

Tele-Bio: Leaving and Receiving Physiological Traces Through a Public Telephone

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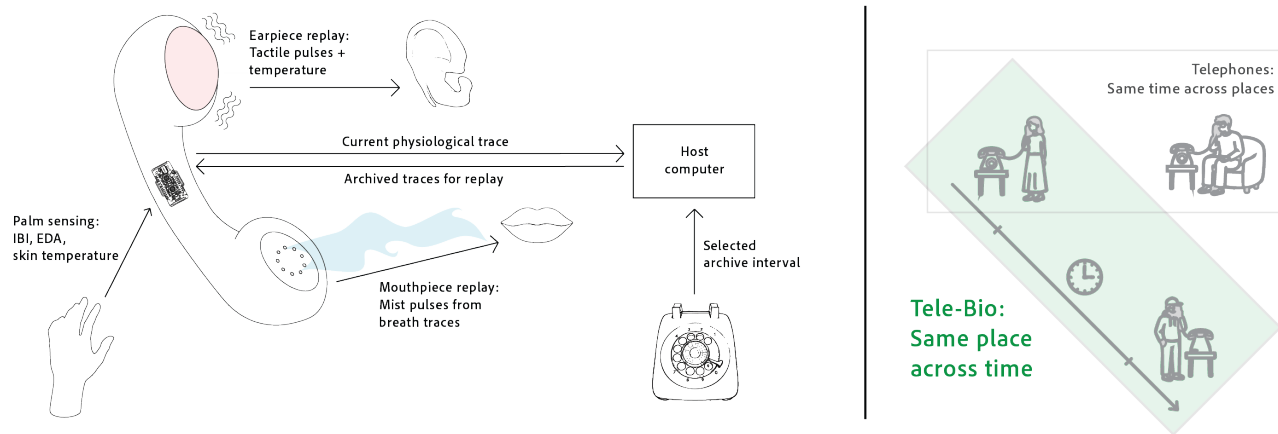


Figure 1: Tele-Bio system architecture and concept. The handset captures inter-beat intervals (IBI), electrodermal activity (EDA), skin temperature, and breath from the current visitor while replaying accumulated traces from earlier visitors as tactile pulses, temperature changes, and mist. The rotary dial controls how far the replay reaches into the archive. The right panel contrasts conventional telephones with Tele-Bio.

Abstract

Public telephones transmit voice between people in different places at the same time. However, because people use the same handset, warmth or moisture left by one caller may remain when the next caller picks it up. Tele-Bio extends this brief material relation by recording physiological signals from each caller and rendering archived signals through the handset for later callers. In the modified rotary payphone, lifting the handset starts both processes: it records inter-beat intervals, electrodermal activity, skin temperature, and breath while replaying traces from earlier visitors. The dial sets how far the replay reaches into the archive; traces within that span are superimposed. Their inter-beat intervals determine the timing of tactile pulses, and electrodermal activity shapes each pulse. Skin temperature becomes warmth or coolness at the ear,

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UIST Adjunct '26, Detroit, MI, USA

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ACM ISBN 979-8-4007-2855-6/2026/11
<https://doi.org/10.1145/3830397.3841318>

while breath returns as mist at the mouth. Hanging up adds the current recording to the archive, allowing the same handset to carry bodily traces between anonymous visitors across time.

CCS Concepts

• **Human-centered computing** → **Interaction devices**; *Haptic devices*.

Keywords

Telephone, physiological sensing, biosignals, traces, asynchronous interaction, tele-absence, installation

ACM Reference Format:

Yohta Kitagawa and Zhiheng Xu. 2026. Tele-Bio: Leaving and Receiving Physiological Traces Through a Public Telephone. In *The 39th Annual ACM Symposium on User Interface Software and Technology (UIST Adjunct '26)*, November 02–05, 2026, Detroit, MI, USA. ACM, New York, NY, USA, 3 pages. <https://doi.org/10.1145/3830397.3841318>

1 Introduction

The telephone is a medium for an absent body. It carries a voice across distance to someone who cannot otherwise be reached. Using

the telephone is itself embodied: the receiver is held in the hand, pressed to the ear, and brought near the mouth. A public telephone makes this contact sequential, as strangers use the same receiver at one site. Warmth or moisture may remain after a call, leaving a short-lived trace of a body that is no longer there.

Voice moves across space during the call; the material trace remains at the telephone after the caller leaves. Tele-Bio records physiological activity during contact and stores it anonymously, extending that trace to later visitors.

The interaction follows the telephone’s existing gestures. Lifting the handset begins sensing and replay, and hanging up adds the current session to the archive. The rotary dial, conventionally used to reach someone elsewhere, now determines how far the replay reaches into the past. Signals within the selected span are superimposed, so a wider selection includes more visitors without retrieving an individual record. Tele-Bio uses the same object that connects people across space to mediate contact among anonymous visitors across time.

2 Related Work

Physiological signals can convey bodily activity without specifying an emotional state. Animo [5] shares abstracted heart rate between known partners, while displays of skin conductance support more open-ended interpretations of biosignals [1]. When these signals remain in public artifacts, the connection can also extend across time. The Heart Sounds Bench [2] combines live and previous sitters’ heart sounds, while HeartSway [3] replays heart rate and motion for the next visitor. Tele-Bio develops this shift from live exchange to archived public traces. It accumulates sessions at one telephone, and the rotary dial sets how much of that history is replayed together.

This accumulation also connects Tele-Bio to work on temporal absence. TeleAbsence examines how physical and digital traces can mediate encounters across time [4]; within the project, Ambient-PhoneBooth uses a rotary telephone and immersive media to evoke homes and places from the past. Tele-Bio turns the telephone’s own history of contact into the temporal material: each session adds to the record of bodies that have handled it, and dialing reveals a narrower or broader layer of that activity.

Tele-Bio renders this accumulated history through the handset’s bodily contact. FaceHaptics [8] demonstrates warmth and water spray as facial cues, ThermoCaress [7] combines thermal feedback with touch, and breathHaptics [6] renders breath as a felt signal. These works establish the individual output channels; Tele-Bio coordinates pulse, temperature, and mist to make the telephone’s physiological archive perceptible at its earpiece and mouthpiece.

3 System

3.1 Interaction and Accumulation

Tele-Bio modifies a rotary payphone to record and replay physiological traces left at the same public site. Lifting the handset starts a session: the system records the current visitor’s physiological activity while the handset renders traces deposited by earlier visitors. Hanging up ends the session and adds the new recording to the anonymous archive, making it available only to later visitors. Because Tele-Bio extends the bodily trace left at the handset after a

call, each session stores physiological activity but not voice, adding to the telephone’s history of bodily contact.

The rotary dial makes this accumulated history accessible at different temporal scales. Each digit sets a progressively longer interval, measured backward from the start of the current session. The shortest interval includes recent sessions; the longest covers the full duration of the exhibition. Longer intervals bring more visitors into the same replay.

3.2 Sensing and Replay

An EmotiBit mounted on the back of the handset grip measures photoplethysmography (PPG), electrodermal activity (EDA), and skin temperature from the visitor’s palm. A thermistor on the inner face of the handset, above the mouthpiece, detects exhalation from changes in air temperature. The system stores the four signals together as a time-stamped session.

The handset returns these signals through two existing contact points. At the earpiece, inter-beat intervals derived from PPG set the timing of tactile pulses, while low-pass-filtered EDA controls their intensity and sharpness. Pulse trains from the selected sessions are superimposed and normalized. The mean of the selected skin-temperature traces controls warming or cooling at the same surface. At the mouthpiece, detected exhalations trigger mist; temporally adjacent events are merged into longer pulses.

Table 1: Mapping recorded physiological traces to replay.

Trace	Input	Replay
IBI	Palm PPG	Timing of earpiece pulses
EDA	Palm electrodes	Intensity and sharpness of pulses
Temperature	Palm sensor	Warm/cool earpiece surface
Breath	Thermistor above mouthpiece	Mist pulses at the mouthpiece

3.3 Physical Integration

The earpiece consists of a thin aluminum heat spreader covered by silicone. A vibration actuator and a Peltier module are coupled to the spreader, allowing tactile pulses and temperature changes to be felt through the same surface. A thermistor beneath the silicone measures its contact temperature for closed-loop control.

The breath thermistor is mounted on the inner face of the handset above the mouthpiece, near the visitor’s nose. The mist outlet remains at the mouthpiece and connects through a tube to a small water container and atomizer in the telephone base. Their separation keeps the mist path away from the breath sensor.

The EmotiBit streams sensor data over Wi-Fi to a host computer, which stores each session and computes replay signals for the dial-selected interval. An ESP32 inside the telephone reads the rotary dial and receives commands over USB serial. Through dedicated drivers, it controls the vibration actuator, Peltier module, and atomizer. USB powers the ESP32, while a separate DC line alongside it powers the actuators.

References

- [1] Noura Howell, Laura Devendorf, Rundong (Kevin) Tian, Tomás Vega Galvez, Nan-Wei Gong, Ivan Poupyrev, Eric Paulos, and Kimiko Ryokai. 2016. Biosignals as Social Cues: Ambiguity and Emotional Interpretation in Social Displays of Skin Conductance. In *Proceedings of the 2016 ACM Conference on Designing Interactive Systems* (Brisbane, QLD, Australia) (*DIS '16*). Association for Computing Machinery, New York, NY, USA, 865–870. doi:10.1145/2901790.2901850
- [2] Noura Howell, Greg Niemeyer, and Kimiko Ryokai. 2019. Life-Affirming Biosensing in Public: Sounding Heartbeats on a Red Bench. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow, Scotland Uk) (*CHI '19*). Association for Computing Machinery, New York, NY, USA, 1–16. doi:10.1145/3290605.3300910
- [3] Zeyu Huang, Zhifan Guo, Xingyu Li, Xiaojuan Ma, and Noura Howell. 2026. HeartSway: Exploring Biodata as Poetic Traces in Public Space. In *Proceedings of the 2026 ACM Designing Interactive Systems Conference* (*DIS '26*). Association for Computing Machinery, New York, NY, USA, 1479–1493. doi:10.1145/3800645.3813022
- [4] Hiroshi Ishii, Daniel Pillis, Pat Pataranutaporn, Xiao Xiao, Hayoun Noh, Lucy Li, Alaa Algargoosh, and Jean-Baptiste Labrune. 2025. TeleAbsence: A Vision of Past and Afterlife Telepresence. *PRESENCE: Virtual and Augmented Reality* 34 (2025), 65–95. doi:10.1162/PRES_a_00441
- [5] Fannie Liu, Mario Esparza, Maria Pavlovskaja, Geoff Kaufman, Laura Dabbish, and Andrés Monroy-Hernández. 2019. Animo: Sharing Biosignals on a Smartwatch for Lightweight Social Connection. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 3, 1, Article 18 (March 2019), 19 pages. doi:10.1145/3314405
- [6] Sunniva Liu, Jianzhe Gu, Dinesh K Patel, and Lining Yao. 2024. breathHaptics: Enabling Granular Rendering of Breath Signals via Haptics using Shape-Changing Soft Interfaces. In *Proceedings of the Eighteenth International Conference on Tangible, Embedded, and Embodied Interaction* (Cork, Ireland) (*TEI '24*). Association for Computing Machinery, New York, NY, USA, Article 24, 11 pages. doi:10.1145/3623509.3633372
- [7] Yuhu Liu, Satoshi Nishikawa, Young ah Seong, Ryuma Niiyama, and Yasuo Kuniyoshi. 2021. ThermoCaress: A Wearable Haptic Device with Illusory Moving Thermal Stimulation. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) (*CHI '21*). Association for Computing Machinery, New York, NY, USA, Article 214, 12 pages. doi:10.1145/3411764.3445777
- [8] Alexander Wilberz, Dominik Leschtschow, Christina Trepkowski, Jens Maiero, Ernst Kruijff, and Bernhard Riecke. 2020. FaceHaptics: Robot Arm based Versatile Facial Haptics for Immersive Environments. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) (*CHI '20*). Association for Computing Machinery, New York, NY, USA, 1–14. doi:10.1145/3313831.3376481