Institution: The University of Edinburgh

Unit of Assessment: 32 Philosophy

Title of case study: 'The Extended Mind, in Science and Society'

1. Summary of the impact

Clark is the foremost exponent of the **extended mind hypothesis**, which is the claim that what constitutes human thought and reason are not factors entirely 'in the head', but can include technologies, social networks, and institutional structures. This research has generated impact across a diverse range of non-academic beneficiaries. First, there has been **technological** impact: this research has led to the production of novel technologies, such as new gaming applications, and has contributed to scientific thinking within the IT industry and within the field of technical communications. Second, there has been an impact on **public discourse**, including educational impact: Clark's presentation of these ideas has led to an enhanced public understanding of the important social and cultural implications of our contemporary dependence on technology and social networks. Third, this research has led to the development of an online think tank that brings together the technological, psychological, and conceptual ramifications of the extended mind hypothesis. This is impact that is in the first instance **cultural**, but which also has obvious implications for **economic development** and **policy making**.

2. Underpinning research

Clark (Chair of Logic and Metaphysics since 2004; leader of the philosophy of mind and cognitive science research cluster) is the foremost exponent of the *extended mind hypothesis*. This hypothesis invites us to consider technologies, social networks, and institutional structures as proper parts of distributed organs for thought. The extended mind hypothesis was originally formulated by Clark in collaboration with David Chalmers in the late 1990s (see their 1998 paper, 'The Extended Mind' *Analysis* 58, 7-19). But its recent impact is directly traceable to Clark's highly regarded 2008 Oxford University Press monograph, *Supersizing the Mind: Embodiment, Action, and Cognitive Extension*. The importance of this work is reflected in the fact that it is one of the most widely cited monographs in philosophy in recent years, with over 1000 citations already (source: Google Scholar).

To see the shape of the claim, it helps to start with a simple comparison to the use of prosthetic limbs. After a while, a good prosthetic limb functions not as a mere tool but as a non-biological body part. Increasingly, the form and structure of such limbs is geared to specific functions and need not replicate the full form and structure of the original biological template. As our information-processing technologies improve and become better adapted to fit the niche provided by the biological brain, they too become more like such prosthetics. But they are cognitive prosthetics: non-biological circuits looping outside the biological organism that come to be integrated into the material underpinnings of human minds. Contentiously, the extended mind hypothesis depicts such integrations as occurring without the need for direct wiring using 'brain-ports' or other such technologies. By shifting the emphasis from implants with wired interfacing to 'explants' with wire-free communication, the claim embraces a large sweep of new (and old) devices and technologies. If a wired interface is acceptable then, at least in principle, a wire-free interface (such as one that links your brain to your notepad, Blackberry or iPhone) should be acceptable too. What counts is the flow and alteration of information, not the medium through which it moves.

Some of the research themes in Clark (2008) have been further developed in Clark (2010a; 2010b; 2010c). Clark (2008) has also recently been the subject of an important and high-profile book symposium that incorporates a significant new contribution from Clark (see Clark 2011). This body of research has also been very important to Clark's role in two large collaborative research grant projects (see 'grants' below), both of which are centrally concerned with the extended mind hypothesis, and both of which have been judged as completed successfully by the funding bodies

concerned.

3. References to the research

PUBLICATIONS

Clark, A. (2008). *Supersizing the Mind: Embodiment, Action, and Cognitive Extension*. Oxford: Oxford University Press. [Part of the REF submission]

Clark, A. (2010a). 'Memento's Revenge: The Extended Mind, Extended'. In R. Menary (ed.), *The Extended Mind*, 43-66, Cambridge, MA: MIT Press. [Available from HEI on request]

Clark, A. (2010b). 'Much Ado About Cognition', *Mind* 119: 1047-66. [DOI: 10.1093/mind/fzr002]

Clark, A. (2010c). 'Thinking Through Objects'. In L. Malafouris *et al* (eds.), *The Cognitive Life of Things: Recasting the Boundaries of the Mind*, 48-62, Cambridge: McDonald Institute Monographs. [Available from HEI on request]

Clark, A. (2011). 'Finding the Mind', *Philosophical Studies* 152: 447-61. [This is part of a major symposium on Clark (2008). This symposium consisted of multiple commentaries, which appeared alongside both a précis of the book and a substantial reply to the commentaries from Clark (which is the item referenced here)]. [DOI: 10.1007/s11098-010-9598-9]

GRANTS

2006-09: Principal Investigator in the UK element of the pan-European 'Consciousness in Interaction: The Role of the Natural and Social Environment in Shaping Consciousness' ('CONTACT') Project, European Science Foundation/AHRC: Eurocores, €1.9m (UK component £886k) [AH/E511139/1].

2008-10 Co-Investigator, AHRC Speculative Research Grant 'Extending the Senses and Self Through Novel Technologies' ('e-sense'), £208k [AH/F011881/1].

4. Details of the impact

There are three principal areas where Clark's work on the extended mind hypothesis has generated demonstrable impact.

(i) ***Technological Developments***
Clark was a core part (CI) of an AHRC Speculative Research Grant designed to apply the extended mind hypothesis as set out in his (2008) work to the special domain of simple, non-invasive, sensory substitution devices (see 'grants' above). A spin-off from this project was a range of new sensory augmentation devices for iPod and iPhones, which are freely available through iTunes. (See corroboration [1 a & b]).

Clark's (2008) book also led to his recruitment, in 2011, as scientific advisor to a game design studio, 'Hide & Seek', which develops iPhone, Xbox, and Kinect apps that give users a chance to experiment with emerging technologies, thereby increasing public engagement with, and understanding of, the sciences. For example, 'Hide & Seek' were interested in exploring scientific effects relating to sensory augmentation and the distribution of control, where this interest was embedded within the philosophical framework set out in Clark (2008). (See corroboration [2], [10]).

In 2012 Clark presented the extended mind thesis at a meeting held at the Pompidou Centre in Paris devoted to the emerging science of the web. A second presentation for web developers at the Googleplex (Mountain View, California) followed in 2013. Clark's work has already impacted on the emerging theory of web science, as shown by technical reports such as Paul Smart's 'The Web Extended Mind'. This report (which develops the notion of the so-called 'real-world web') repeatedly references Clark's ideas, and makes explicit use of three key criteria for cognitive extension drawn from Clark (2008) and (2010a). (See corroboration [3 a, b, c & d], [11]).

The concept of the extended mind as presented in Clark (2008) has also impacted on the general

area of technical communications research, as evidenced by the recent report in *Technical Communication Quarterly* ('Future Convergences: Technical Communication Research as Cognitive Science'). This report, written for professionals in technical communication, begins by citing Clark (2008)—indeed, Clark is the only author mentioned in the report's abstract—and contains 135 references to Clark's work on the extended mind hypothesis. (See corroboration [4]).

(ii) ***Impact on Public Discourse***

Clark presented the technological developments that came about as part of the AHRC 'e-sense' project (see 'grants' above) to more than 300 schoolchildren at the 'Bright Sparks' event at the Brighton Science Festival in 2009 (an event which was attended by around 2000 people). (See corroboration [5]).

Clark presented the main ideas in Clark (2008) as part of a public discussion on 'Reclaiming the Body' that was held at the *How the Light Gets In* festival that formed part of the 2010 Hay-on-Wye international book festival. The theme for the *How the Light Gets In* festival was 'Being Human'. It was attended by more than 3000 people over the two weekends of talks, and was widely reported in the mainstream media. (See corroboration [6]).

In 2010 Clark was invited to write a blog for the *New York Times* based on his (2008) work on the extended mind hypothesis. This resulted in a significant and inspectable feedback cycle whereby public responses appeared on the blog, with replies from Clark (both in the blog and to individual emailers). The blog piece, 'Out of Our Brains', appeared on the *New York Times* 'Opinionator' blog in 2010, a blog that is read by around 500K people. This blog entry solicited nearly 200 public responses. (See corroboration [7], [12], [13]).

In 2012 Clark outlined the Cyborg/Extended Mind theme as developed in Clark (2008) as part of a New Media Scotland InSpace public engagement event (part of the 'Upgrade' series). (See corroboration [8]).

(iii) ***Think Tank***

There is now an online, Finland-based, 'Extended Mind Think Tank' that is devoted to drawing together the technological, psychological, and conceptual implications of the extended mind thesis. The Extended Mind Think Tank is "a loosely put together informal group of people interested in figuring out what the extended mind is, and how it could be implemented and used". The Think Tank includes, as active members, computer games developers and the CEOs of several internet companies. This initiative was directly influenced by Clark's work on the extended mind, especially Clark (2008). (See corroboration [9]).

5. Sources to corroborate the impact

CITED LINKS (tinyurl links to archived web content hosted by HEI)

[1a] [http://crc.open.ac.uk/Projects/ES (or http://tinyurl.com/mhtuvup): the e-sense project webpage, which confirms Clark's involvement].

[1b] [http://itunes.apple.com/itunes-u/sensory-augmentation-devices/id380232303 (or http://tinyurl.com/lnlxyuo): the augmentation devices that were created as part of the e-sense project that Clark was involved with].

[2] [http://hideandseek.net/2011/06/22/being-there-playing-there/ (or http://tinyurl.com/lfbznck): announcement from the Hide & Seek gaming company webpage which confirms that they have appointed Clark as a scientific advisor].

[3a] [http://eprints.soton.ac.uk/336621/1/The_Web-Extended_Mindv6.pdf (or http://tinyurl.com/m7xbzq4): technical report by a researcher at the University of Southampton which confirms the influence of Clark's research on web science].

[3b] [http://core.kmi.open.ac.uk/display/36056 (or http://tinyurl.com/m7u6awd): technical report co-authored by a researcher at the University of Southampton which confirms the influence of Clark's research on web science].

[3c] http://larvalsubjects.wordpress.com/2011/05/24/it-thinks-some-reflections-on-blogging/#more-4914 (or http://tinyurl.com/kgra4bw): posting from Larval Subjects blog which discusses the relevance of Clark's research to web science].

[3d] [http://xkcd.com/903/ (or http://tinyurl.com/l3b5aas): comic strip concerning the relevance of the extended mind hypothesis to web science].

[4] [www.tandfonline.com/doi/pdf/10.1080/10572252.2011.591650 (or http://tinyurl.com/lhyc43u): journal article detailing the relevance of Clark's work for technical communications research ('Future Convergences: Technical Communication Research as Cognitive Science', N. Rivers, *Technical Communication Quarterly* 20: 412-42)].

[5] [www.bhparentsforum.org/events/bright_sparks_family_fun_day_part_brighton_science_festival (or http://tinyurl.com/lrr8b6k): detail of Clark's involvement in the 'Bright Sparks' event which took part of the Brighton Science Festival in 2009].

[6] [http://blog.wellcome.ac.uk/2010/06/07/how-the-light-gets-in/ (or http://tinyurl.com/jwq56gq): Welcome Trust blog posting confirming Clark's participation in the 2010 Hay-on-Wye international book festival].

[7] [http://opinionator.blogs.nytimes.com/2010/12/12/out-of-our-brains/?emc=eta1 (or http://tinyurl.com/n86dtgf): Clark's New York Times Opinionator blog posting].

[8] [www.mediascot.org/research/upgrade/unravel (or http://tinyurl.com/karltlo): webpage for New Media Scotland InSpace Upgrade event, which confirms Clark's participation].

[9] [http://extendedmind.org/ (or http://tinyurl.com/m65f2v7): webpage for the Extended Mind Think Tank, which is inspired by Clark's research].

CITED CONTACTS

[10] Creative Director at Hide & Seek gaming company: can confirm Clark's role as a scientific advisor on their development of new gaming products.

[11] Team Member of the World Wide Web Consortium (MIT): can confirm the influence of Clark's research on web science.

[12] Staff Editor, New York Times: can confirm Clark's participation in New York Times Opinionator blog.

[13] Opinionator Blog Moderator, New York Times: can confirm Clark's participation in New York Times Opinionator blog.