From lighthouses to barcodes

Cliona Harmey

Cliona Harmey is an artist based in Dublin, Ireland, whose work explores hybrid forms of technology and their histories. She often combines sculpture with data and attempts to make ephemeral digital information more tangible or physical. In particular, she has been reflecting on artefacts and histories of technological communication systems within a maritime environment and has in the past made works inspired by the stories of Marconi, Brunel, and mariner Robert Halpin who was responsible for the laying of the original transatlantic cable. She also engages with similar contemporary concerns in the field of aviation and climate transformation. The following text explores the lighthouse as an originary form of infrastructure[1] *with links to the ubiquitous barcode and modern, controlled spaces such as the airport. It also highlights the lighthouse as a node in a global network where the ability to regulate and direct light historically enabled safer shipping, which was linked to the advent of the modern age and the acceleration of globalisation.*

At Poolbeg in Dublin, the lighthouse is at the end of a long sea wall. The seawall was built as an attempt to hold back shifting sands. In the lantern room, there is a red octagonal glass screen that encloses a thick glass structure called a Fresnel lens.[2] The Fresnel lens surrounds a series of small glass bulbs. One bulb is operational and the others are backups ready to automat-

1 John Durham Peters, *The Marvellous Clouds: Toward a Philosophy of Elemental Media* (Chicago: University of Chicago Press, 2015), 106. 'Though the lighthouse can transmit news about weather and events, its most important communication is not subject to updates: "I am here" (this makes it a classic logistical medium).'

2 Optics Work Group, 'Glossary of Lighthouse Optics Terminology' (London: World Lighthouse Society, 2005), 17, accessed 2 Dec 2018., https://fyr.org/wiki-files/fyrskepp/Lighthouse_Terminology_read_2005.pdf

ically rotate into place should the operating bulb fail.[3] The Fresnel lens itself amplifies and refracts the light from the working bulb and projects it.[4] The Fresnel is made up of stepped individual rows of thick prismatic glass, which radiate around a large shallow bullseye lens. Its multipart assembly allows it to function as the compressed form of a much larger convex lens, taking on the properties and functions of a lens whose size and weight would make it impractical in the confines of a lighthouse.[5]

The first major working prototype of this type of lens was installed at a lighthouse at Courdouan, France, in 1823. Named after the French engineer and physicist who developed and popularised it, the Fresnel represented a major innovation in optics and lighthouse technology. The increase in control of light enabled by this lens coupled with new developments in engineering and lighthouse design revolutionised navigation, making shipping easier and safer. Theresa Levitt in her study *A Short Bright Flash: Augustin Fresnel and the Birth of the Modern Lighthouse*, describes the lighthouse and its technology as an enabler of increased globalisation. She describes the appearance of a Fresnel lens in a region as a marker of the increased importance of that location for the then developing global trade network.[6] There was a marked increase in worldwide trade in the late 1800s, which was supported by cheaper maritime transport and spurred on by increased investment in infrastructure, the sharing of technologies across borders and an increase in national and 'colonial ambition'.[7] The period between 1870 and 1939 has been

3 Bulb Changer – also known as a Lamp Changer – an electro-mechanical or clockwork device used to automatically detect and replace defective electric light bulbs in a lighthouse optic. Ibid.

4 'Fresnel Lenses: How They Work', *Jarphys.wordpress*, accessed 2 Dec 2018, https://jarphys.wordpress.com/2015/04/19/fresnel-lenses-how-they-work/.

5 Ibid., 'A lighthouse also needs a large diameter convex lens to project a wide beam across the water. But, there is limited space available at the top of the lighthouse. A set of huge and heavy glass lenses won't fit the small space.'

6 Theresa Levitt, *A Short Bright Flash: Augustin Fresnel and the Birth of the Modern Lighthouse* (New York: W.W. Norton & Company, 2013) (ebook edition), 288: 'The moment a location became important in the new global commerce was when it received a Fresnel lens … Fresnel lenses lit the way for a period known as "modern globalisation", marked by an explosion in sea travel and worldwide trade.'

7 Ibid., 12, 'safely lighting the seaways of human commerce allowed international trade and colonial ambitions to flourish.'

described as the first phase of modern globalisation.[8] This was a time when global economies became economically integrated around the flows of trade, migration and capital.[9]

In Dublin, there had also been an increase in overseas trade in 1876 and it was in that year that operation of the Poolbeg lighthouse was taken over by The Dublin Ports and Docks Board via the Poolbeg Lighthouse Act.[10] Three years later Poolbeg's lens was one of two 'dioptric' lantern lenses mentioned as ordered by the port's chief engineer Bindon Blood Stoney in his Engineers Report for 1879.[11] Dioptric is another name for a Fresnel lens.[12] These lenses arrived against the backdrop of the increased worldwide overseas trade and after two decades of the modernisation of Dublin City. The previous decades there had seen the addition of buildings associated with an increasingly modern city such as 'elaborate banks, commercial and retail premises, railway stations and public buildings', which also used a range of new materials.[13] Poolbeg's new lens and light were 'exhibited' on the 11th of August 1880,

8 Antoni Estevadeordal, Brian Frantz and Alan M. Taylor, 'The Rise and Fall of World Trade, 1870–1939', *National Bureau for Economic Research* (working paper), 20, accessed 28 Dec 2019, https://www.nber.org/papers/w9318.pdf. In this paper the authors discuss the increase in global trade from the 1870s, ceding that this was in part due to a decrease in transport costs and an increased productivity in shipping. 'From 1870 to 1914 shipping was a sector with faster than average productivity advance, due to steam power, new infrastructure, communications and navigation improvements, and so on.' They link the rise in global trade to both the fall in transport costs and the also the rise of the adoption of the gold standard, which allowed for ease of transactions.

9 Paul Collier and David Dollar, 'Globalisation, Growth and Poverty', 39 (2002) *Policy Report World Bank* (Oxford: The World Bank and Oxford University Press, 2002), accessed 28 Dec 2019, http://documents.worldbank.org/curated/en/954071468778196576/pdf/multiopage.pdf. This article mentions that the 45 years after 1870 were characterized by increased global economic integration. The authors state that 'economic integration occurs through trade, migration, and capital flows'.

10 Dublin Port and Docks Act; 1803-1902, printed by Eyre and Spottiswoode, online version accessed 29 Dec 2019, http://www.irishstatutebook.ie/eli/1929/prv/2/enacted/en/html.

11 Ibid., Engineers Report for the year 1880.

12 See Ian C. Clingan, 'Rectangular and Drum Lenses', *Encyclopedia Britannica*, accessed 29 Dec 2019, https://www.britannica.com/technology/lighthouse#ref593057.

13 'Dublin's Buildings' article on Dublin Civic Trusts website, see section on nineteenth-century Dublin: It was not until the 1850s and 1860s, following the Great Famine, that the city centre began to take on a different appearance to the classical Georgian city, when many elaborate banks, commercial and retail premises, railway stations and public buildings

alongside another lighthouse to the north of the city, which improved visibility on both sides of the shipping lane.[14] The red exterior marking of the Poolbeg lighthouse at the entrance to the port still enables ships to identify their port side (red). A second green light structure in the channel to the north now marks out the starboard side of the channel.

'For a lighthouse to fulfil the reason for its existence, it must not only be seen but recognised when seen'.[15] While contemporary navigation systems are automated and enable using radio signals such as GPS and AIS,[16] physical markers such as lighthouses and buoys are still extremely important. Each lighthouse is identifiable via its lanterns' light sequence called a 'characteristic'. To identify a lighthouse at night its characteristic can be timed and cross-checked against a known directory listing for that area. Poolbeg Lighthouse has a number of unique global identification numbers (A5882, NGA 6620) in directories. A5882 is its UK Admiralty List number. The 'Admiralty List of Lights and Fog Signals',[17] its name a legacy of the British Empire, is a subscription-based digital directory, which identifies Poolbeg as a node in a global 'network of over 85,000 light structures worldwide'.[18] In fact, the data from digital UK Admiralty List coupled with information from maritime

were erected. These buildings employed new materials in their construction, such as terracotta, machine-made brick and plate glass windows, which must have appeared radically different to contemporary eyes. Accessed 24 Feb 2018, http://www.dublincivictrust.ie/dublins-buildings.

14 Eyre and Spottiswoode, Engineers Report for the year 1880, Blood Stoney, Bindon: 'At Poolbeg a new lantern has been erected and the improved light was exhibited on the 11th of August. On the same date an occulting light was lighted for the first time at the North Bull lighthouse, so that both sides of the entrance are now well defined.'

15 Sir William Thompson, 'On Lighthouse Characteristics', reprinted in *Popular Lectures and Addresses* Vol. iii, accessed 24 Feb 2018, https://zapatopi.net/kelvin/papers/on_lighthouse_characteristics.html#:~:text=For%20a%20lighthouse%20to%20fulfil%20the%20reason%20of,primary%20and%20most%20important%20quality%20of%20a%20lighthouse.

16 AIS stands for Automatic Identication System. Ships transmit their location through an Automatic Identification System (AIS), using their IMO number as an identifier.

17 'List of Lights and Fog Signals', *Admiralty: Maritime Data Solutions,* accessed 24 Feb 2018, https://www.admiralty.co.uk/publications/publications-and-reference-guides/admiralty-list-of-lights-and-fog-signals.

18 Its website lists the Admiralty List as having the 'Official light and fog signal information for over 85,000 light structures' with a global reach. Ibid., https://www.admiralty.co.uk/digital-services/admiralty-digital-publications/admiralty-digital-list-of-lights.

radio receivers form the data backend for many ship bridges, navigation systems and route planners today. The use of unique individual identification codes is an important tenet of modern systems of logistics and navigation.

Poolbeg has its own light characteristic: a red light on a 4-second sequence (fl1s, ec. 3s), this means a 1-second flash followed by a 3-second eclipse. This short on/off sequence of light and dark echoes the type of optical encoding used by the modern bar code. Here information is stored in a sequence of printed lines of varying thickness (from wide to narrow). The barcode reader emits a laser beam and decodes the data from the barcode sequence based on its reflection and absorption of light. This process of on and off signals of different lengths mimics the structure of morse code with its 'longs' and 'shorts' of tone or light. Both auditory and optical morse codes have a long tradition of being used for maritime and naval communication; with the additional use of codebooks, optical morse can still be used for the secure encryption of information.

In stories concerning the development of the barcode, one of its inventors, Joe Woodland, mentions a direct connection between the morse code he learned as a boy scout and his thinking around the concept for the barcode.

> I remember I was thinking about dots and dashes when I poked my four fingers into the sand and, for whatever reason—I didn't know—I pulled my hand toward me and I had four lines". …they could be wide lines and narrow lines, instead of dots and dashes…Then, only seconds later, I took my four fingers—they were still in the sand—and I swept them round into a circle.[19]

The prototype idea for the barcode was a circular graphic like a bullseye, an image not unlike the radiating rings of a Fresnel lens and indeed this is the image you see on the patent drawing of 1949 by Woodland and Silver. [20] It would be many years before technology was in place to develop it fully. A circular version of the barcode was prototyped initially, but proved too expensive to print and was error-prone so that a horizontal design was used instead.

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19 Gavin Weightman, 'The History of the Bar Code', *Smithsonian Magazine* (23 Sept 2015), accessed 2 Jan 2019, https://www.smithsonianmag.com/innovation/history-bar-code-180956704/.

20 US Patent for barcode Woodland and Silver, online version accessed 2 Jan 2019, http://pdfpiw.uspto.gov/.piw?Docid=02612994.

If one looks closely at an actual barcode reader, one can see that the forms used echo some elements of the lantern room of a lighthouse, and more particularly the red glass wraparound screen at Poolbeg. While investigating these correspondences and wishing to photograph a barcode for my work, I sourced a defunct Motorola Symbol barcode reader online. I then took it apart to understand it better. It consisted of a thick red plastic optical mask which screened the laser light; behind that, there was a small section of ornately fluted, gold-plated plastic cradling a small triangular mirror, which rotated and must have transmitted the laser beam. On other barcode readers, one can sometimes see the vestige of the Fresnel lens in small sections of clear plastic at the edge with their elliptical ridges. Miniature and adapted versions of the Fresnel lens have found their way into a host of modern media devices, from overhead projectors, stage lights, traffic lights, to the micro-optics of mobile phone flash units and lights.[21]

Indeed the form of the lighthouse itself and even the ship's bridge/control room could be seen to linger and 'persist'[22] in the architectural infrastructural forms we find in other controlled spaces that exist further inland from the port. These can be seen in the control towers found at airports built in the first half of the twentieth century, such as the old airport in Dublin. This echo of the maritime precedent is made clear in geographer Peter Adey's description of Liverpool's Speke airport's landmark octagonal tower as a 'control tower-cum-lighthouse' in his essay *The Wish Image*. The wish image to which the title refers was a term coined by Walter Benjamin to describe a kind of interstitial 'object' in 'which the old and new interpenetrate',[23] an object in which the past leaks through. Adey describes how the glass-encased light on top of the control tower used to flash and optically transmit LV (Liverpool) in Morse code, thereby becoming a kind of inland lighthouse and transmission beacon.

The modern airport is a peculiar kind of space, which relies on a user's and agent's interaction with many automated technical systems, such as the

21 BCD Technology, 'Fresnel Lens in Mobile Phones', accessed 2 Jan 2019, https://www.youtube.com/watch?v=e1typvw9bJI.

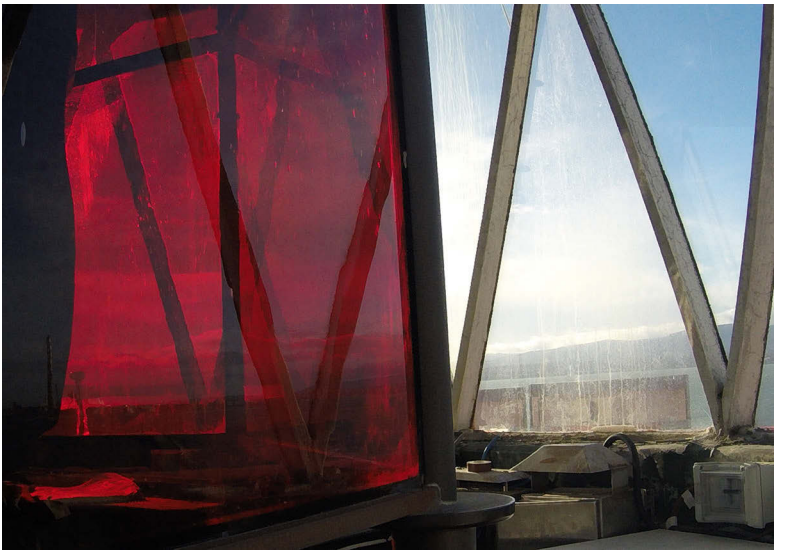
22 Peter Adey, 'wish image' in *From the lighthouse: Interdisciplinary reflections on light*, eds.Veronica Strang, Tim Edensor, Joanna Puckering (Abingdon-on-Thames: Routledge, 2018).

23 Max Pensky, 'Method and time: Benjamin's dialectical images', in *The Cambridge Companion to Benjamin* (Cambridge University Press, 2004).

light-emitting barcode readers decoding the information that controls the transit and access rights of individual travellers.[24]

On a recent trip to Berlin, I visited the old Tempelhof airport. Tempelhof was originally a testing ground for early aviation and was later re-built during the Third Reich as a flagship engineering project. Indeed, its massive scale has enabled it to be used both as a modern film set and as a much-needed shelter for refugees during the Summer of 2015. Tempelhof could provide us with a glimpse of contemporary 'wish image' where the past and present powerfully collide. This was a building built as an image. As we ascended the cantilevered roof previously designed as a spectator's terrace, a panoramic view of the Berlin skyline behind us, I spied in the corner, almost out of view and behind a cordon, a structure reminiscent of a miniature lighthouse with a partially shaded but intricately formed Fresnel lamp.

Fig. 1: Cliona Harmey, lamp interior with red glass octagonal screen, March 2018



24 Martin Dodge, Rob Kitchin, 'Airport code/spaces', in *Aeromobilities: Theory and Research*, eds. Saulo Cwerner, Sven Kesselring and John Urry (London: Routledge, 2009), accessed 28 Feb 2018, https://personalpages.manchester.ac.uk/staff/m.dodge/airport_codespaces. See also the book *Code/Space - Software and Everyday Life* by Rob Kitchin and Martin Dodge from MIT Press (2014).

Fig. 2: Cliona Harmey, Fresnel lens and lamp apparatus, March 2018

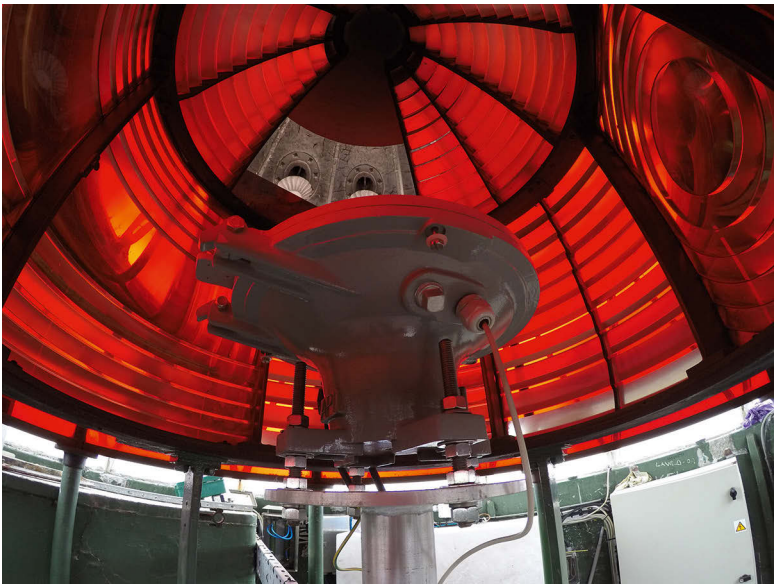


Fig. 3: Cliona Harmey, barcode reader image, April 2018

Fig. 4: Cliona Harmey, structures on roof of Tempelhof Airport Berlin with shaded Fresnel lens, July 2019

Fig. 5: Cliona Harmey, view from roof of Tempelhof Airport Berlin with shaded Fresnel lens, July 2019