

Can software suffer? The complicated ethics of brain emulation

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Credit: Rice University

Scientists may be years away from successfully emulating a human or animal brain for research purposes, but the significant – and perhaps unexpected – ethical challenges such work presents have been outlined in a thought-provoking article in the *Journal of Experimental & Theoretical Artificial Intelligence*.

"Whole brain emulation (WBE)," writes Anders Sandberg of Oxford's Future of Humanity Institute, "is an approach to achieve software intelligence by copying the functional structure of biological nervous systems into software."

"The basic idea is to take a particular brain, scan its structure in detail at some resolution, construct a software model of the physiology that is so faithful to the original that, when run on appropriate hardware, it will have an internal causal structure that is essentially the same as the original brain. All relevant functions on some level of description are present, and higher level functions supervene from these."

It is this similarity to a 'real' brain that triggers the substantial [ethical concerns](#) which Sandberg addresses in detail, including:

- How do we know if emulations are accurate enough to be worthwhile scientific tools?
- Can they suffer and if so, how can we guarantee them a good 'quality of life'?
- When and how is it appropriate to 'kill' or 'revive' an emulation?
- What is the legal, moral and personal identity status of multiple, parallel emulations?
- What happens if we 'kill' one version but leave others 'running'?

With many of these questions unresolved – or currently unresolvable – Sandberg concludes that there is a pressing need for 'computational modellers to safeguard against software suffering' as the field progresses.

But human emulations may present other, bigger problems. Sandberg notes that "the preliminary work that has been done on the economics and social impact of brain emulation suggest they could be a massively disruptive force." He discusses the reasons why some scholars take this view as well as whether or not emulations could contribute directly to 'the risk that humanity and all Earth-derived life go extinct'; perhaps inevitably, there is mention of 'zombies'.

From the likely impact of initial experiments on the simplest animals to the risks and ethical implications of emulations for all of humanity, this fascinating paper gives an insight into just some of the dilemmas facing brain emulation researchers – who, just like those involved in stem-cell therapy and cloning before them – are working at the cutting edge of science.

More information: "Ethics of brain emulations." Anders Sandberg. *Journal of Experimental & Theoretical Artificial Intelligence*. Published online: 14 Apr 2014

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