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Hearing a receipt: sonification and material analogies as ways of inspecting decision records

Draft v0.1 · label: proposed (Sonification and Material Analogies, paper 4 of the Neverthought programme)

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> **Status of this draft.** Written with AI assistance. It must be read, corrected and owned by its human author before any posting, and AI assistance must be disclosed as the target venue requires. **The sonification mapping is specified, not implemented, and no comparative study has been run.** Hearing a sound is not evidence of anything. This draft proposes a study that could show the mapping adds nothing.

Abstract

Decision records such as receipts from a warrant gate are dense: a dozen or more checks, each with a status, a reason and sometimes a margin, and a history of reassessments. We ask whether a specified, non-visual presentation reveals information that ordinary presentations miss. We specify a mapping from receipt states to sound:

- check status becomes one of four fixed, labelled timbres;
- check order becomes onset time;
- the outcome becomes a sustained final tone or silence;
- a reassessment replays the prior sequence and then only the changed checks.

We also describe a discipline for *material analogies* (physical pictures of organisational quantities): every analogy carries a label stating whether its quantity is a formal measure, a measure with an analogical name, an analogy only, or has no physical counterpart. We propose a preregistered comparative study against visual, textual and shuffled-mapping controls, with tasks that have right answers. We cite prior work that translated protein sequences into sound [1] as relevant prior art only; it does not validate this mapping.

1. Introduction

Two claims are often made loosely about unusual presentations of data: that they help people notice things, and that an analogy explains a mechanism. Both are testable, and both are easy to overclaim.

This paper keeps them apart from any claim about the decisions themselves. A pleasing sound, or a vivid picture, is not evidence that a decision was warranted.

Question. Does a specified mapping reveal information that controls miss?

2. The mapping (specified, not implemented)

Receipt feature	Sound
Check status: PASS, FAIL, UNAVAILABLE, UNMEASURABLE	One of four fixed, labelled timbres
Order of checks	Onset time, at a fixed interval
Outcome: EXECUTE or HOLD	A final sustained tone, or silence
Reassessment of an earlier receipt	The prior sequence repeats, then only the changed checks play

The mapping is chosen so that each audible feature corresponds to exactly one receipt feature, and so that the difference between a receipt and its reassessment becomes a short, isolated passage. The last row is where we expect any advantage: a visual table shows *states*, while a sound shows *changes over time*.

A related implementation. A companion site plays kernel standing statuses (warranted, unsupported, not valid at time *t*, invalidated, revoked, quarantined, defeated) as fixed pitches, 0.25 seconds per unit of valid time, with a second voice a fifth above. It is labelled as art and pedagogy, not mathematics, and not evidence. We cite it as a demonstration that such a mapping can be built, not as a test of whether it helps.

3. Material analogies, labelled

Physical pictures are useful for teaching and dangerous as claims. The programme's risk archetypes carry a label for each quantity:

Label	Meaning
FORMAL	A defined operator on declared inputs
FORMAL_MEASURE_ANALOGY_NAME	The quantity is exact; its physical name is an analogy
ANALOGY	Explanatory only
NONE	No physical counterpart; forcing one would be an error

For example, the review ratio (review time over time to commitment) is an exact quantity with the analogical name of a Deborah number. The programme's explainer that draws a crossing's headroom as the depth of a basin is labelled ANALOGY, on screen and in its narration. The labels make an analogy's status part of the record, so a reader can see when a picture is carrying weight it has not earned.

4. Proposed study

Design. Within-subject, counterbalanced, preregistered. Participants are people who review decision records professionally (for example claims handlers or auditors), plus a group of blind or low-vision reviewers for whom a non-visual channel may matter most.

Stimuli. Synthetic receipts from the programme's workbench, including reassessments with known changes.

Conditions.

1. *Sonified:* the mapping in §2.
2. *Visual table:* the same receipt as a table of checks (control).
3. *Text:* the same receipt as plain text (control).
4. *Shuffled mapping:* sound with timbres assigned at random per trial (control for novelty and attention).

Tasks with right answers.

- Which check failed?
- Was the outcome EXECUTE or HOLD?
- Which checks changed between a receipt and its reassessment?
- Did any check become UNMEASURABLE?

Measures. Accuracy (primary), time and confidence (secondary), each against a fixed answer key generated from the receipts.

Hypotheses.

- H1: on the change-detection task, the sonified condition beats the visual table.
- H2: on the single-state tasks, it does no worse than the visual table.
- H3: the sonified condition beats the shuffled mapping. If it does not, any advantage is novelty, not the mapping.

Reporting. All results are reported, including a null result for H1, in which case the claim that the mapping reveals information that controls miss is withdrawn.

5. Out of scope

A separate protocol in the programme compares spectra of candidate reference sequences against matched random and Poisson controls. It is not a sonification study. No run of it has been registered or performed, and it makes no claim that any sequence governs decisions.

6. What this paper does not claim

- That the mapping is implemented.
- That hearing a receipt, or seeing an analogy, is evidence about the decision it represents.
- Any collaboration with, or validation by, the authors of [1].
- That any organisational quantity obeys a physical law.

References

1. C.-H. Yu, Z. Qin, F. J. Martin-Martinez and M. J. Buehler, "A Self-Consistent Sonification Method to Translate Amino Acid Sequences into Musical Compositions and Application in Protein Design Using Artificial Intelligence," *ACS Nano* 13(7):7471–7482, 2019. doi:10.1021/acsnano.9b02180.

Checklist before a preprint

☐ Author reads and rewrites, and confirms the AI-assistance disclosure for the target venue.
☐ Implement the mapping and publish the audio for every stimulus before recruitment.
☐ Preregister conditions, tasks, answer key, analysis and sample size.
☐ Add related work on auditory display and sonification evaluation, from verified sources only.