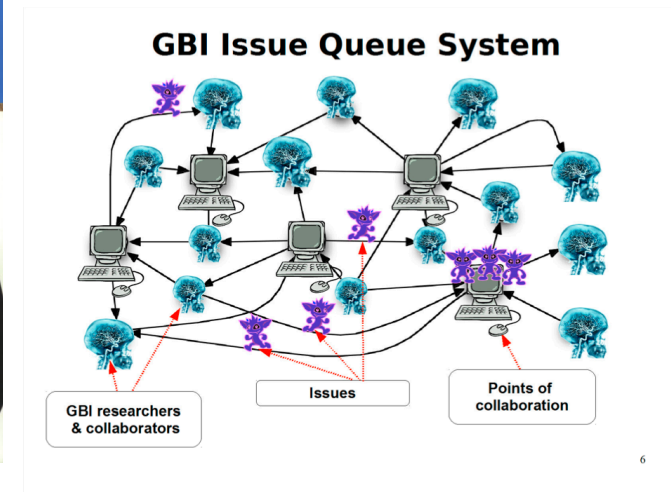
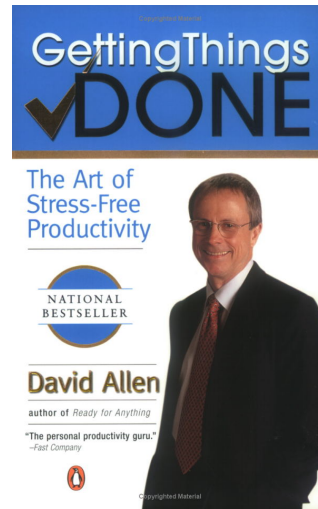


Emotions (2/2)

- 3.1 Social empathy on the web
 - Collective Psychotherapy (Morris & Picard 2012)
 - Crowdsourcing empathy?
(e.g. for people with autism)
- 3.2 What about algorithmic empathy?
 - Face recognition to recognize human emotions?
 - e.g. Microsoft Kinect
 - Many applications yet to be discovered.

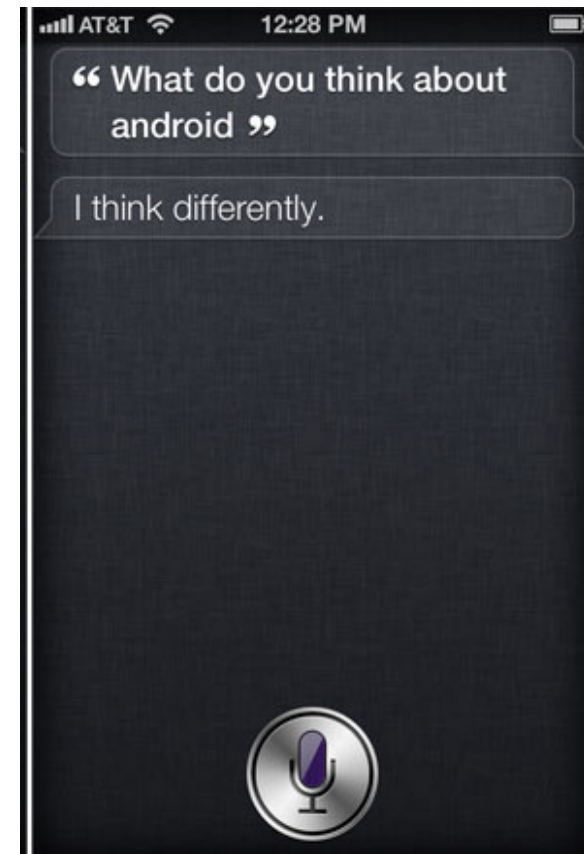
Actions

- 1. Doing
- 2. To do list
- 3. Collective action
 - 3.1 Social
 - Job-ticketing systems (e.g. in call centers, open-source development)
 - Collective "Getting Things Done" (Heylighen & Vidal 2008)
 - Issue queue (group, yet to be scaled up!)
 - Propagation of challenges
 - 3.2 Software
 - Example: Omnifocus on Iphone: contextual to-do list, depending on your location.
 - 3.3 Do what with whom, when and where?



Incubating your digital twin?

- If you externalize yourself, you logically create a digital twin
- A caring artificial agent which, whenever you want, wherever you are, will help you to remember, listen, see, calculate, orient, brainstorm, reason, communicate and act.
- Integration of all externalized cognitive functions into an artificial agent which supports our decision-making.
- Early example: Application Siris, answers questions by using big data on the web. No social aspect.
- Technical challenge: design a conversational interface



(see Smart 2003)

Incubating a Global Brain?

- Emergent global consciousness?
- An intelligent entity emerging from the interactions of softwares and humans on the internet, as our consciousness emerges from the interaction of billions of neurons in our brain?
- Fascinating and much debated question in Global Brain research and discussions.



“cognition leaks out into body and world”

Andy Clark.

Conclusion

*“cognition leaks out into body and world **and Internet**”*

- The externalization of cognition has three aspects:
 - immediate environment,
 - Internet + **social**
 - Internet + **software**
- Integrating our three selves incubates
 - our **digital twin**
 - the **Global Brain**.
- Further research:
 - Machine-machine interactions;
 - Contextual, "ubiquitous computing"
- Humans able to tap into their externalized and Global Brain selves will be fitter than others simple "selves" who don't.

Thank you for your attention!

Questions are welcome now or later:
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