The Society of Brains: How Alan Turing and Marvin Minsky Were Both Right

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Abstract

Our ability to form a functional unity with the tools we use is almost proverbial. And indeed we are particularly good at making and using machines. This ability to form functional 'imaginary' unity scales both up and down. It scales down to brain modules and neuronal assemblies, possibly to individual cell interactions. And it scales up to interpersonal relations, social assemblies of individuals and organisational modules and structures – along the dimension of social network interactions. Analysing the properties and understanding the mechanisms of emergence of such functional networks (of networks) of interactions may be essential in grasping the origins and basis of human conscious intelligence.

Keyword: neuronal network, consciousness research, social phenomena, artificial intelligence, World Wide Web, hybrid systems

Networks of Brain Networks

The neurons and glia cells in our brains form a hybrid network of networks and a continuum of social interactions with the outside world. The organisation of our brains adapts to the increasing complexity of societal organisation. As this complexity of societal organisation increases, so does that of our self-aware, conscious existence.

The amazingly complex working of hybrid brain networks is far from being understood. Even the neuronal networks grown in vitro are capable of developing 'intelligent' communication resembling that of human social interactions. Orlandi et al [1] recently studied the mechanism of burst propagation in cultured neuronal networks observed with high-resolution calcium imaging and in silico. They identied what could be described as an emerging 'functional adaptive network' - a set of points specific to each culture and selected by a non-trivial interplay between dynamics and topology of the network. On the basis of the statistics of avalanche size at different scales, they have shown that one may identify different effective networks which decompose the dynamics into separate layers. The focal points which appeared to be most influential in the global dynamics did not exactly follow local properties of the original or the effective network for large avalanches, but resulted from complex patterns of propagation. This mechanism appears to have direct correspondence with that of rumour propagation in social networks, where the role of the integrate-and-fire response is played by the so-called illusion-of-truth effect, that is, the requisite of repeated inputs to grant credibility, before propagation. Accordingly, not only the rumour activity network will differ from the underlying social network, but the points of rumour ignition will in general depart from the actual community structure of both the social and the effective networks.

Such functional mapping may exist at the level of higher brain networks. Indeed, neuronal networks of our brains have an amazing capability to form a functional unity with the tools we create, including the 'instruments' of our societal, religious and cultural systems. One such mechanism, of 'mirror neurons' claimed to have been discovered in macaques, shows that premotor and parietal cortical areas are not only involved in executing ones own movement, but are also active when observing the action of others. To date there is, however, relatively weak evidence for the existence of a circuit with 'mirror properties in humans, such as that described in monkeys [2]. Although debates about the evolution of the mirror neuron system imply that it is an adaptation for understanding of actions, an alternative, simpler explanation suggests that mirror neurons may be a by-product of associative learning. Heyes [3] argues that the mirror neuron system is a product, as well as a process, of

social interaction. The associative account implies that mirror neurons come from sensorimotor experience, and that much of this experience is obtained through interaction with others.

While the 'mirror neuron network' primarily aims at explaining sensorimotor behaviour, the paradigm and research questions of 'neuroeconomics' address the greater concept of social mechanism and choices. However, they may lead to a paradox, as other primates are likely better than us at survival games [4]. What they miss are the multi-dimensions and multi-scales of both the social and temporal horizons and the associated complexity of conscious strategy making.

Homo computabilis-socialis

The title of this article purposefully resembles that of the Marvin Minsky's highly acclaimed book. But it is not supposed to mimic the subject of the book.[1] The title of the book is evoked here in a new meaning, as here humans play the role of not necessarily intelligent 'agents' involved in social interactions and advanced into an intelligent society. This evolution process is reciprocal in that the agents locally 'mirror' to a certain degree the intelligence of the societal network in which they are embedded.

In his well-known prediction, Alan Turing stated that computer intelligence would surpass human intelligence by the year 2000. Although the Turing Test, as it became known, was devised to be played by one human against one computer, this is not a fair setup. Every human is a part of a social network, and a more fair comparison is that between one human at the console and a network of computers behind the console.[2]

Towards the year 2000, the number of web pages on the WWW overtook the number of neurons in the human brain. But these websites would be of little use without the ability to search for knowledge. By the year 2000 Google Inc. became the search engine of choice [6] and the WWW became an intelligent entity. This was not without good reason. The basis for the search engine was the analysis of the 'network of knowledge'. The PageRank algorithm, linking information on the web according to the hierarchy of 'link popularity', continues to provide the basis for all of Google's web search tools [7]. While PageRank was developed by Larry Page and Sergey Brin in 1996 as part of a research project about a new kind of search engine, the idea of formulating a link analysis problem as an eigenvalue problem was probably first suggested in 1976 by Gabriel Pinski and Francis Narin, who worked on scientometrics ranking scientific journals [8].

Indeed, Alan Turing was right, as hybrid human-computer internet machines have already surpassed our individual intelligence - this was done around the year 2000 by the Internet - the socially-minded, human-computer hybrid Homo computabilis-socialis.

We are now much better equipped to tackle the problem of the social origins of humanity. Yet, as of today, we may still be unable to obtain sufficient insight to understand the very basis of our individual and social consciousness. We cannot, however, delay much longer with understanding our own human nature. Paradoxically, the machines we produce may understand us before we do.

[1] Minsky postulated that human intelligence arises from interactions of mindless 'agents' as constituting a 'society of mind', hence the title.[5]

[2] The Turning Test was debatably passed by a standalone computer during the 2014 University of Reading competition. This test was, however, subject to constraints and has been criticised.

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