

Sounding the Horn: Designing Auditory Misinformation Warnings to Foster Critical Engagement with Podcasts

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1. Abstract

The spread of online misinformation constitutes an ongoing challenge and is particularly prominent for debated topics, which are associated with polarization, suppressed critical thought, and heightened emotionality (Ecker et al., 2022; Rieger et al., 2024). These attributes diminish one's tolerance towards alternative outlooks and increase their susceptibility to misconceptions (Beauvais, 2022; French et al., 2025; Martel et al., 2020). Beyond traditional Web search, podcasts represent a popular medium which offers greater accessibility and engagement, yet their fast pace and passive mode of consumption make it difficult to identify falsehoods, thereby facilitating the latter's dissemination (Jones et al., 2021; Tobin & Guadagno, 2022).

In the visual modality, fake news interventions are implemented as nudges that prompt changes in user behavior by introducing minor "design frictions", e.g. obscuring webpage content (Cox et al., 2016; Kaufman et al., 2025; Kirchner & Reuter, 2020; Martel & Rand, 2023). Exploring the integration of flag-like signals into podcasts, this work aims to inform the design of salient nudging interventions that capture listeners' attention and trigger misinformation awareness (Cabral & Remijn, 2019; Cherumanal et al., 2024). Considering podcasts' reliance on an uninterrupted and intelligible narrative for audience comprehension, however, such cues must cause neither cognitive resource interference, nor prolonged dissatisfaction (Kozyreva et al., 2020; Lewandowsky et al., 2012). Key to an effective design balancing between attention capture and warning-induced disruption, identifying how users perceive these signals is the contribution's central objective.

To that end, two exploratory crowdsourcing studies were conducted. The first ($n = 150$) involved subjectively evaluating 15 auditory icons interspersed into brief dialogue excerpts to determine the least disruptive and most favorably perceived among them. Those then acted as misinformation warnings in three NotebookLM-generated podcasts on controversial scientific topics, injected with falsehoods from sources supplied in-prompting. Study 2 ($n = 115$) examined the interventions' interplay with podcast-content recall, misinformation recognition, and listener-experience judgments using a between-subjects design to disambiguate 4 warning-placement configurations (Figure 1).

Through Study 1, salient samples instilling a sense of urgency without being overly distracting were identified across the three categories of alarms, animal noises, and natural/domestic sounds, qualitative findings also highlighting the importance of a sound's listener-perceived appropriateness – based on pre-existing notions of "regular" podcast-editing effects – for it to be interpreted as an intentional signal rather than an immersion-breaking, out-of-context interruption. Serving as misinformation indicators throughout Study 2, the cues were not explicitly heeded by participants assessing a statement's veracity, yet those *enclosing* a falsehood or *appearing after* one were accurately presumed to fulfill that role by some evaluators. Significant regression-model results were obtained for placement – signals *positioned after* a misleading statement were the least distracting and interruptive of the listening experience, while *concurrently placed* interventions were linked with the poorest recall-assessment performance.

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Attitudes towards warnings, however, lack cohesion: attributing them higher importance from their second occurrence onwards, passively discarding them through habituation, independently scrutinizing content without automatically trusting them, or actively opposing them as paternalistic are all expressed. Such variety only widens the research gap, offering many worthwhile directions for future work.

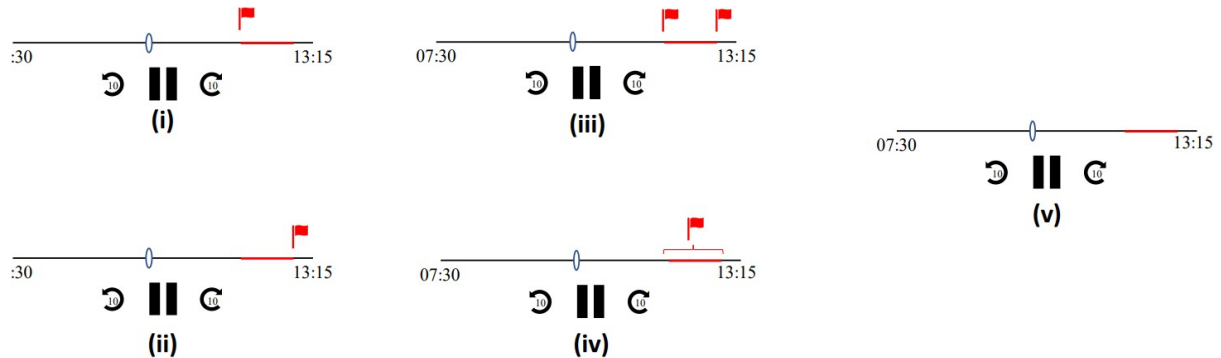


Figure 1: An illustration of the 4 warning-placement alternatives (red flags) w.r.t. the misinformation segment (red horizontal-bar portions) – before (i), after (ii), enclosing (iii), and concurrent (iv) – as well as the control-group condition without sound cues (v).

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