

Institution: University of Edinburgh		
Unit of Assessment: 26 (Modern Languages and Linguistics)		
Title of case study: Research into language evolution results in creation of new artworks		
Period when the underpinning research was undertaken: 2013 – 2017		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Christine Cuskley	Postdoctoral Fellow	Jan 2016 – Feb 2019
Simon Kirby	Professor of Language Evolution	Mar 1996 – present
Monica Tamariz	Teaching Fellow in Language Evolution	Sep 2013 – Aug 2015
Period when the claimed impact occurred: 2016 – December 2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact</p> <p>Kirby's research on language evolution has led to creation of new artworks. In collaboration with Kirby, performance artist Hanna Tuulikki, and sound artists Tommy Perman and Rob St John drew directly on Kirby's research on <i>iterated learning</i>, <i>cultural evolution</i>, <i>ideophones</i> and <i>phonaesthemes</i> to inform their artistic practice, and develop new material.</p> <p>Kirby's research has continued to help shape these artists' practice in solo works: for example, St John's art-geography installation with Tate Modern explores the relationship between language and landscape, and Tuulikki's <i>Deer Dancer</i> exhibition explores the evolution of culture, gender performance, and iconicity (the correspondence between form and meaning).</p>		
<p>2. Underpinning research</p> <p>Edinburgh's Centre for Language Evolution (CLE) is an interdisciplinary research centre which aims to understand the origins and evolution of language using a combination of laboratory techniques, computational simulation, and mathematical modelling. Growing from a preceding research unit founded in 1997, CLE currently houses 14 academic staff and 30 postgraduates. Working collaboratively with a number of CLE academics, notably Cuskley and Tamariz, Kirby has led the following underpinning research, for which key findings include:</p> <p>Iterated learning</p> <p>Kirby argues that iterated learning (a form of cultural transmission whereby an individual acquires a behaviour by observing it in another individual, who also acquired the behaviour through observation), may play an explanatory role not only in how languages change, but in how they originate. Compositionality – the idea that understanding the words <i>black</i> and <i>gate</i> allows us to understand potentially novel combinations such as <i>black gate</i> – has long been viewed as essential to the human capacity for language. Kirby has emerged as a leader in evolutionary linguistics due to his exploration of how iterated learning can account for the emergence of this compositionality [3.1].</p> <p>A key feature of Kirby's work is the use of iterated learning in experiments and computational simulations designed to identify how interactions between individuals using initially arbitrary and non-compositional pairings of signals (e.g. words) and meanings can lead to the emergence of compositional and structured communication at a population level [3.1, 3.3, 3.5].</p>		

More recently, Kirby has expanded this work in two main directions. First, he has shown that not only iteration, but also interaction (the way pairs of individuals communicate), and improvisation (the way individuals spontaneously create novel strategies for signalling) are crucial processes in language evolution [3.1]. Language structure is the result of the interplay of all three of these processes. Secondly, he has broadened out the research methods to include different modalities such as gesture [3.1], music [3.4], and graphical communication [3.2].

Phonaesthemes and cultural evolution

Most language is comprised of arbitrary pairings between the sound or look of a word and its meaning (e.g. *street*, *road*, and *avenue* have related meanings but different sounds; *beat*, *bite* and *bait* have different meanings but sound fairly similar), and any systematicity in the lexicon is very diffusely spread [3.5]. However, there are pockets of the lexicon where words with similar meanings tend to group together with words with similar sounds. One example is English words that begin with “sn”: many of these words related to the nose (*sniff*, *snot*, *snore*, ...) These words are called *phonaesthemes*, and they seem to represent cases where the normally arbitrary nature of language breaks down. Kirby’s work looks at how the existence of these words might have been shaped by the process of cultural evolution [3.5, 3.6].

In some cases, the patterns we see reflect subtle cognitive biases connecting different modalities. These biases get amplified by the process of cultural evolution. In some cases, however, it is likely that patterns of phonaesthemes are a pure product of shared history: this allows us to see the fingerprints of cultural evolution directly in our lexicons [3.6].

3. References to the research

- [3.1] Kirby, S. (2017). Culture and biology in the origins of linguistic structure. *Psychonomic Bulletin & Review* 24(1), 118–137. <https://doi.org/10.3758/s13423-016-1166-7>
- [3.2] Tamariz, M., & Kirby, S. (2015). Culture: copying, compression, and conventionality. *Cognitive Science*, 39(1), 171–183. <https://doi.org/10.1111/cogs.1214>
- [3.3] Verhoef, T., Kirby, S., & de Boer, B. (2016). Iconicity and the emergence of combinatorial structure in language. *Cognitive Science*, 40(8), 1969–1994. <https://doi.org/10.1111/cogs.12326>
- [3.4] Ravignani, A., Delgado, T., & Kirby, S. (2017). Musical evolution in the lab exhibits rhythmic universals. *Nature Human Behaviour*, 1(1), 0007. <https://doi.org/10.1038/s41562-016-0007>
- [3.5] Monaghan, P., Shillcock, R. C., Christiansen, M. H., & Kirby, S. (2014). How arbitrary is language? *Phil. Trans. R. Soc. B*, 369(1651), 20130299. <https://doi.org/10.1098/rstb.2013.0299>
- [3.6] Cuskley, C., & Kirby, S. (2013). Synesthesia, cross-modality, and language evolution. In J. Simner & E. Hubbard (Eds.). *Oxford Handbook of Synaesthesia*. Oxford: Oxford University Press, pp. 869–902. <https://doi.org/10.1093/oxfordhnb/9780199603329.013.0043> (can be supplied by HEI on request)

4. Details of the impact

Kirby’s work with British and European artists explores his idea that ordered structure (e.g. language) can arise from disordered inputs via a process of cultural transmission over multiple generations.

Sing the Gloaming, Tommy Perman and Rob St John

Having previously collaborated with Kirby on the BAFTA-winning *Cybraphon*, artist Tommy Perman contacted Kirby in 2015 to develop a new artwork for the Sanctuary festival – a

“The idea for *Sing the Gloaming* first developed when I saw a diagram on light-related gl- Phonaesthemes from Kirby’s research. I was immediately caught by the idea that you could follow the trajectory of a language’s development via a 2-D map” [5.3]

[illegible]

Design and build specialists, Old School Fabrications Ltd, who created this physical representation of Kirby's research, confirm the project's significant impact on their wider practice ("this project ... helped shape the way we think about designing and making things for other projects") and in generating GBP14,000 of commercial income from other clients including exhibits for The National Museums of Scotland and Historic Scotland, which also used Corian (a synthetic material commonly used in the manufacture of worktops) in a similar way to that pioneered by its use for creating sculptural artworks in the *Sing the Gloaming* installation: "we simply wouldn't have had these requests had we not been involved in representing Kirby's research" [5.5].

Page 3

was provided by St John, Perman, and Kirby, with additional input from Simon Lewin, whose new Blackford Hill record label chose the recording as its opening release. Vocal contributors included some of the most respected musicians in the Scottish independent music scene, including artists who have been nominated for the 2011 Mercury Prize (King Creosote's Kenny Anderson); won the 2012 Scottish Album of the Year (Arab Strap's Aiden Moffat); and shortlisted for the 2020 Scottish Album of the Year (SHHE's Su Shaw). Building on Kirby's research, each artist chose an illuminated location to record their *gl*-phonaestheme-derived lyric, evolving their performance from the recorded vocal of the previous contributor [5.6].

The record was critically acclaimed, being played twice on BBC Radio 3's *Night Tracks* programme, and receiving positive reviews in over 20 publications, including: "A process of transmission and transmutation that glistens with suggestiveness and is glossed with charm" (*The Wire*); "Electrifyingly good!" (*Electronic Sound*); and "... we have a new appreciation for sound, language, and the origins of utterances. What was once dry and inaccessible has now become glamorous" (*A Closer Listen*). In November 2020, the record project received the Creative Edinburgh 2020 Award for collaboration. Commercially, the vinyl pressing and accompanying booklet generated 70 pre-release orders and 127 sales from release in July 2020 until end of December 2020 (an uptake of 75% of available vinyl units); tracks from the record have been downloaded or streamed from Apple Music, Spotify, and SoundCloud over 1,400 times [5.6]. The recording also influenced the future direction of the record label on which it was released, with Blackford Hill's owner stating that it "inspired my concept for my new record label by showing how geography and iterated interactions can positively influence music ... The project has had influence and resonance beyond its immediate critical and commercial success" [5.6].

Another output from the Kirby-Perman-St John collaboration is **Concrete Antenna**. This 2015 site-specific sound installation, commissioned by Edinburgh Sculpture Workshop, explores "the relationship between place and [art], and the role of language as a collaborative act and cultural marker within that relationship" (St John) [5.7]. The installation resulted in a 2016 spin-off album (*Score Tae The Toor*), featured on BBC 6 Music (2.56 million weekly listeners, first quarter of 2020), *The Wire*, *Mojo*, and BBC Radio 3 (where it was *Late Junction*'s record of the week), and a limited-edition book of writers' responses to the installation [5.8].

The collaborations between Kirby, Perman, and St John are notable because the format, as well as the content, draws on Kirby's research: multiple iterations around a single message [3.1]. Perman describes how "Knowing about Kirby's work on iterative, interactive learning has helped shape the way I view and engage with artistic collaborations in general" [5.3]. St John credits Kirby's work as being "part of the thinking" behind his subsequent solo works drawing on similar themes, such as his **Emergent Landscapes** installation at Tate Modern, which attracted in excess of 1,500 visitors in three days [5.7].

Influence on Hanna Tuulikki

In 2017, Scotland-based UK-Finnish artist Hanna Tuulikki began a 9-month Leverhulme Trust funded Artist-in-Residence programme at Kirby's research centre. The residency is documented on Tuulikki's blog using visual poems and mind maps [5.9]. Her experience resulted in her creating a fully sketched out plan for a new multi-disciplinary performance artwork, **HOST**, and accompanying video installation, which "draws directly on core principles of Kirby's work on language evolution: improvisation, interaction, iteration" [5.10]. The residency influenced Tuulikki's thinking on "how culture evolves, how ideas evolve", and inspired her to "think about language and culture in new ways" [5.10].

Kirby's research centre has pioneered use of laboratory experiments and computer simulations in research on evolution of language, and these techniques led Tuulikki to develop new approaches to musical and visual composition. *HOST*'s soundtrack applies the "transmission chain" method [3.2] (each participant learns from behaviours produced by the previous participant) to vocal recordings, while its choreography draws on the "dyadic interaction" method [3.1] (two participants take it in turns to react to each other's behaviour)

[5.9, 5.10]. Tuulikki also used gestures, drawings, slide whistles, rhythm and vocalisations as a medium for transmission between singers, based on Kirby's use of these modalities in research [3.2, 3.3, 3.4].

Subsequent to her residency, Tuulikki's practice has continued to be influenced by Kirby's research. Tuulikki now uses the dyadic interaction method as a standard part of her vocal workshops with students and the public (approximately 300 people thus far) [5.10]. Her recent artworks draw on conceptual insights from his research. For example, *Tidesongs* (2017) is a vocal composition responding to Scottish poet Alec Finlay's *Minnmouth* collection. Tuulikki's notes concerning the composition of this piece explicitly reference iconicity, ideophones, and cross-sensory perception [5.9]. Her *Deer Dancer* installation (Edinburgh, 2019; 4,747 visitors, including 400 at the opening) explores themes around our relationship to culture; iconicity and abstraction; and the evolution of gender performance. Tuulikki comments that these ideas in her work "were influenced by the Centre's research ... Working with Simon made me realise language is just one cultural modality within culture more broadly. Looking at tangible forms evolving (e.g. gesture, drawing, rhythm, melody of the voice) [...] influenced my thinking around how culture evolves, how ideas evolve" [5.10]. In 2019, Tuulikki was shortlisted for the Max Mara Art Prize for Women, one of the leading art prizes promoting emerging female artists.

5. Sources to corroborate the impact

- [5.1] Information on *Sing the Gloaming*
- [5.2] Sanctuary lab reports for Creative Scotland, 2017
- [5.3] Statement from Tommy Perman, artist, 2019
- [5.4] Email from Dundee Leisure and photographs of *Singing Glass*, Dundee, 2019
- [5.5] Statement from Old School Fabrications, 2019
- [5.6] Statement from Blackford Hill Proprietor and information on *Sing the Gloaming* record release coverage, 2021
- [5.7] Statement from Rob St John, artist, 2019
- [5.8] Media coverage of *Concrete Antenna*. 2015
- [5.9] Information on *HOST*, *Tidesongs*, *Minnmouth* and Hanna Tuulikki's residency blog.
- [5.10] Testimonial from Hanna Tuulikki, artist, 2021