

Paper Tape — A Cassette Tape without Prior Acoustic Information

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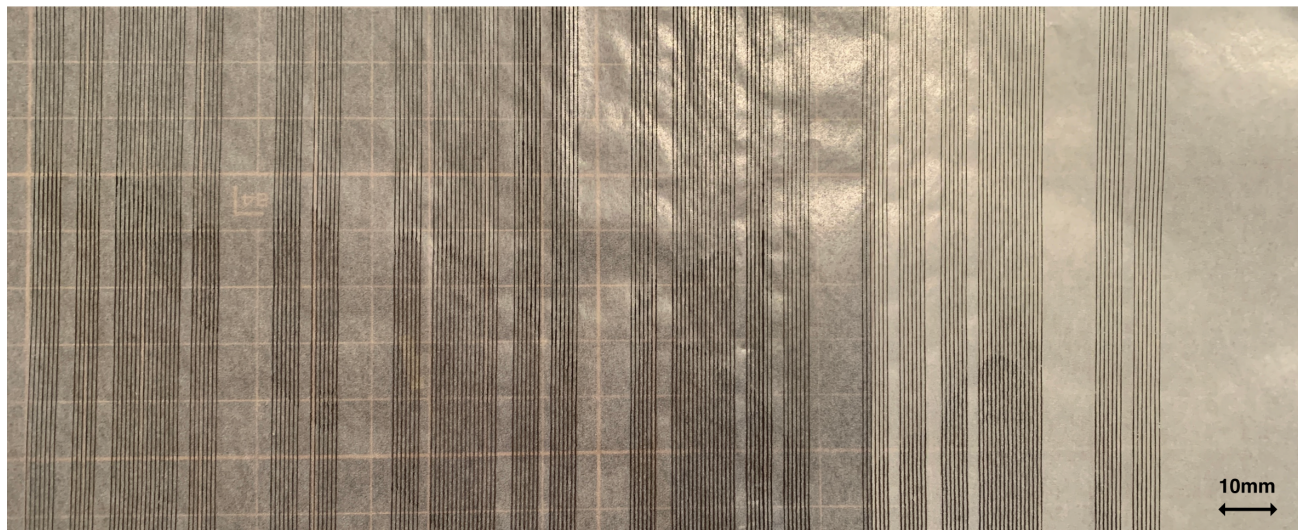


Figure 1: Black-and-white stripe patterns printed on a thin paper with magnetic ink

Abstract

This paper presents *Paper Tape*, a cassette tape without prior acoustic information. The work consists of a circular loop of paper printed with magnetic ink via digital silkscreen printing and housed in a standard cassette shell. Situating the work within the technical and artistic lineage of magnetic recording and sound generation from visual patterns, the paper repositions the cassette tape player as an instrument for sound generation without recordings. Through analysis of five tapes presented in the exhibition *Maybe It's Music*, it proposes a minimal yet concrete rereading of the history of magnetic sound media.

Keywords

Magnetic Sound Media, Cassette Tape, Digital Silkscreen Printing, Sound Generation from Visual Patterns

1 Background

In 1878, Oberlin Smith proposed the idea of magnetic sound recording[7]. Although he never produced a working model, his proposal already contained the principal elements of magnetic recording: a recording medium (wire), a record/reproduce transducer (coil), and a transport mechanism (spools) [23].

In 1898, Valdemar Poulsen realized this idea in practice with the invention of the *telegraphone*[20]. There is no clear evidence that Poulsen was aware of Smith's earlier proposal; nevertheless,

the telegraphone is recognized as the world's first functional magnetic sound recorder [4].

In 1928, Fritz Pfeleumer, an expert in specialty paper, received a patent entitled "Lautschriftr ager" (sound record carrier), which described a magnetic recording medium composed of paper, iron oxide powder, and a glue. Building on this invention, the German companies AEG and BASF introduced the *Magnetophon* in 1934—a magnetic tape recording system using a cellulose acetate base coated with carbonyl iron powder [6].

Following these developments, in 1963 the Dutch company Philips introduced the *Compact Cassette*, a magnetic tape format housed in a cartridge that was later internationally standardized[26]. The format has been widely adopted within the ecosystem of sound media and continues to persist to the present day through periodic revivals[5], while also enabling a range of technological applications.

One notable example is the *Walkman*, a portable cassette player designed for headphone listening made by Sony in 1979. As Hosokawa noted[12], the technical development of the device itself was minimal; it was essentially "a cassette recorder minus the recording function and the speaker." As he observed, this reduction opened up a mode of privatized listening: "This listener seems to cut the auditory contact with the outer world where he really lives: seeking the perfection of his 'individual' zone of listening ..." Nevertheless, this functional reduction profoundly transformed listening practices around the world.

Alongside these technical developments, the unique properties of magnetic tape gave rise to several experiments. One notable example is the work of the Groupe de Recherches de Musique



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NIME '26, June 23–26, 2026, London, UK

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Concrète (GRMC) [22] from the 1950s onward, which made compositions assembled from *objet sonore* (sound objects) by manipulating recorded tape through splicing, looping, reversing, and speed alteration.

Another example is the *Chamberlin*, developed by Harry Chamberlin in the late 1940s, and its successor, the *Mellotron* in the 1960s-70s. Both instruments housed pre-recorded tape loops assigned to individual keys, allowing performers to trigger recorded sounds—such as flutes, choirs, or church organ—in real time[21].

Particular artistic practices that reconfigure the physical relationship between tape and tape head are *Random Access* (1963) by Nam June Paik[9] and *Tape Bow Violin* (1977) by Laurie Anderson[1]. In *Random Access*, the tape is removed from the cassette mechanism and placed on a wall, while the tape head is held in the performer's hand and manually scanned across the surface. *Tape Bow Violin* does so by situating a tape head on the bridge of a violin and replacing the conventional horsehair bow with magnetic tape.

More recent practices include *Open Reel Ensemble*[27], a group that performs using multiple open-reel tape decks as instruments—manipulating tape speed, direction, and playback by hand—and, the *Magnetotron*[3] by Michael Colombo which consists of a large rotating cylinder with dozens of strips of audio tape, each holding a recording of a single note, combining the note-by-note structure of the *Mellotron* with the tactile playing style of the glass harmonica.

In this paper, we present an approach that draws partially on the lineage of magnetic sound production while removing recording altogether, instead proposing the generation of sound from visual patterns through magnetic processes using a tape enclosed in a cassette case.

Just as the *Walkman* reconfigured listening practices through the reduction of the recording function, this removal of recording reopened a fundamental question: whether sound media must necessarily presuppose recorded sources at all.

2 Paper Tape — A Cassette Tape without Prior Acoustic Information

In 1923, Bauhaus master László Moholy-Nagy proposed the idea of mechanically generating sound without any prior acoustic information (i.e., recordings) from the surface of the gramophone [18]. At the time, this provocation was never fully realized. However, roughly a decade later, the idea partially materialized through optical means in the work of Rudolf Pfenninger, Oskar Fischinger, and others [17]. They used synchronized sound films in which sound was produced from patterns of light—minute graphic traces printed on a narrow strip running parallel to the celluloid film images. Rather than translating sound waves via a microphone, they directly drew the shapes of sound as graphics and printed these patterns onto film.

Nearly a century later, the authors revisited this history with the aid of mature computational technologies as a form of *A record without Prior Acoustic Information* [13][14]. Instead of relying on vibrations from an original sound source, the authors visually draw zigzag groove patterns using conventional vector graphics applications (e.g., Inkscape, Adobe Illustrator).

Unlike standard record-cutting machines, laser cutters or plotters are used to engrave the grooves in a non-scalable, artisanal manner instead of through the scalable, mass-production processes of vinyl pressing using stampers. The resulting objects can generate sound on conventional record players.

Paper Tape belongs to this lineage of practices that generate sound without prior acoustic information (i.e., recordings) from a conventional playback machine, yet it operates neither mechanically nor optically, but magnetically. Drawing on the author's earlier work, *We Were Away a Year Ago* (2023), in which sound is produced by detecting variations in a magnetic field using a custom cartridge (i.e., a coil) attached to a turntable's tonearm (Figure 2)[15]—*Paper Tape* adopts a related printing method while reconfiguring the playback machine.

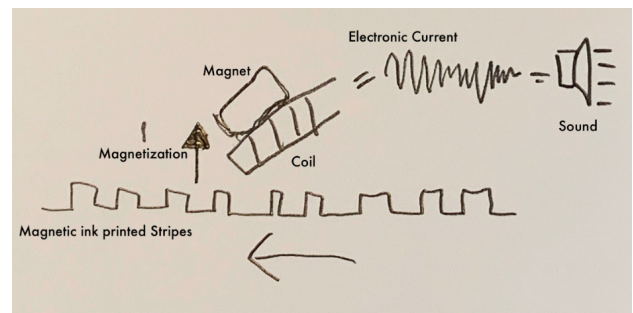


Figure 2: Schematic drawing of *We Were Away a Year Ago* (2023).

In principle, *Paper Tape* generates magnetic variations through the presence or absence of black-and-white stripe patterns printed with magnetized ink via digital silkscreen on a thin paper loop housed in a cassette shell; however, instead of a custom cartridge mounted on a turntable, these variations are detected by the tape head of conventional cassette players, including the *Walkman*.

Based on the resolution of the digital silkscreen printer (RISO Mi Screen A4), defined in the software (RISO ScreenMaking) as 8 px/mm, with a tape-loop length of 219 mm, we designed the black-and-white stripe pattern as a 1752 px bitmap image using conventional bitmap graphics software (e.g., GIMP, Adobe Photoshop). Given the transport speed of a cassette player (47.6 mm/s), this configuration produces a 4.6 s sound loop. The image is then translated by the printer into a series of perforations on the screen surface. Using this screen and a squeegee, magnetic ink (Turner Colour Works Ltd., Magnet Paint) is printed onto thin glassine paper (Figure 1), which was selected to avoid snagging at the pinch roller of the cassette player. The printed paper is cut by hand to a size of 3.8 mm × 219 mm using a handheld cutter. Because the magnetic ink itself has no inherent polarity, the printed pattern is magnetized by tracing a neodymium magnet across the surface of the cut paper. The paper is then formed into a circular loop by joining the ends with thin polyimide adhesive tape by hand. Finally, the loop is installed in a standard cassette shell by replacing the original magnetic tape. The printed side faces inward to prevent the ink from directly contacting and potentially damaging the tape head.

When the tape is played in a cassette player, the magnetized black-and-white stripe pattern actuates the tape head, inducing variations in electrical current that generate sound through the player's output (Figure 3). However, when an attempt is made to record onto the tape, the recording head effectively re-magnetizes the printed pattern in proportion to the input level rather than inscribing a new signal. This phenomenon arises from the size of the magnetic particles in the ink, which are approximately one hundred times larger than those used in standard magnetic tape (on the order of 10 μm versus approximately 0.1 μm). As a result,

the tape cannot support conventional sound recording, which requires fine-grained magnetic resolution. Rather than being a technical limitation, this incompatibility situates *Paper Tape* within a lineage of practices concerned with sound generation without recorded sources.

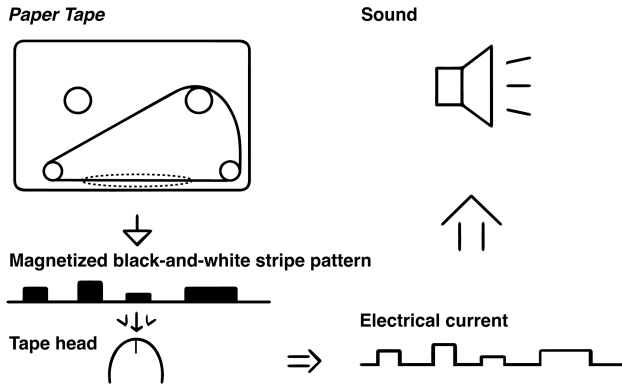


Figure 3: Schematic drawing of *Paper Tape*.

3 Maybe it's Music

Maybe it's Music is an exhibition of sound apparatuses by the author and OSHIMA Takuro at Parallax Records, Kyoto, Japan, from 22nd November to 13th December, 2025.

Inspired by the following statement by Jacques Attali, the exhibition explores possible modes of musical expression that emerge through these instruments:

“In music, the instrument often predates the expression it authorizes, which explains why a new invention has the nature of noise.” — Jacques Attali (1977)[2]

In the exhibition, the author presents a series of five *Paper Tapes* (Figure 4), listed below as well as a collaborative work that replays Oshima’s well-known piece *My DTM* using the authors’s *Paper Tape*. The *Paper Tapes* are exhibited with a cassette multi track player (TASCAM PORTASTUDIO 424), which allows visitors to listen to printed patterns divided into four tracks, with individually adjustable volume and panning (left-right positioning) for each track. Visitors free to pick the tapes and listen to them with the player (Figure 5).

Paper Tapes (2025)

- TEST TONES (2025): Lines printed at equal intervals. The sample represents gradual variations in amplitude caused by differences in magnetization strength, along with subtle gaps caused by smudging in the print.
- PULSE (2025): Lines and spaces printed at a constant period. The sample has a discontinuity at the joint of the tape loop.
- BLANK (2025): A blank tape.
- LETTERS (2025): The exhibition title printed from left to right. From each letter, a low, unsettling rustling sound emerges with a weird panning derived from the letters being divided into four tracks.
- RHYTHM ver. (with HINO Koshiro) (2025): Lines and spaces composed by musician HINO Koshiro. A danceable, percussive rhythm unfolds through sounds of identical pitch that subtly vary in character.

Paper Tapes and My DTM (2025)

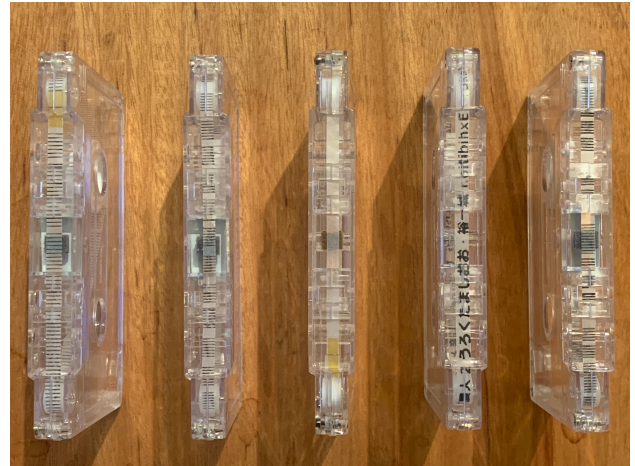


Figure 4: From left to right: *TEST TONES* (2025), *PULSE* (2025), *BLANK* (2025), *LETTERS* (2025), *RHYTHM ver. (with HINO Koshiro)* (2025)



Figure 5: *Paper Tapes* at the exhibition.

My DTM (2016) is a sound device created by OSHIMA Takuro that combines Plarail toy trains with cassette tapes. Cassette tapes carrying different audio recordings are affixed to the underside of each train. As the train passes over a playback head embedded in the track, the tape is played back. For this exhibition, OSHIMA replaced the cassette tapes with the author’s *Paper Tape*, redesigned specifically for this presentation.

4 Discussion

The following discussion situates *Paper Tape* within broader technical and artistic contexts in order to clarify how it challenges inherited assumptions of magnetic sound media.

4.1 Sound Generation from Visual Patterns

Building on the pioneering work mentioned above, attempts to generate sound directly from visual patterns have been pursued across a wide spectrum of approaches — from listening to the live output of a photodetector, to analyzing scanned images computationally [19]. *Paper Tape* follows in this tradition by converting visual patterns into sound through magnetic rather than optical means, with the computer serving solely as a device for printing the visual patterns.

What distinguishes this approach from the broader family of image-to-sound conversion is that the sounds produced are not the result of software-defined mappings or specialized apparatus, but emerge from the standard functions of the playback machine (i.e., cassette player) itself. This sets *Paper Tape* apart from a wide range of practices — spanning from Xenakis’s UPIC [16] in the 1970s, through commercial tools such as MetaSynth [25], to

the field of sonification more broadly [10] — which rely on the computer as the primary medium of transformation.

4.2 Letterform into Sound

In the work *LETTERS* (2025), the exhibition title is printed from left to right. Although the letters differ in their graphical proportions, when played through a multitrack head (e.g., stereo or four-track), variations in the tilt and thickness of each letterform generate distinguishable sounds with characteristic spatial effects arising from the panning of the tape tracks. This functional relationship between letterform and sound directly recalls earlier graphic sound practices of *Optophone*[8], an optical device designed to enable blind readers to perceive printed text in books and newspapers through sound.

While the purpose and operational principles of the optophone differ fundamentally from those of *Paper Tape*, the transformation of letterforms into sound—without abstraction into semantic units, as in optical character recognition (OCR)—repositions letters not as symbols to be read, but as material structures to be listened to. In doing so, it invites listeners to attend to the minute variations embedded within typographic forms themselves by magnetic means.

4.3 Deconstruction and Reconstruction

In the previous cases of Paik, Anderson, and others, the re-configuration functions as a bodily performative reactivation of recorded sound. By contrasting these precedents, *Paper Tape* proposes an inverse condition: a medium in which no sound is recorded (i.e., paper) is inserted into the standard cassette case, and in which sound arises solely through the push of the play-back button. Together, these practices delineate the conceptual extremes of magnetic sound media: on the one hand, the performative reactivation of recordings through the deconstruction of format; on the other, the production of sound without recording through the reconstruction of the medium itself.

4.4 Fidelity

Because silk screen printing is performed by hand, even when the same screen is used, each paper tape differs in its appearance. Variations such as uneven glazing or smudging of the magnetized ink produce glitches or attacks in the generated sound. The magnetization process using a neodymium magnet further introduces fluctuations in amplitude. Owing to these characteristics of the making process, each tape inevitably acquires unique sonic qualities. Such imperfections invite us to regard the *Paper Tape* not as a tool designed to faithfully realize a predefined task, but as an instrument that manifests a distinctive character or personality as noted by Tanaka[24]. In this sense, *Paper Tape* calls into question the notion of fidelity that has been deeply embedded in sound media technologies since their invention in previous centuries.

5 Conclusion

Paper Tape is designed to be playable on standard cassette players without any hardware modification. Rather than treating the cassette tape as a form of dead or zombie media [11], our approach revisits the cassette tape at the level of its material and operational principles. By replacing the conventional magnetic tape with a paper-based magnetic surface that cannot store recorded sound, *Paper Tape* repositions the cassette tape player not as a device for reproduction but as an instrument of sound generation.

6 Ethical Standards

This work repurposes a mass-produced consumer device — the cassette player — as an instrument for sound generation in a non-scalable, artisanal manner. Without recourse to specialized equipment, it proposes an alternative model of accessibility and sustainability in instrument design.

7 Appendices

Samples of five *Paper Tapes* are available at the following links. <https://x.gd/nmPW3>

Acknowledgments

This work was supported in part by JSPS KAKENHI (Grants JP23H00591 and JP23K17267).

References

- [1] Laurie Anderson. 1994. *Stories from the Nerve Bible*. Harper Perennial, New York, NY.
- [2] Jacques Attali. 1985. *Noise: The Political Economy of Music*. Manchester University Press. Original work published 1977.
- [3] Brian Benchoff. 2011. Magnetotron Is An Armonica Mellotron Mashup. Hackaday. <https://hackaday.com/2011/12/16/> Accessed: 2026-04-29.
- [4] Miles H. Clark and Helge Nielsen. 1998. The Telegraphone. In *Magnetic Recording: The First 100 Years*. John Wiley & Sons, 15–29.
- [5] Benjamin Duester. 2025. *Tomorrow on Cassette: Tape Jams in the New Media Age*. Bloomsbury Publishing USA.
- [6] Friedrich Engel, Peter Hammar, and Rainer Hess. 2006. A Selected History of Magnetic Recording. Unpublished manuscript, August.
- [7] Friedrich Karl Engel. 1990. Documents on the Invention of Magnetic Recording in 1878: An Appreciation on the 150th Anniversary of the Inventor's Birth. In *Proceedings of the 88th AES Convention*. Audio Engineering Society.
- [8] Edmund Edward Fournier d'Albe. 1914. On a Type-Reading Optophone. *Proceedings of the Royal Society A* 90, 619 (1914), 373–375.
- [9] Byeongwon Ha. 2017. Interactive Art Based on Musical Genealogy: Nam June Paik's Random Access. In *Proceedings of the International Symposium on Electronic Art*. Manizales, Colombia, 453–460.
- [10] Thomas Hermann, Andy Hunt, and John G. Neuhoff. 2011. *The Sonification Handbook*. Vol. 1. Logos Verlag, Berlin.
- [11] Garnet Hertz and Jussi Parikka. 2012. Zombie Media: Circuit Bending Media Archaeology into an Art Method. *Leonardo* 45, 5 (2012), 424–430.
- [12] Shuhei Hosokawa. 1984. The Walkman Effect. *Popular Music* 4 (1984), 165–180.
- [13] Kazuhiro Jo. 2025. Fragmented Music: Procedures, Behaviours, and Culture from "A Record without Prior Acoustic Information" (2012–). In *Proceedings of the First Alpaca Conference on Algorithmic Patterns in the Creative Arts*. Sheffield, UK. <https://doi.org/10.5281/zenodo.17084386>
- [14] Kazuhiro Jo and Mitsuhiro Ando. 2013. Cutting Record — A Record without (or with) Prior Acoustic Information. In *Proceedings of the International Conference on New Interfaces for Musical Expression (NIME)*. 283–286.
- [15] Kazuhiro Jo and Paul DeMarinis. 2023. Producing Sounds from the Past of Media: Mary Had a Little Lamb (2019) and We Were Away a Year Ago (2023). *The Journal of Media Art Study and Theory* 4, 2 (2023), 21–33.
- [16] Uta Kopp. 2024. *From Xenakis's UPIC to Graphic Notation Today*. Hatje Cantz Verlag.
- [17] Thomas Y. Levin. 2003. "Tones from Out of Nowhere": Rudolph Pfenninger and the Archaeology of Synthetic Sound. *Grey Room* 12 (2003), 32–79.
- [18] László Moholy-Nagy. 1989. New Plasticism in Music: Possibilities of the Gramophone. In *Broken Music: Artists' Recordworks*, Ursula Block and Michael Glasmeier (Eds.). Berliner Künstlerprogramm des DAAD and gelbe MUSIK, Berlin, 53–58.
- [19] N. Pashenkov. 2004. A New Mix of Forgotten Technology: Sound Generation, Sequencing and Performance Using an Optical Turntable. In *Proceedings of the 2004 Conference on New Interfaces for Musical Expression*. 64–67.
- [20] Valdemar Poulsen. 1898. Method of Recording and Reproducing Sounds or Signals. Danish Patent No. 1260.
- [21] Frank Samagaio. 2002. *The Mellotron Book*. ProMusic Press.
- [22] Pierre Schaeffer. 2012. In *Search of a Concrete Music*. Vol. 15. University of California Press.
- [23] Oberlin Smith. 1888. Some Possible Forms of Phonograph. *The Electrical World* (1888), 116.
- [24] Atau Tanaka. 2000. Musical Performance Practice on Sensor-Based Instruments. In *Trends in Gestural Control of Music*, Marcelo Wanderley and Marc Battier (Eds.). IRCAM, 284–405.
- [25] U&I Software. 1997. MetaSynth. <https://metasynth.com> Accessed: 2026-04-29.
- [26] Pieter Van der Lely and Gerhard Missriegler. 1970. Audio Tape Cassettes. *Philips Technical Review* 3 (1970), 77–92.
- [27] E. Wada, K. Sato, K. Kuno, and H. Yoshida. 2009. Open Real Ensemble. In *ACM SIGGRAPH ASIA 2009 Art Gallery & Emerging Technologies: Adaptation*. 50–51.