

Institution: The University of Edinburgh
Unit of Assessment: 28B Linguistics
Title of case study: Cultural evolution research inspires art
<p>1. Summary of the impact</p> <p>Our L[anguage] E[volution] and C[omputation] group investigates culture, communication and social networks, focusing on language evolution. Communicating the key concepts of cultural evolution to a general audience is a challenge imaginatively met through Kirby's collaboration with, then membership of, the art collective FOUND. LEC's research (and Kirby's computational expertise) has inspired and extended FOUND's sculpture, music and design practice. They now create interactive installations exploring culture and communication in a connected, informationally promiscuous world. The impact of the research is thus twofold: a change in the practices of a now award-winning art collective, in turn sparking awareness in a wide audience of new ideas about communication and human evolution.</p>
<p>2. Underpinning research</p> <p>The research which led to the impact was into the fundamental role of culture, communication, and social networks in the evolution of humans, supported by the development of techniques for interactive online experiments. Since around 1996, both strands have been the focus of the Language Evolution and Computation research group (LEC), now led by Kirby, Professor of Language Evolution (lecturer; reader; professor, arrived 1996); see for example Kirby (1999); Brighton et al. (2005).</p> <p>LEC's primary focus is on explaining the origins and evolution of human language, but in the course of its research, emphasis has grown on the central importance of cultural evolution in this explanation (Kirby et al. 2007). There is a long and strong tradition of viewing language as arising from a species-specific and domain-specific language faculty shaped through natural selection. However, this de-emphasises the role of culture in the evolution of language. LEC is best known for its use of computational models (Brighton et al. 2005) and laboratory experiments (Kirby et al. 2008) that demonstrate that cultural transmission of language can lift the burden of explanation from biology, because language itself is a complex adaptive system.</p> <p>Beyond its impact on behaviour, cultural evolution itself may shape how a species evolves biologically. It is widely accepted that when a species is domesticated, many selection pressures are essentially removed, with remarkable and rapid effects on the species' physical and cognitive makeup. Work at LEC has recently been approaching human evolution in this light. As shown by modelling work at LEC, culture can "shield" genes from natural selection, leading to degeneration of strong innate constraints (Kirby, Dowman & Griffiths 2007, Smith & Kirby 2008). By comparing ourselves to other domesticated species, we can consider whether self-domestication has (and continues to have) an effect on our evolution as a species.</p> <p>This research treats human evolution—biological and cultural—in terms of major evolutionary transitions (for an overview, see Kirby's recent paper on <i>The evolution of linguistic replicators</i>). These have taken place throughout the history of life on earth whenever mechanisms for information transmission have qualitatively changed. Our relevant research here focuses on transitions early in human evolution; one central argument is that the development of cultural transmission in a communication network was the key change that made human language possible. Thus human language is fundamentally shaped by the unique cultural networks that characterise human society, while in turn language is the mechanism that makes these geographically and temporally extensive networks possible.</p> <p>Key findings from this underpinning research that have contributed to its influence on FOUND's artistic output are:</p> <ol style="list-style-type: none"> 1. The trajectory of the biological evolution of humans has been profoundly altered by the emergence of cultural transmission of signalling in our species; 2. The stage was set for this emergence through a process of self-domestication, through which our species shielded itself from some of the pressures from natural selection;

3. The nature of our social networks affects the way structured behaviours evolve in populations.

3. References to the research

Brighton, H., K. Smith, and S. Kirby (2005). Language as evolutionary system. *Physics of Life Reviews*, 2:177-226. (DOI: [10.1016/j.pprev.2005.06.001](https://doi.org/10.1016/j.pprev.2005.06.001))

Kirby, S. (1999). *Function, Selection and Innateness: the Emergence of Language Universals*. Oxford University Press. (Book available from University of Edinburgh)

Kirby, S., H. Cornish and K. Smith (2008). Cumulative cultural evolution in the laboratory: an experimental approach to the origins of structure in human language. *Proceedings of the National Academy of Sciences*, 105(31):10681-10686. (DOI: [10.1073/pnas.0707835105](https://doi.org/10.1073/pnas.0707835105)) Output returned in REF.

Kirby, S., M. Dowman, and T. Griffiths (2007). Innateness and culture in the evolution of language. *Proceedings of the National Academy of Sciences*, 104(12):5241-5245. (DOI: [10.pnas.0608222104](https://doi.org/10.pnas.0608222104))

Scott-Phillips, T. C., S. Kirby, and G. R. S. Ritchie (2009). Signalling signalhood and the emergence of communication. *Cognition*, 113(2):226–233. (DOI: [10.1016/j.cognition.2009.08.009](https://doi.org/10.1016/j.cognition.2009.08.009)) Output returned in REF.

Smith, K., and S. Kirby, (2008). Cultural evolution: implications for understanding the human language faculty and its evolution. *Philosophical Transactions of the Royal Society B*, 363(1509):3591-3603. (DOI: [10.1098/rstb.2008.0145](https://doi.org/10.1098/rstb.2008.0145)) Output returned in REF.

Reviews of Kirby (1999) include:

“In this important and highly original work Simon Kirby proposes a new method for addressing a major issue in the explanation of language universals [...] Kirby's computer simulations model the 'adaptive mechanism', and his discussion of the relationship between function, selection and innateness is both clarifying and timely.”—John A. Hawkins, University of Southern California

“A brilliant, innovative computer-simulated exploration into the problem of linkage—a missing link in the current functional attempts at explaining language universals [...] In these [...] richly illustrated [...] pages Simon Kirby succeeds admirably in integrating usage-based functional approaches and formal, innatist theories. This intelligent, thought-provoking book is an essential reading for all those concerned with grammatical theory”—Masayoshi Shibatani, Kobe University

4. Details of the impact

FOUND (<http://foundcollective.com>) are an Edinburgh-based band and art collective founded by Gray's Art School graduates, Ziggy Campbell, Tommy Perman and Kev Sim, signed to the seminal label, Chemikal Underground. FOUND's work with Kirby starts from LEC laboratory findings and explores their relevance in a world of new mechanisms for communication, networking, and information storage. FOUND ask their audiences: Are we continuing a process of self-domestication? Augmenting ourselves with new kinds of memory? Changing the ways behaviours evolve? Does the online world, which much of human cultural behaviour now inhabits, represent a new kind of evolutionary transition like those we have already been through?

The impacts described below stem from the evolving practices of a collective of artists. Unsurprisingly then, this is not a simple linear story, so for clarity we present the impact categorised by **who** has been impacted, and within each category we then provide a narrative of how one well-defined aspect of the underpinning research has led to a specific impact.

Artists:

Kirby has been involved with FOUND since 2007, but his collaboration only began to have significant impact with the creation of *Three Pieces* in 2008, and all the artworks described here were created between January 2008 and July 2013. Initially a significant part of the contribution that he brought from the experimental work on cultural transmission was technical: he helped FOUND develop much more sophisticated interactive artworks—described below—by deploying the computational skills and methodologies developed for laboratory experiments in the LEC. This collaboration then led to a further and deeper exchange of ideas, with a still-continuing

discussion around the concepts of cultural evolution and evolutionary transition that has resulted in FOUND's exploration in the medium of art of a fundamental research finding of the LEC's work on language evolution—the centrality of the relationship between us as a species and our cultural products. Thus the LEC's research on language evolution has led to a fundamental change in the art practices of the artists who make up the FOUND collective [5.ESW; 5.NMS]. "His [Kirby's] involvement has had a huge impact ... I cannot imagine being able to produce any of our subsequent installations without [it]. ... helped us to conceptualise our work ... examine some very pertinent issues. ... added an extra level of depth to FOUND's work ... missing before" [5.PER].

Audiences in galleries:

The finding that the nature of social networks affects the way structured behaviours evolve in populations inspired the creation of *Cybraphon* (2009), an autonomous, emotional, robotic band similar to a Victorian orchestrion. *Cybraphon's* emotional state is driven by an obsession with its own online celebrity and online fans (it is perhaps the only artwork likely to be emotionally affected by its citation in the REF). This engages audiences with questions about how the social online world changes the way we communicate, and explores our perceptions of this new kind of social networking [5.PRE]. *Cybraphon* is an enormously successful and widely-known artwork, which has attracted extensive media coverage in books, newspapers, magazines, and television [5.PRE]. This high visibility has in turn given Kirby the chance to explain the relationship between artwork and research, in public talks alongside high-profile exhibitions (Edinburgh Art Festival 2009, 2011; Glasgow International Festival 2010; London Word Festival 2011; De La Warr Pavilion 2011) [5.NMS], and in interviews such as the *Guardian Professional* article of July 2013 [5.PRE]. Amongst other awards [5.ESW, 5.NMS], *Cybraphon* won the BAFTA Scotland Best Interactive award in 2009, the only time a piece of device art has won a BAFTA, and its national importance was recognised in early 2013 by selection for display in the permanent collection at the National Museum of Scotland, the most visited UK museum outside London.

A core hypothesis in the research on the cultural transmission of language through iterated learning is that central aspects of language as it currently exists (such as compositionality) are the product of *limitations* imposed by the nature of the network in which the system is transmitted. This hypothesis inspired FOUND's *End of Forgetting* (2010), which explores the possibility that the exponential increase in digital storage capacity might be leading to a new transition, by effectively *lifting* limitations on what can be remembered. Exhibited at the *Material Rites* exhibition in Edinburgh and the Royal Society of British Sculptors in London [5.ESW], *End of Forgetting* is a device that records sound, mixing it with sound uploaded by anyone in the world, allowing visitors to access a seemingly infinite memory. It asks: how should we live in a world where the Internet records everything, forgets nothing? FOUND with Simon Kirby won the LIST Award for "outstanding contribution to Scottish art" in 2011 against a shortlist including 2011 Turner Prize nominee Karla Black.

The research theme of limitations on human memory and how they may or may not be overcome found further resonance with the art collective which they realised as #UNRAVEL (<http://www.unravelproject.com>, or <http://tinyurl.com/ozylun3>), involving celebrated lyricist Aidan Moffat, which invites visitors to play records and hear stories from a Narrator's past. Despite the seemingly reliable nature of records, the stories change, responding to audience, environment, and online opinion, conveying the underlying notion that memory is unreliable and constructed through interaction. This work received a £42,000 Creative Scotland Vital Spark award in 2011. It was initially shown at Inspace (Edinburgh: Jan–Feb 2012) and the Glasgow International Festival of Visual Art (April–May 2012). It was then invited to the TEDGlobal exhibition (EICC, Edinburgh: June 2012). The total audience at exhibitions in 2012 was estimated at around 1000, the 3 online videos have over 15000 views to date (July 2013) and there was coverage in print media [5.UNR] and two interviews on BBC Radio Scotland.

Audiences online:

Cybraphon, *End of Forgetting*, and #UNRAVEL all engage online audiences, leading to a direct engagement with, and impact on, a wider public. This is evidenced by a high volume of tweets from the public, and Facebook friends of the art works which can be found online. While we

cannot archive tweets, Cybraphon, for example, had over 4000 Facebook friends by July 2013.

Audiences not expecting art:

The evolution of structured behaviour in populations emerging out of individual pairwise interactions, as studied by the LEC, naturally led to an art work in which the installation and (unsuspecting) audience formed just such an interacting population, with unexpected emergent behaviours. In 2008, FOUND with Kirby were commissioned to build an installation using musical instruments with small robotic components at the Royal Botanic Gardens Edinburgh. *Three Pieces* reacted to the state of the plants and movement of visitors, leading to spontaneous and surprising interactions between audience and artwork, as well as among audience members [5.PRE]

Non-traditional audiences for science:

The nature of FOUND's artworks means that the collective reaches audiences quite different to—and generally much wider than—those likely to attend an academic talk or read about science, even “popular” science. In Glasgow (May 2012) and at the Edinburgh Festival Fringe 2012, #UNRAVEL was exhibited as a live robot band on stage. Audience members engaged by tweeting opinions, which shaped the music (via an implementation of automatic sentiment analysis). FOUND were subsequently invited to the major art event OFFF, Barcelona 2012 (<http://www.offf.ws/2012> or <http://tinyurl.com/pc6uzo5>), where they presented #UNRAVEL to an audience of around 2000. Performances and talks relating to #UNRAVEL had a total audience over 2,800, and exhibition attendances at least an additional 1,000 [5.UNR].

5. Sources to corroborate the impact

Individuals who can provide corroboration of claims made in this impact case study:

- 5.ESW Quality and importance of FOUND's work and Kirby's involvement with it; Funding for *Cybraphon*: Edinburgh Sculpture Workshop (2 contacts)
- 5.NMS Impact of Kirby's involvement with FOUND, and Alt-W award (*Cybraphon*, *End of Forgetting*): New Media Scotland
- 5.PER Importance to FOUND of Kirby's work: FOUND member
Factual statement available from the University of Edinburgh

Other sources of corroboration:

- 5.PRE Coverage of *Cybraphon*, *Three Pieces* and *End of Forgetting* includes:
 - a. *Wired* article (<http://www.wired.com/gadgetlab/2009/07/cybraphon/> or <http://tinyurl.com/gev3a5v>)
 - b. *Cybraphon* on the BBC's *Culture Show* (<http://vimeo.com/9914964> or available from the University of Edinburgh)
 - c. Interview for *Sync* magazine on art and science (<http://www.welcometosync.com/art-and-science-different-ways-of-engaging-with-what-matters/> or <http://tinyurl.com/pc3nq9m>);
 - d. Edited version of the *Sync* interview, published in *The Guardian*, 26th July 2013 (<http://www.theguardian.com/higher-education-network/blog/2013/jul/26/art-science-academic-collaboration-edinburgh> or <http://tinyurl.com/phmxq91>)
 - e. Inclusion of *Cybraphon*, *Three Pieces*, and *End of Forgetting* in R. Klanten, S. Ehmann, V. Hanschke (eds) 2011. *A Touch of Code*, Gestalten
- 5.UNR Press coverage and audience figures indicating the impact of #UNRAVEL:
 - a. Audience figures are from FOUND's final report to Creative Scotland, a copy held at the University of Edinburgh
 - b. *Scotsman* (<http://www.scotsman.com/the-scotsman/scotland/original-foundtracks-discovering-found-s-new-invention-1-2228456> or <http://tinyurl.com/nurocjh>)
 - c. *The List* (<http://www.list.co.uk/article/41328-found-and-aidan-moffat-collaborate-on-new-project-unravel/> or <http://tinyurl.com/popx2by>)
 - d. *Scotland on Sunday* preview for the 2012 concert (<http://www.scotsman.com/lifestyle/music/news-and-features/scotland-on-sunday-s-edinburgh-festival-picks-1-2425544> or <http://tinyurl.com/popx2by>)