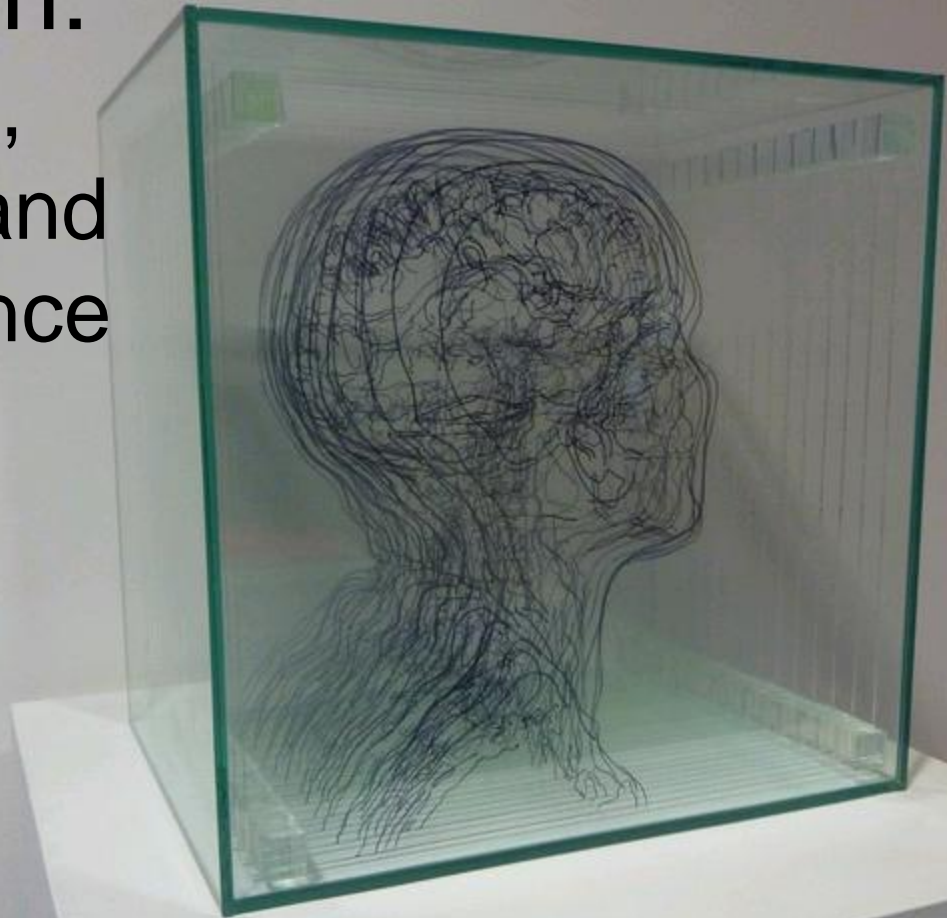
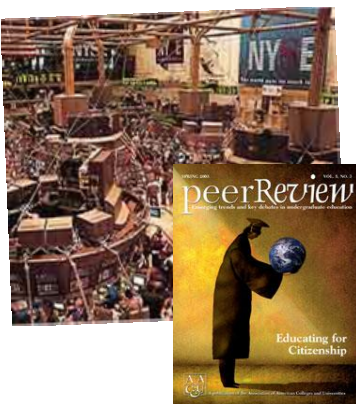
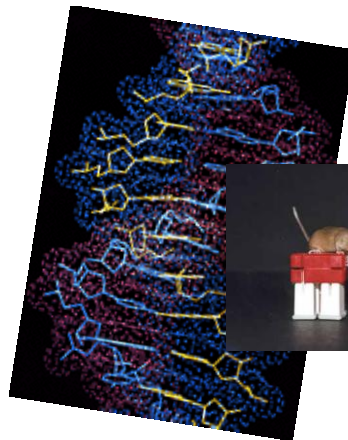
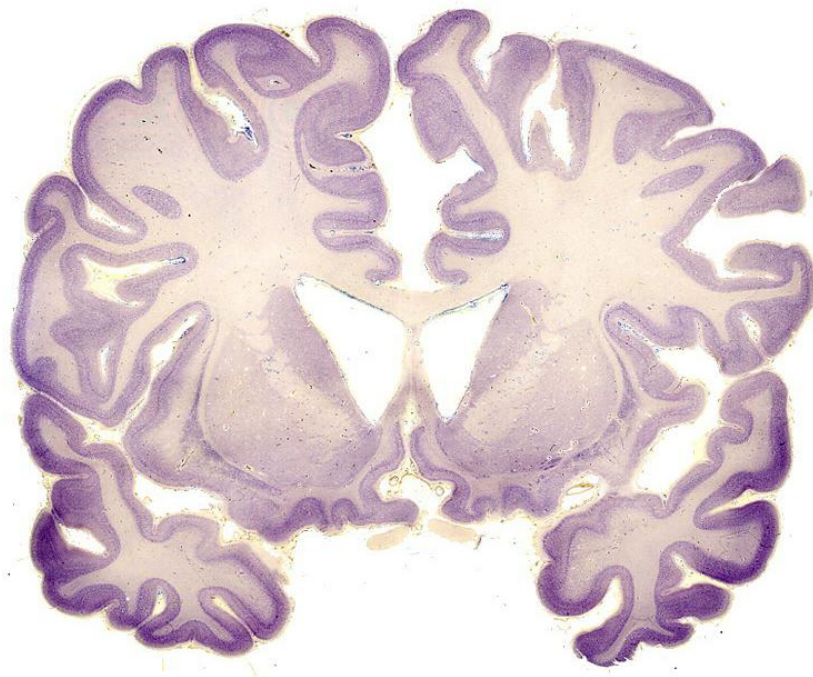


The fuzzy brain: extended minds, neural interfaces and collective intelligence

Anders Sandberg
Future of Humanity Institute
Oxford Centre for Neuroethics
Uehiro Centre for Practical Ethics
Oxford University







Technology independent concerns

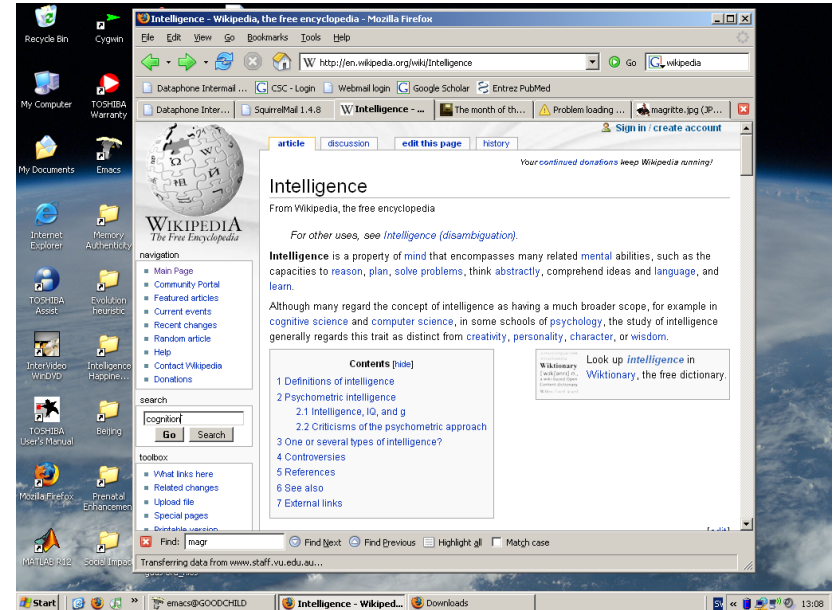
- Justice/equal access
- Cheating
 - Easy shortcuts
 - Competition
- Corrosive effects on character/humanity
 - Lack of gratitude
 - Authenticity
 - Human nature
- Free choice – coercion
 - Freedom to use
 - Coercion to use
 - Obligation to take
- Benefits drawbacks for society
 - Rat race vs. individual and collective benefits
 - Generational concerns
- Safety and efficacy
 - Long term?
 - Developing brains?
 - Testing ethics
 - Increase our vulnerability
- Social pressure
- Shifting norms normality and underperformance
- Personal identity
- Autonomy

(list borrowed/adapted from Maartje Schermer)

Embodied cognition

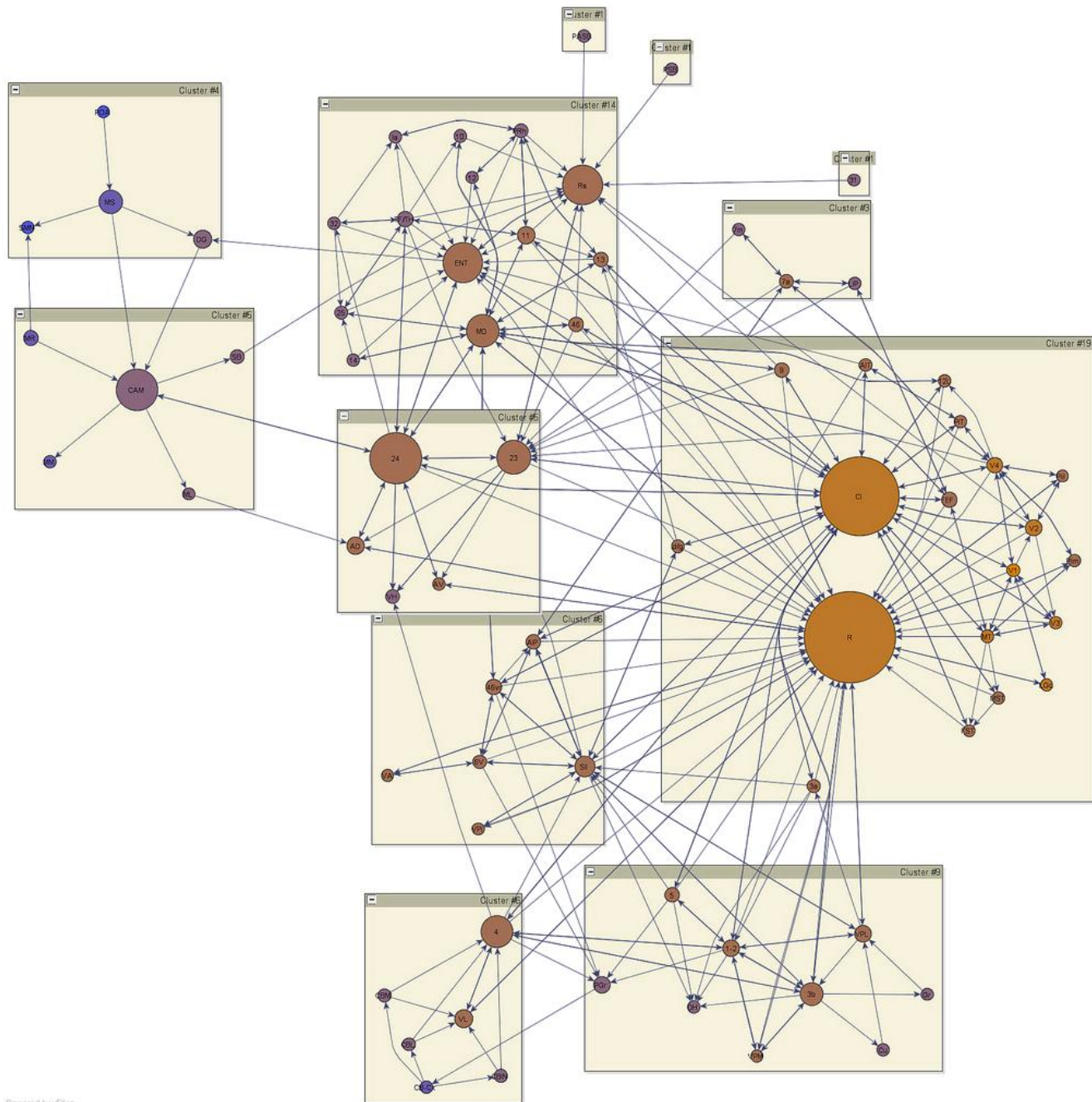


Extended cognition



Extended cognition



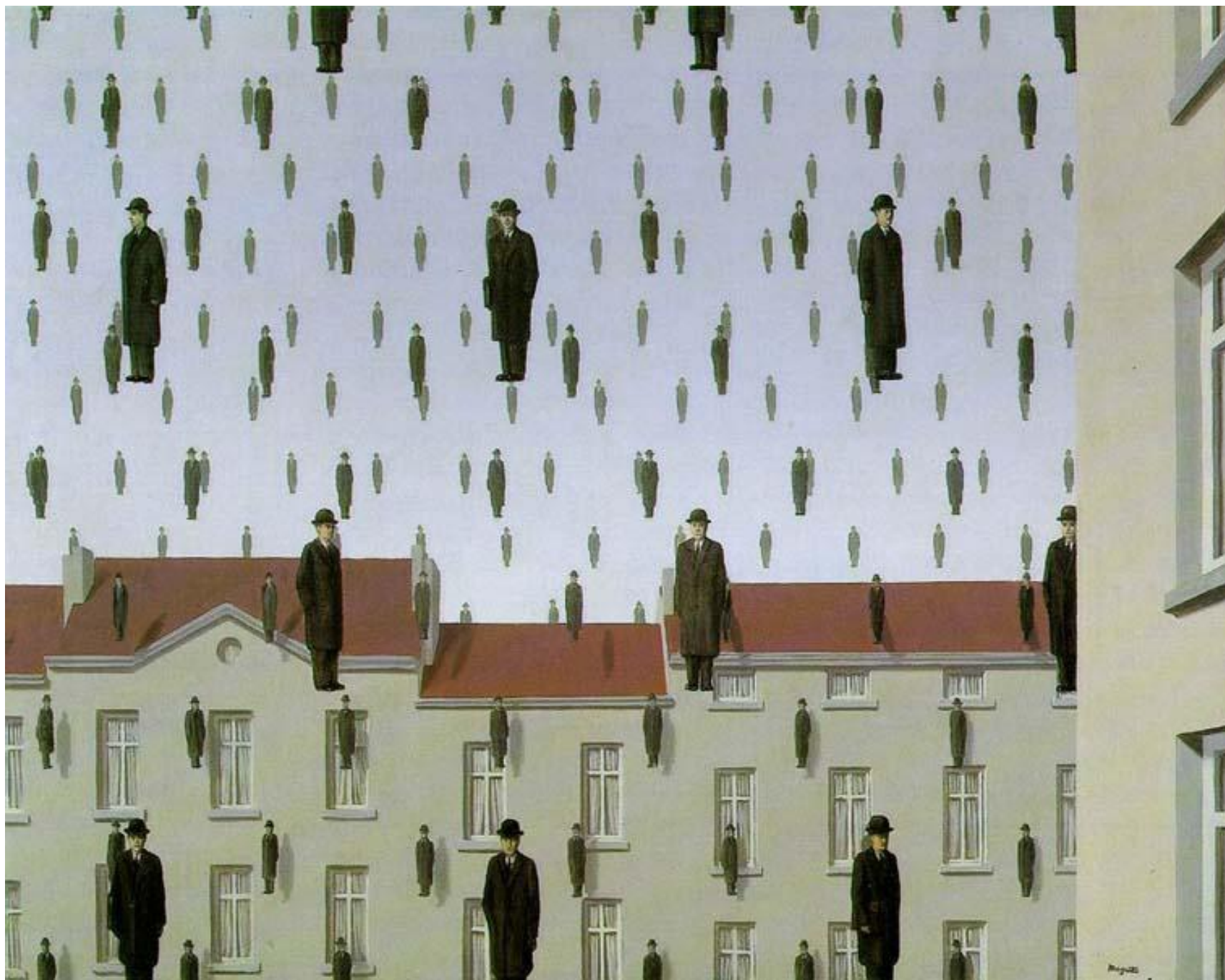


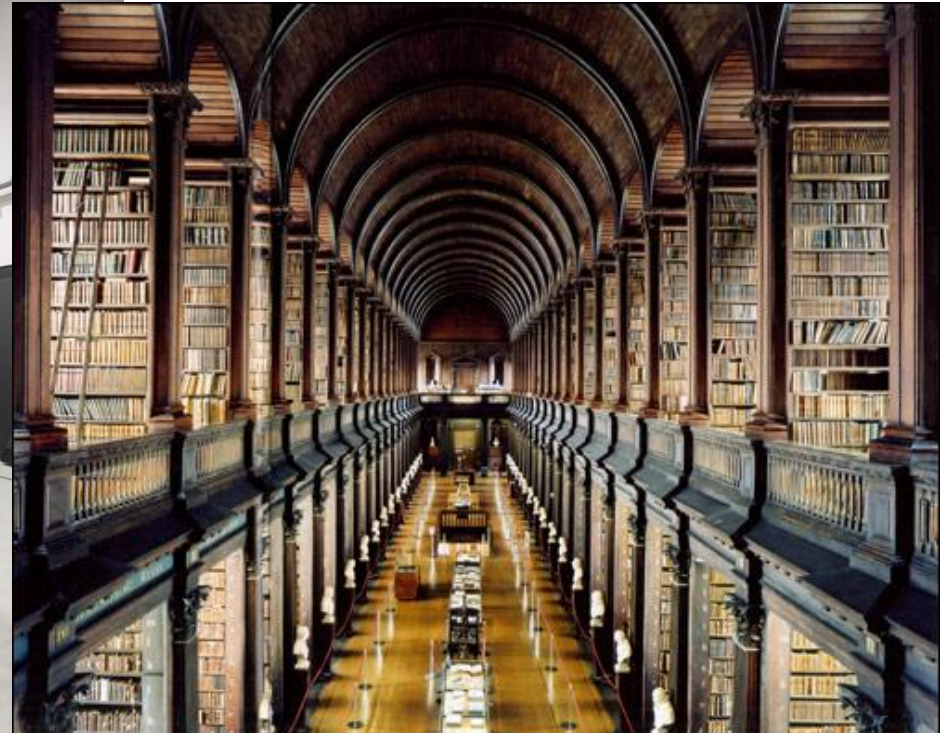


Personal exoselves

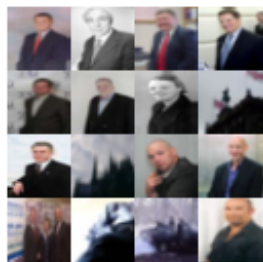








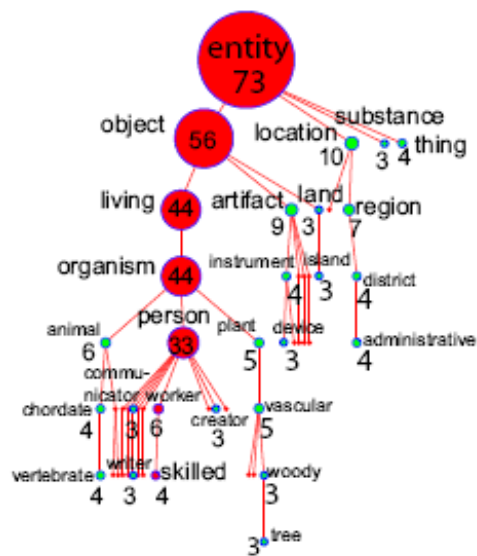
a) Input image



b) Neighbors



c) Ground truth



d) Wordnet voted branches

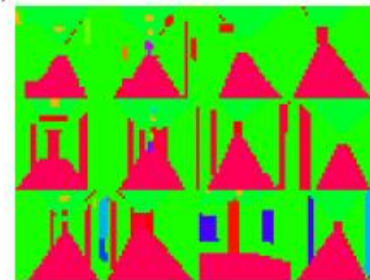
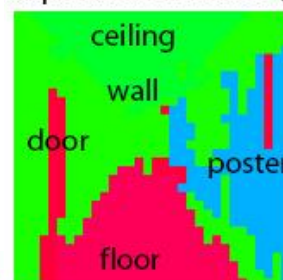
Input image



Ground truth neighbors



M predicted labels (63%)

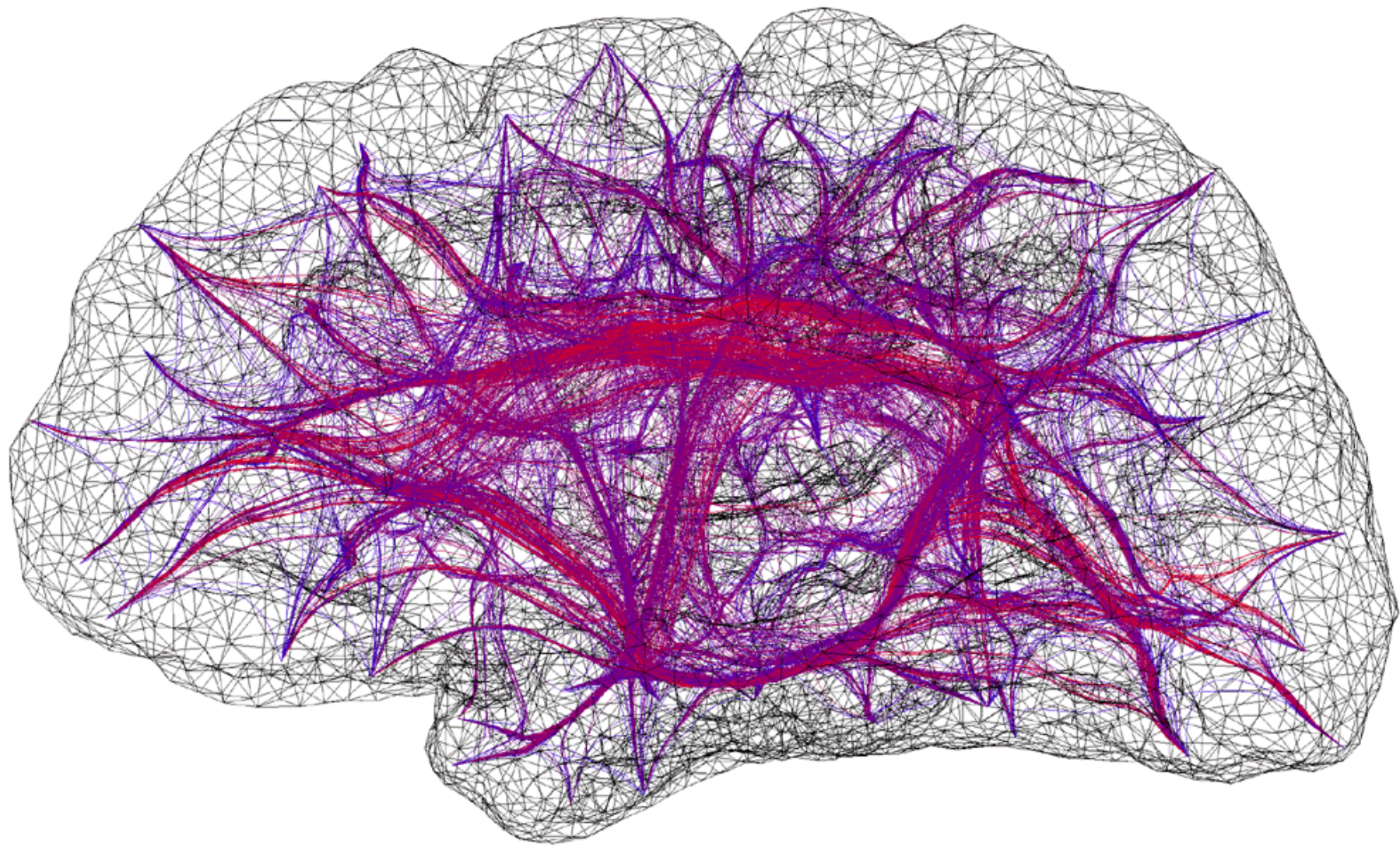




Extended exoself issues

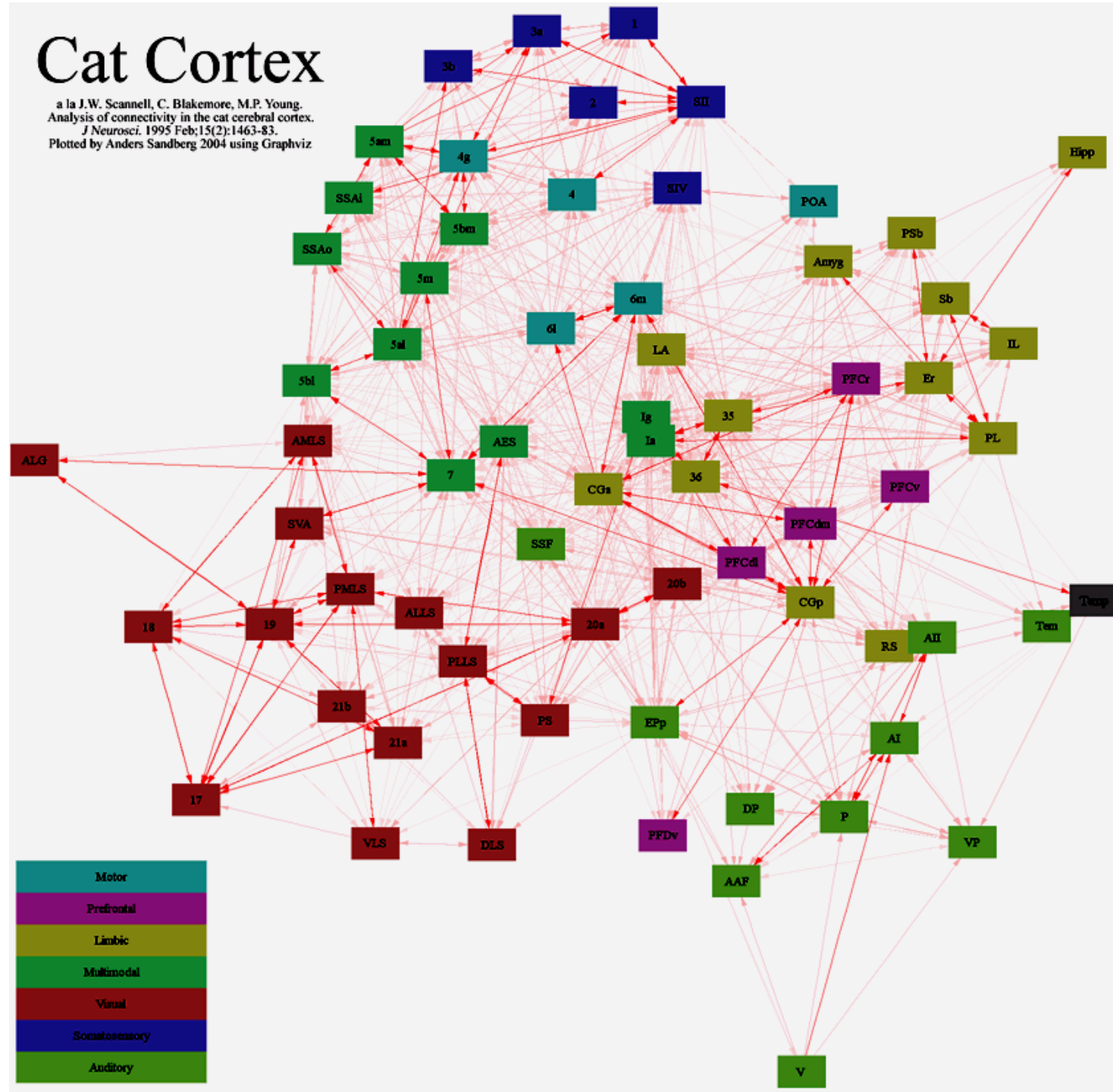
- **Justice/equal access**
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 - Easy shortcuts
 - Competition
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 - **Authenticity**
 - Human nature
- **Free choice – coercion**
 - **Freedom to use**
 - **Coercion to use**
 - **Obligation to take**
- **Biases**
- **Benefits drawbacks for society**
 - Rat race vs individual and collective benefits
 - **Generational concerns**
- Safety and efficacy
 - **Long term?**
 - **Developing brains?**
 - Testing ethics
 - **Increase our vulnerability**
- **Social pressure**
- Shifting norms normality and underperformance
- **Personal identity**
- **Autonomy**
 - **Distributed autonomy**
- **Privacy**





Cat Cortex

a la J.W. Scannell, C. Blakemore, M.P. Young.
Analysis of connectivity in the cat cerebral cortex.
J Neurosci. 1995 Feb;15(2):1463-83.
Plotted by Anders Sandberg 2004 using Graphviz



Brain Research

Central Nervous



- Current debate in on the ethics of cognitive enhancement tend to focus on biomedical modifications such as cognition enhancing drugs or genetic modifications. While some issues such as safety, addictiveness or the therapy/enhancement distinction are tied to their biomedical nature, many issues such as social equality, possible effects on identity, authenticity or human nature are not tied to specific technologies. This paper examines which different ethical issues come to the forefront when dealing with technologies extending our "exoself", interfacing brains with machines and enhancing ourselves (and out societies) through collective intelligence. Is it possible to develop an extended or shared form of autonomy? To what extent are we responsible for the emergent biases of our extended selves?