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OPTOPHONIC READING, PROTOTYPING OPTOPHONES

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Transcription and/as Translation

Optophones convert type into patterns of audible tones. Initially designed in the United Kingdom in the 1910s to give blind readers direct access to inkprint materials such as books, new versions continued to be produced in the U.K., Germany, and United States through the 1970s, chiefly in the context of post–World War II rehabilitation. Reading with an optophone requires learning a tonal code: correlating sonic motifs to letters. In the first commercial version of the device, developed by the firm Barr & Stroud between 1918 and 1920, the letter "V" was indicated by the sequence G', E', D', C', D', E', G', whereas a lowercase "o" yielded the motif D', E'C', D' (see Figure 1).

Fig. 1: Diagram detailing the optophone's conversion of letters into audible tones.
Credit: The Graphic (date and author unknown); reprinted on page 124 of *The Moon Element*, by E. E. Fournier d'Albe (1924).

Optophones are often recalled as tools for sonification, and indeed a precursor model – the "exploring optophone" (see Figure 2) – converted light into sounds of corresponding intensity, as a proposed aid to navigation.

Fig. 2: Illustration of the exploring optophone. Credit: page 102 of *The Moon Element*, by E. E. Fournier d'Albe (1924).

“Reading” optophones (see Figures 3 and 4), on the other hand, perform the sonic equivalent of transcription. [1] Popularly understood to mean hand-copying documents or writing down speech and music, *transcription* also refers to transliteration between scripts: the conversion of shorthand into standard writing, for instance, or inkprint into Braille. [2] Despite the fact that optophones do not require any switch between languages, they do require deciphering a code. During the twentieth century, they were characterized as *translation* devices by their designers and operators, at a time when transcription and translation were often synonymous. [3]

Fig. 3: Optophone for blind readers, patented by E. E. Fournier d’Albe. Device pictured here assembled by Barr & Stroud, ca. 1921. Credit: Wellcome Library, London and Wellcome Images, accession number PHO 4336.

Optophones have few remaining users and are no longer commercially produced, yet the technology has been remarkably influential. The apparatus itself has given rise to multiple generations of reading machines, while its components, principle of audiovisual conversion, and synaesthetic mythos have disseminated into distant provinces of engineering and the arts. [4] Most notably, Vladimir Zworykin examined first-hand the pilot optophones of E.E. Fournier d’Albe in London and then took up this line of experimentation himself decades later at Radio Corporation of America (RCA). After building a new version of the optophone, Zworykin and his RCA colleagues proceeded to assemble a reading machine (1946-47) capable of Optical Character Recognition (OCR) – the first of its kind. Scholarly treatments have mostly depicted optophones as obsolete, framing them in the narrowest terms as discrete instruments, rather than more general *technologies*. And most of these accounts remain anchored in a narrative of the lone male inventor, attributing the optophone solely to Fournier d'Albe, who first announced the "reading" model in a 1913 publication. [5] Those scholars who trace the impact of the optophone in music and literature have similarly furnished "great artist" and "avant-garde" accounts of optophonic experiments by Raoul Hausmann and other Dadaists during the early 1920s. [6]

We propose instead that the labour of translation – the practice of reading *with* the optophone – was paramount to the machine's technical innovation, design, marketing, and early acclaim. The labour point of view encompasses manufacturer, developer, and reader. Far from being mere "end-users," the first optophone readers were also developers, who worked closely with manufacturers such as Barr & Stroud, offering abundant recommendations about hardware and tonal codes as the technology was updated and maintained. These early adopters popularized the optophone through their public demonstrations, lending it a reputation that far outstripped actual use. Exceeding the conventions of what came to be called human factors design and usability testing, optophone reading required extensive training; moreover, the capabilities of the technology only became evident in concert with skilled reading. The embodied experiences of blind readers were distinct from those of sighted inventors and manufacturers; blind readers likewise demonstrated greater expertise about many aspects of optophone use.

Fig. 4: Mary Jameson reading Anthony Trollope's The Warden on an optophone, ca. 1921. Credit: Blind Veterans UK.

Most obviously, the labour and expertise of optophone reading can be examined by treating the technology and its operators as *objects* of historical inquiry. Pictured in Figure 4, Mary Jameson was the first celebrity optophone reader; she was both subject and author of numerous articles on the device. She used the British optophone daily and tested subsequent American models, such as the visotoner (see Figure 5), into the 1970s. Her unpublished reflections on her experiences with optophonic translation are available in the Barr & Stroud collection at the University of Glasgow archives and in the private collection of Harvey Lauer, a blind technology transfer specialist for the U.S. Veterans Administration with whom Jameson corresponded via braille and tape recording.

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Fig. 5: Demonstration of visotoner, a "miniaturized optophone" developed by Mauch Laboratories (Dayton, Ohio) in the 1960s. From a tape recorded letter by Margaret Butow to Mary Jameson, March 1971. Original 7" open reel tape courtesy of Harvey Lauer; digitized by Mara Mills.

We further propose that optophones can be remade or prototyped (see Figures 6, 7, and 8), such that optophonics itself becomes the *mode* of inquiry into machine labour and maintenance of machine work. [7] The prototyping process involves archival research alongside techniques such as 3D modeling, physical computing, and additive and subtractive manufacturing (with a laser cutter and router, for instance). It is especially useful when historical devices, such as reading optophones, are minimally documented, no longer available, or do not function as they once did.

Prototyping the Past is an expansive research program at the University of Victoria, where two of us (Chan and Sayers) are located. [8] While prototyping an optophone, the University of Victoria group read an academic article by Mills on the history of the device. In this instance, prototyping enables researchers to study and *test* the dimensions involved in past listening, reading, coding, and decoding practices – without any assumption of recovering specific past experiences. If archives provide testimonial fragments about individual use, then 2D to 3D translation helps scholars in the present to broadly characterize optophone reading, weigh historical controversies, and understand technical affordances. The prototype by Chan and Sayers, in turn, prompted Mills to return to the archival materials she had previously collected on the optophone, looking for concrete design contributions of early blind readers (as discussed below).

Like translation more generally, prototyping does not seek a straightforward, 1-to-1 equivalency, nor does it seek to replicate past devices or embodied experiences. Instead, it highlights smaller gains or losses over time and across versions. That is, it foregrounds difference and absences: what we cannot retrieve, repeat, or translate in the present. Furthermore, the process calls attention to the *labour* of translation – both in the past (the labour of Mary Jameson and other optophone users) and now (the labour of remaking) – that typically escapes media studies scholarship.

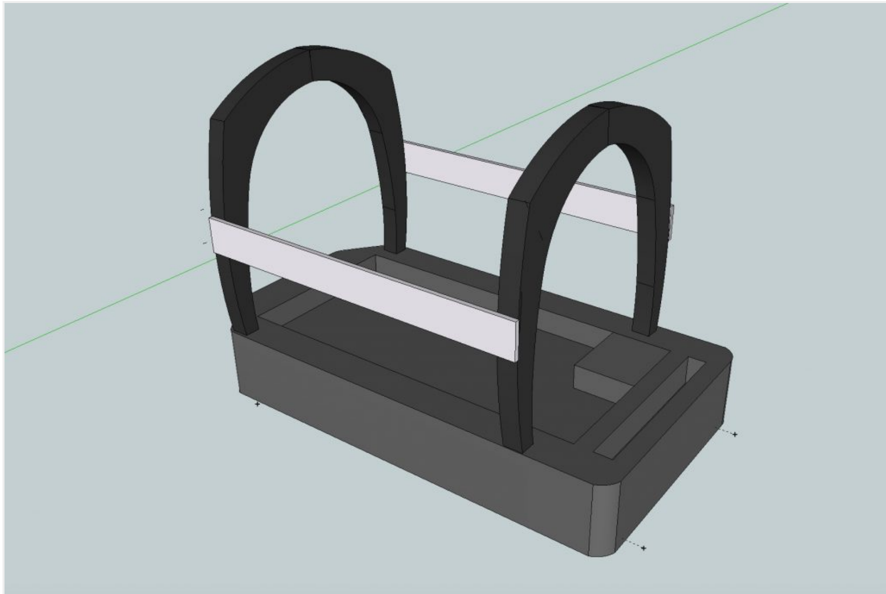

Fig. 6: 3D model of a reading optophone frame. Credit: Tiffany Chan, Danielle Morgan, Victoria Murawski, and Jentery Sayers.

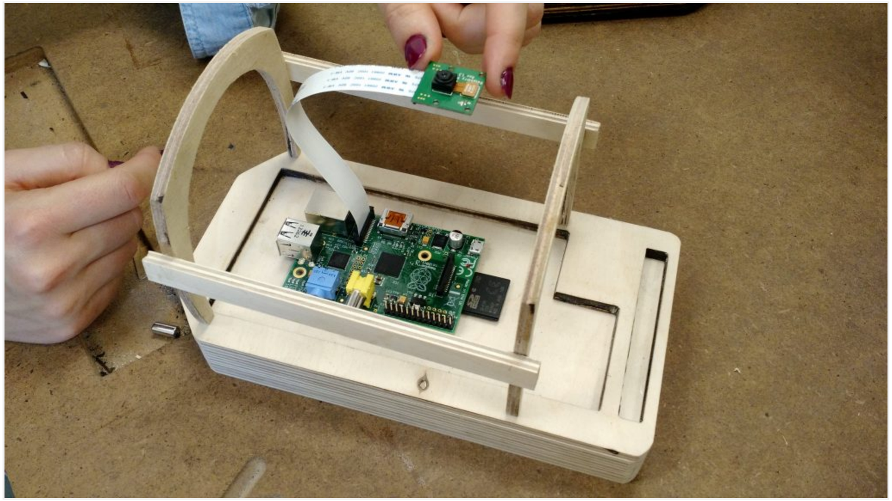

Fig. 7: Prototype of a reading optophone (glass and handle not pictured), laser-cut and powered by a Raspberry Pi and Pi camera. Credit: Tiffany Chan, Katherine Goertz,

Danielle Morgan, Victoria Murawski, and Jentery Sayers.

Fig. 8: Video demonstrating the process of prototyping a reading optophone. Credit: Tiffany Chan, Katherine Goertz, Danielle Morgan, Victoria Murawski, and Jentery Sayers.

Jameson's Archives: Reader, Demonstrator, Teacher, Developer, Designer

Fournier d'Albe announced his exploring optophone in 1912 and began working on a type-reading version the following year. After a hiatus imposed by World War I, during which he traveled to Lahore, Pakistan to teach at the University of Punjab, he returned to London and contracted the manufacturing firm Barr & Stroud to develop a commercial model. Barr & Stroud had constructed military equipment such as rangefinders during the war, and their interest in the optophone was framed by the affiliated national discourse of postwar rehabilitation. In 1919, Fournier d'Albe, Archibald Barr, and William Stroud jointly filed for a U.S. patent on the optophone. [9] An early Barr & Stroud configuration required operators to place books and other print materials on the curved glass surface of a large tabletop device (see Figures 1 and 2, above). Human operators facilitated the machine transcription process, preliminary to the act of reading the tonal code. Operators used a handle to move a reading head (called a "tracer") located below the glass, sliding it back and forth to scan pages. The tracer contained an element called selenium, which detected contrasts between white pages and black type and then converted this pattern into streams of tones and silences. To listen, operators wore telephone receivers over their ears like headphones, translating the tones and silences into characters or words. They could also tune an optophone with a knob and physically control the pace and location of reading. [10]

Among the first optophone readers, Mary Jameson was surely the best known: she attracted the international attention of blind schools in the 1920s, as well as engineers after World War II. Thomas Gilman Moorhead, another early adopter, was a distinguished physician who became blind after falling on a train platform as an adult. He was later elected President of the British Medical Association. And Mabel Green, who tested and demonstrated more than one model with Fournier d'Albe himself, met with some acclaim as assistant to BBC program director Arthur Burrows. Green was one of 80 blind typists trained by The National Institute for the Blind (NIB) to use a new shorthand machine, and she helped Burrows prepare the manuscript for *The Story of Broadcasting* (1924), a fact he publicized in the text itself:

> In the writing of this book it has been my great privilege to have the assistance of one – a Miss Mabel Green – who has been blind from infancy. Nearly every word here set down in print was dictated to Miss Green at normal dictation speed. The shorthand notes were made by a machine having seven keys only, one for each of the six dots upon which the Braille system is built, and one for spacing. The phonetic signs were embossed on a paper tape similar to that used for recording telegraphic messages. The transcriptions from this tape, made by means of an ordinary typewriter, have been astonishingly accurate, and would do credit to one in full possession of his powers of vision. This book is, I believe, the first to have been prepared under such conditions. [11]

In this book, Burrows also remarked on Green's use of an optophone, forecasting that radio might one day make more extensive use of sound as a semiotic system: "In the training of the blind to read by sound effects, we have perhaps a novel and unexpected use for broadcasting." [12] Due to the cost of the Barr & Stroud device (£35 in 1920, which is roughly equivalent to £1600 today), its use was mostly limited to wealthy or well connected blind readers such as Jameson, Moorhead, and Green. According to the Barr & Stroud records at the University of Glasgow, the firm began to have doubts about the optophone's commercial viability as early as 1922. Press coverage aside, most blind schools could not afford to purchase one. Moreover, local educators at the NIB and St. Dunstan's complained that its reading speed was too slow. Barr & Stroud stopped "pushing the sale of the optophone" entirely by 1928. [13]

Jameson had begun using an optophone after meeting Fournier d'Albe at the University of London Club in 1917, when she was 18 years old. Her father, Thomas Jameson, who was an attorney, wrote a letter to Barr & Stroud on her behalf in 1920, asking if they would take her on as an affiliate – namely, by providing compensation and training for the increasing number of public demonstrations she was being asked to give. [14] She began working on Mondays with A.M. Lundie from the London branch of Barr & Stroud, and soon thereafter Lundie developed an optophone handbook and training guidelines based on their collaboration. Within 18 months of training with Lundie, Jameson's average reading speed with the optophone was 40 words per minute (at her fastest she attained 60 wpm). The first book she read in its entirety was Anthony Trollope's *The Warden* (1855), which she said "happens to be the first ordinary printed book to have been read completely by a blind person." [15] She also read Nathaniel Hawthorne's *The Scarlet Letter* (1850) and Herman Charles Merivale's *Bar, Stage, and Platform: Autobiographical Memories* (1902). "I have purposely chosen writers differing widely in style from one another," she reported to Barr, "so as to accustom myself to varying turns of phrasing. I am surprised to find how easy it is to know what is coming when one becomes familiar with a writer, to pass quickly over the words, and then fancy one is making wonderful progress in speed; and then, what disappointment when one takes up a fresh book!" [16] She gave numerous demonstrations throughout the 1920s at her home in London as well as at scientific exhibitions, meetings of medical societies, and nearby schools and universities. Barr & Stroud compensated her on a piecemeal basis; Thomas Jameson remained frustrated that the firm did not offer her a formal contract or regular employment.

In another letter to Barr, Thomas Jameson insisted that the success of the optophone depended on four elements – the inventor, the manufacturer (with whom he included sales), the demonstrator and teacher (whom he listed together), and the repairer. [17] In addition to demonstrating the optophone, Mary Jameson made practical suggestions for the redesign of its hardware and tonal code. She strongly advocated the "black-sounding" version, which converted inkprint directly into tones, over Fournier d'Albe's preferred "white-sounding" version, which generated a chord when it encountered white paper and then "dropped out" certain notes as it passed over letterforms. [18] More specifically, she suggested "making the top and bottom notes discordant as far as possible with the four middle ones" such that "the sound of the latter would not be obscured" when reading certain letters. [19] Jameson requested new selenium cells that would generate a louder sound, so the tones could be heard more clearly above the background hum of the machine. She worked with Lundie on improvements to the line-changer and to a component that allowed the reading of italics. [20] She also taught other blind students how to read with the Barr & Stroud device. One, Michael Lloyd, was a music teacher in Birmingham who himself demonstrated its application to the reading of music. [21] Jameson's written reflections on how to introduce the optophone to new pupils offers the clearest description of its translation function:

> I always begin by the general statement that the optophone translates print into musical motifs, and that the nature of these depends on the shapes to be translated. I go on to say that every vertical line produces a chord – examples *h* and *I*; every diagonal a tune – examples *v* and *w*. (Having to do *v* I may invite those listening to tell me how *w* will sound. If they can, I know they are grasping the idea.) It is more difficult to describe curves, but I ask people to listen to the smooth passing of the notes. I then, as you do, talk about the distribution of the notes; middle range with ascenders and descenders. I like to use *p* and *b*, *q* and *d* for this. Over and over again I have found this approach awakens an interest in the optophone, and teaches them the basic sounds. With pupils familiar with letter-shapes it helps them to memorise the corresponding motifs. [22]

Even after Barr & Stroud abandoned optophone production, their machine was "part of her everyday life" until Jameson died in 1980. She used it to read books, food labels, and typed mail. In the 1960s and 1970s, she corresponded with two blind Americans, Harvey Lauer and

Margaret Butow, who were involved with the development of two new handheld optophones, the visotoner and the stereotoner. Lauer sent a visotoner to Jameson along with recorded instructions on how to use it. In a series of tapes exchanged by mail (see Figures 9 and 10), they weighed the advantages and disadvantages of each. Which code was clearer, the six notes of the British optophone or the nine of the visotoner? Did the portability of the visotoner outweigh the tracking complexities it entailed? Why didn't the visotoner work with red and purple print, such as the output of a mimeograph machine? [23] Some of these questions were a matter of taste, but all derived from expert use – the transcription of heterogeneous materials in sundry daily situations over extended periods of time.

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Fig. 9: Mary Jameson, comparing the British optophone to the visotoner. From a tape-recorded letter by Mary Jameson to Harvey Lauer, ca. 1970. Original 7" open reel tape courtesy of Harvey Lauer; digitized by Mara Mills.

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Fig. 10: Harvey Lauer, demonstrating the visotoner and discussing varieties of print. From a tape-recorded letter by Harvey Lauer to Mary Jameson, ca. 1970. Original 7" open reel tape courtesy of Harvey Lauer; digitized by Mara Mills.

Prototyping the Past

Prototyping optophones with both Jameson and translation in mind offers us another way to understand the labour, maintenance, and incremental change involved in the design of reading machines – in contrast to the hyperbole of masculine, "make or break" narratives of historical ruptures and innovations. Prototyping prompts us to return to the archive to more carefully unravel how Jameson read with different models of the optophone, [24] without assuming we can ever inhabit her embodied position in time or empathize with how she experienced the world during the 1900s. Far from collapsing distinctions between present and past, the prototyping process renders them more palpable and explicit. [25] In this sense, prototyping is not about replicating the "original" optophone or reclaiming embodied translation experiences such as scanning, listening, and interpretation. It instead turns our gaze outward to scrutinize how reading practices and identities materialize and congeal with and through technologies – and to reflect on our own embodied relationships to machine work.

To remake the translation process of optophonics, Chan and Sayers used present-day technologies (including OCR technologies such as Tesseract) to imitate the sounds as heard through headphones. In the glass-topped version of the optophone pictured in Figures 3 and 4, the tracer emitted six to eight beams of light, stacked vertically to correspond to different points on a letter. As these beams of light swept horizontally across a line of type, the machine converted the pattern of reflected light into sound. Based on historical images of the schema, Chan sketched each letter and approximated the pattern (see Figure 11) – and consequently, the sound – of each letter. This rehearsal and remediation of machine work reveals numerous contingencies in a single act of translation: for example, different fonts and font colours produce different results, affecting how quickly the tracer "samples" a given letter.

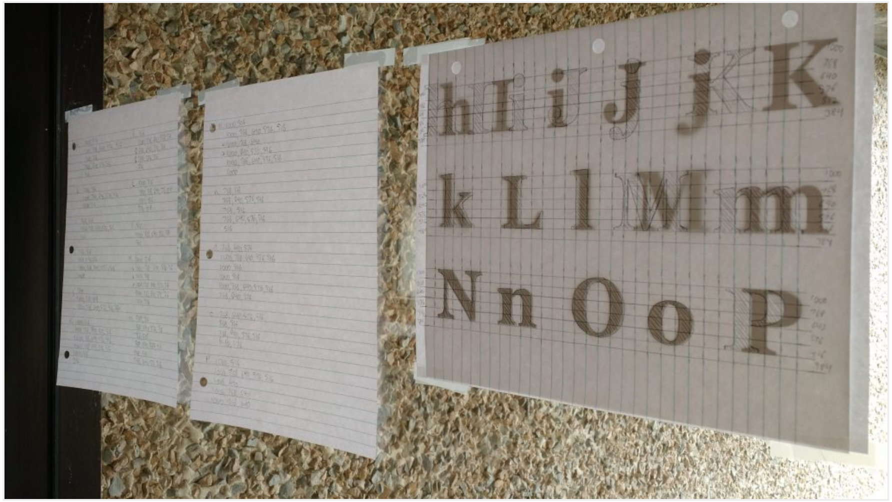

Fig. 11: Using a window to trace letters and punctuation marks to create a Python script for a reading optophone prototype running on a Raspberry Pi and Tesseract. Credit: Tiffany Chan.

Multiply these questions by each version of the reading optophone, and the difficulties of translating the historical and material functions of optophonics into the present become clear. Yet extant narratives of the optophone's invention minimize these differences by collapsing versions of the device into a single technology: "The Optophone." Such narratives eclipse evidence of maintenance and changing use over time. They also suggest that innovation moves in a linear fashion (e.g., each new version improves upon a previous one) with few outside influences. [26]

By prototyping an optophone using present-day components, we find that today's gadgets cannot represent some of the behaviours and interactions associated with past technology. Because OCR scans page images discretely, character by character, rather than continuously, Chan and Sayers's optophone prototype could not account for the fine-grained feedback and control provided by an analog optophone. Since OCR is purpose-built for machine-readable text, it does not afford many creative or counterintuitive uses. Ironically, the newer technology seems almost inefficient or inadequate. Automation, then, does not by default make technology easier or less problematic. That is not to say that manual labour and difficulty are desirable or that we should be nostalgic for pre-digital technologies and cultures. However, we should recognize that fetishizing efficiency and ease in contexts of translation and transcription obscures the labour that subtends these activities, both past and present. When studying media history, we might seek out difficulty, absence, and contradiction rather than assume that these issues need to be resolved or eliminated. As an alternative to grand narratives of invention and disruption (as to how, for example, optophonics and OCR changed translation "as we know it"), we can attend to everyday negotiations and contributions, tracking historical change in terms of smaller gains or losses over time.

We might then ask what *are* appropriate technical goals and endpoints when prototyping early translation devices? One impulse might be to design and build an optophone with output tones that are as easy to distinguish and interpret as possible. But to prototype an "ideal" optophone – one that adheres to longstanding commercial attitudes that require technology to be rigorously optimized – would be to create an optophone that *never existed*.

Throughout the first half of the twentieth century, sighted people exaggerated the sonic and physical accessibility of reading optophones. In publications such as *The Moon Element*, [27] Fournier d'Albe highlighted the listening process over the demanding physical procedures of setting up, moving, and navigating books on an optophone. Operators like Jameson needed to plug an optophone into an outlet, find and align the first line of print material with the tracer, and calibrate the device to the size of the type –all before reading a single word. Not only were these procedures difficult for newcomers to learn, but expert operators had to physically navigate an optophone from moment to moment throughout the reading process in a way that is difficult, if not impossible, to capture with two-dimensional materials alone. Prototyping an optophone in three dimensions reminds us that the listening experience was entwined with the tactile experience of moving the handle to adjust reading speed as well as shifting the print material to translate lines of type (see Figure 12).

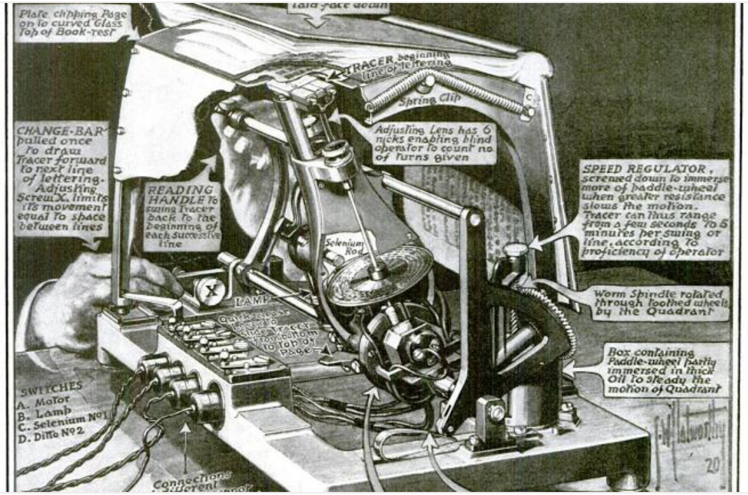

Fig. 12: Illustration of an optophone's features, care of Scientific American (Nov. 1920, from "How the Blind May Read with Their Ears").

Chan and Sayers's prototype further demonstrates that the added labour required of operators, built into an optophone's very design, was accompanied by small gains in independence and control. Several features, such as differently sized plugs and dials with clicking notches, suggested that operators were expected to manipulate the machines without assistance. And while an optophone's frame was open and transparent, its headphones created a private acoustic sphere for listening. When combined with the plugs and knobs of an optophone's interface, this acoustic space marked optophonic reading as an intimate, individual experience. Similarly, as Jameson noted with regard to *The Warden*, optophones allowed operators private access to the same materials intended for and read by sighted readers, circumventing the costs associated with creating parallel reading materials, such as talking books. This privacy could be read as either a move toward integration or an attempt to conceal signs of difference and disability (especially in the case of miniaturized models). However such privacy is ultimately interpreted, the prototyping process foregrounds it as an embodied negotiation frequently at play in the design and culture of early translation devices.

Although optophones have few operators or applications today, the technology of optophonics is central to a broader history of machine reading and audiovisual translation. The routine contributions of developers, manufacturers, test subjects, and early adopters are frequently minimized in inventors' memoirs and in subsequent histories. Documenting them is nearly often impossible when archives are thin, unavailable, or confidential. Yet especially with early reading machines, which purported to *automate* transcription, the labour of equipment operation and output decoding was *essential* to the design, function, maintenance, and significance of any given device. Integrating early technologies into a circuit of 2D and 3D historical research – in this case by combining archival work with prototyping – foregrounds iterative development and invests in the pleasures of "suboptimal" design.

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1. The terms "transcription" has also been employed in the field of electroacoustics to indicate recording. In the early years of radio, transcriptions were programs pre-recorded on disc, rather than broadcast live. ↩
2. Text-to-text transcription is known as "visual transcription," whereas sound-to-text transcription is known as "aural transcription." We are suggesting that optophonics is a form of text-to-sound "transcription." See Tore Lind, *The Past Is Always Present: The Revival of the Byzantine Musical Tradition at Mount Athos* (Lanham, MD: The Scarecrow Press, 2012), 81. Automated inkprint-to-braille transcribers, on the other hand, are marketed as "braille translation devices." ↩
3. See the *Oxford English Dictionary* entry for "transcribe" (definition 2a). ↩
4. For details, see Mara Mills, "Optophones and Musical Print," *Sounding Out!* (5 January 2015), https://soundstudiesblog.com/2015/01/05/optophones-and-musical-print/. ↩
5. E.E. Fournier d'Albe, "A Reading Optophone," *The Electrician*, 24 (October 1913), 102-103. ↩
6. For instance, see Jacques Donguy, "Machine Head: Raoul Hausmann and the Optophone," *Leonardo* 34.3 (2001): 217-220. ↩
7. On design as inquiry, see the work of Daniela K. Rosner (http://www.danielarosner.com/). ↩
8. See Jentery Sayers and Tiffany Chan, "Prototyping the Past: The Maker Lab at the University of Victoria." Interview by Darren Wershler. *What Is a Media Lab? Situated Practices in Media Studies* (10 May 2016), https://whatisamedialab.com/2016/05/10/prototyping-the-past-the-maker-lab-in-the-

humanities-at-the-university-of-victoria/. See also Jentery Sayers, “Prototyping the Past,” *Visible Language* 49.3 (December 2015): 157-177; and the Maker Lab’s website: http://maker.uvic.ca. ↩

9. See US1350954 A, filed in 1919 and granted in 1920. ↩
10. For a photograph of an early Barr & Stroud optophone, with associated sound recordings, see Mills, “Optophones and Musical Print.” The device and recordings were located as part of a multi-year investigation with research assistant Shafeka Hashash, who is a member of the National Federation of the Blind. Mills and Hashash obtained the sound recordings from the personal collection of Elaine Nye. After unsuccessfully searching numerous repositories in the U.S. and U.K. for the machine itself, Mills found an uncatalogued optophone in the storeroom of Blind Veterans UK in 2014 with the help of archivist Robert Baker. (An irony considering that St. Dunstan’s—the prior name for Blind Veterans UK—held a low opinion of the device in the early twentieth century.) Matthew Rubery subsequently incorporated this optophone and the Nye recording into a Youtube video that can be accessed at https://www.youtube.com/watch?v=w0wuIv1JVGU. ↩
11. Arthur Burrows, *The Story of Broadcasting* (London: Cassell, 1924), 178-9. ↩
12. Burrows, 179. ↩
13. Letter from Francis Morrison to Dr. Barr, 20 July 1928, p. 2, Folder: “Dr. Barr Optophone with Inward Letters” (295/26/2/35), Barr & Stroud Ltd Collection (UGD295), University of Glasgow Archives (hereafter Barr & Stroud Collection). ↩
14. Letter from Thomas Jameson to Dr. Barr, 1 May 1920, p. 2, and Thomas Jameson to Dr. Barr, 21 June 1920, Folder: “Optophone Correspondence Historically Interesting” (295/26/2/37), Barr & Stroud Collection. Mary’s sister Margaret also trained on the optophone in the early years, although scant documentation remains about her work. Unlike Mary, she neither corresponded directly with Barr & Stroud nor wrote articles about the optophone. ↩
15. Letter from Mary Jameson to Dr. Barr, 30 August 1922, p. 1, Folder: “Optophone Correspondence Historically Interesting” (295/26/2/37), Barr & Stroud Collection. ↩
16. Letter from Mary Jameson to Dr. Barr, 30 August 1922, p. 1, Folder: “Optophone Correspondence Historically Interesting” (295/26/2/37), Barr & Stroud Collection. ↩
17. Letter from Thomas Jameson to Dr. Barr, 24 June 1920, p. 1, Folder: “Optophone Correspondence Historically Interesting” (295/26/2/37), Barr & Stroud Collection. ↩
18. Letter from Mary Jameson to Dr. Barr, 22 January 1921, p. 2, Folder: “Optophone Correspondence Historically Interesting” (295/26/2/37), Barr & Stroud Collection. ↩
19. Letter from Mary Jameson to Thomas Jameson, n.d., enclosed in letter from Thomas Jameson to Dr. Barr, 1 May 1920, Folder: “Optophone Correspondence Historically Interesting” (295/26/2/37), Barr & Stroud Collection. ↩
20. Letter from Mary Jameson to Dr. Barr, 30 August 1922, p. 1, and A.M. Lundie to Archibald Barr, 18 January 1921, Folder: “Optophone Correspondence Historically Interesting” (295/26/2/37), Barr & Stroud Collection. ↩
21. Braille letter from Margaret Butow to Harvey Lauer, 21 December 1970, original given to Mara Mills from the personal collection of Harvey Lauer (Aurora, IL). Transcribed by Shafeka Hashash. ↩
22. Braille letter from Mary Jameson to Harvey Lauer, 10 June 1967, original given to Mara Mills from the personal collection of Harvey Lauer (Aurora, IL). Transcribed by Shafeka Hashash. ↩
23. Jameson also discusses her difficulties with the visotoner (namely, the inconvenience of aligning text with the colineator, and the inability to read red print) in a braille letter to Harvey Lauer dated 25 November 1970. In this letter Jameson reflects on the trickiness of parsing the benefits of learning (or habit) from the affordances of the machine: “It appears that, like me, you find small print easier than capital. Is this because capital print is more

difficult or because one meets much less of it than small?" Original given to Mara Mills from the personal collection of Harvey Lauer (Aurora, IL). Transcribed by Shafeka Hashash. ↩

24. To be clear, reading optophones did not automatically convert type into audible tones and then into words or characters. Developers such as Jameson were central to the translation process. ↩
25. For an elaboration on this relationship between the past and present, especially in a design context, see Jentery Sayers, "Design without a Future," *Interactions* 23.6 (November-December 2016): 74-76. ↩
26. We might assume that innovation trickles down from a supposedly general populace to the specialized domain of assistive technology. In fact, innovation is more diffuse. It spreads in all directions, and histories of disability as well as designs for disability are rich sources of both technical and aesthetic innovation. See Sara Hendren, "All Technology Is Assistive," *Backchannel* (16 October 2014), https://medium.com/backchannel/all-technology-is-assistive-ac9f7183c8cd; and Graham Pullin, *Design Meets Disability* (Cambridge, MA: MIT Press, 2011),1-4. ↩
27. Fournier d'Albe, E. E. *The Moon Element: An Introduction to the Wonders of Selenium*. New York: D. Appleton and Company, 1924. ↩

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