"My Tummy Has a Little Dragon": From Everyday Experiences of Gut Sounds to Interoceptive Interaction Design

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Abstract

Gastrointestinal sounds are a constant part of human physiology, offering potential insights into digestive functions and everyday bodily awareness. However, these sounds are rarely noticed and often socially stigmatised, remaining underexplored in HCI despite calls to recognise the gut as a site for embodied awareness. We extend HCI's engagement with involuntary biosignals by positioning gut sounds as a uniquely generative context for interoceptive interaction design, where systems can scaffold awareness, reflection, and care. We conducted a week-long in-the-wild qualitative study with ten participants, which showed how making gut sounds audible reshaped bodily awareness, provoked affective responses, and prompted acts of reflection and tinkering. From these insights, we contribute four bodily perspectives – Registering, Reacting, Reflecting, and Responding- that capture the oscillatory nature of interoceptive engagement and offer design strategies that position biosignals as sites of curiosity, care, and awareness that are socially situated.

CCS Concepts

• **Human-centered computing → Interaction paradigms**.

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1 INTRODUCTION

How can listening to involuntary gut sounds (from the gastrointestinal system) shape bodily awareness? Human–Computer Interaction (HCI) has increasingly embraced body-centric design, creating systems that help individuals perceive, interpret, and connect meaningfully with their own bodily processes [45, 73, 107, 120]. This "somatic turn" [65] has led to interactive systems that bring lived bodily experiences to the foreground, shifting focus from quantifiable metrics to the felt body. Yet most of these HCI systems focus on signals such as heart rate or respiration, which are easily measurable, straightforward to visualise, and socially normalised, leaving other internal signals, such as gut sounds, underexplored. Drawing on soma design principles, we orient our work toward the felt, pre-reflective qualities of gut sounds and approach internal acoustics as lived bodily experience rather than a signal to be measured or optimised.

Figure 1: A person using GastroPod, a wearable device that makes gut sounds audible in real time.

Research increasingly demonstrates that our gut and the bodily processes with which it is closely entangled affect human emotional, cognitive, and physiological well-being [15, 70]. Far from just being a passive site for digestion, the "gut complex", i.e., the interplay of gut, brain, immune system, and microbiome, is now recognised as perceptual, affective, and agentive [11]. This reorientation presents HCI with opportunities to expand its focus beyond voluntary processes and visible metrics, towards designing for subtle, involuntary processes. Gut sounds, which include flatulence, belching, and borborygmi [27], are generated by the movement and processing of food, fluids, and gas in the intestines. The generated sounds often vary in intensity, type, and frequency of occurrence, making them less amenable to quantification [31]. This challenge resonates with broader accounts of documenting somatic experience, where bodily sensations are described as elusive, ephemeral, and resistant to capture or measurement. In clinical settings, they are carefully considered as diagnostic indicators, while in everyday life, they are often dismissed as trivial, embarrassing, or humorous [10, 21]. Their association with social stigma, as well as their ambiguous medical and cultural status, makes them a uniquely challenging yet generative design material for HCI. Despite this potential, involuntary internal sounds have rarely been investigated as a basis for interoceptive interaction design. Every day, digestive sensations frequently prompt curiosity, discomfort, or uncertainty, indicating that people often seek ways to recognise patterns and make sense of subtle internal cues.

From a physiological standpoint, gut sounds are part of the body's interoceptive signalling system. Interoception is the process by which the nervous system senses, interprets, and integrates internal bodily signals, shaping subjective experience, emotion, and daily participation [86, 89]. Interoceptive awareness refers to the capacity to consciously notice and interpret such signals, a skill that HCI systems often scaffold through biofeedback and soma design. These signals reflect processes such as digestion, arousal, and homeostasis [54]. Often, such knowledge remains tacit, surfacing only through lived experience [114]. Soma design provides a framework for engaging this kind of subtle, pre-reflective awareness, positioning the felt body at the centre of interaction [45].

Our design process and study setup were shaped by attending to felt bodily experience during early listening trials, aligning our approach with soma design's emphasis on first-person, experiential engagement while not claiming engagement with the entire soma design process. In our project, such first-person exploration sensitised attention to shifts across contexts and highlighted experiential qualities that later shaped the journalling prompts and study design. Research on involuntary phenomena, such as aesthetic chills, demonstrates that even fleeting, uncontrollable bodily events can profoundly shape affective and reflective experience [50]. Prior HCI systems, such as the Soma Mat and Breathing Light [106], DeLight [122], and VoxBox [87], have explored biofeedback to facilitate interoceptive awareness. By contrast, the gut, with its rich innervation (i.e., the distribution and function of nerves) and complex internal

rhythms, remains largely underexplored in interoceptive design [11, 79].

In contrast to their unfavourable social impression, gut sounds convey rich information about internal bodily states, reflecting digestive activity alongside affective signals that can shape mood and instinctive responses [67, 78]. Their ambiguous and affectively charged nature affords both embarrassment and humour, offering rare access to hidden aspects of bodily functioning. These features suggest that gut sounds offer potential as design material for creating open-ended, subjective interactions, positioning them as a fertile site for interoceptive design in which oscillations between stigma and curiosity, disruption and play, and care and dismissal can be leveraged as design opportunities. Together, the ambivalent and often stigmatised nature of gut sounds makes them uniquely generative for design, echoing prior HCI scholarship that identifies discomfort as a catalyst for deeper reflection and engagement [38].

We address this gap through the GastroPod (Figure 1), a wearable system that makes gut sounds audible in real time. Combining a digital stethoscope (involving a contact microphone with digital sound processing capabilities that allows to amplify internal sounds) with Bluetooth bone-conduction headphones, GastroPod allows users to listen while engaging with daily life. Unlike medical auscultation, which is typically limited to brief encounters where internal sounds are assessed against normative baselines, GastroPod surfaces the raw sonic qualities of gut activity. It does not analyse or visualise data; instead, it invites open-ended, self-directed listening, encouraging personal interpretation, embodied inquiry, and affective resonance. Alongside the wearable, we developed a multimodal sound journal to support articulation through sketches, symbols, and contextual notes. Together, the system and journal extend soma design [48] by treating involuntary gut sounds not as anomalies to eliminate but as resources for curiosity, reflection, and playful engagement.

To examine how people perceive and interpret gut sounds in everyday life, we conducted a seven-day in-the-wild deployment with 10 participants in a multi-phase study comprising: 1) a pre-study interview to understand their prior experiences related to their gut health, bodily awareness and sound; 2) a field deployment of the GastroPod system, used at their discretion during everyday activities (e.g., eating, working, resting, moving, socialising), complemented with a guided sound journal that prompts contextual note-taking, free-form reflection, and spatial body-mapping to document their moment-to-moment sound experiences; 3) a post-study interview to reflect on their experiences; and 4) a sensemaking workshop (not reported in this paper) where participants externalised the experiences of their gut sounds through craft-based artefacts.

Guided by theories of interoception, auditory biofeedback, and soma design, we ask: *How can augmented listening to gut sounds in everyday life inform the design of interactive interoceptive systems?* Our contributions are twofold:

(1) **Theoretical Contributions:** We propose four bodily perspectives, Registering, Reacting, Reflecting, and Responding, that shape our central contribution to interoceptive interaction design. The four perspectives capture the oscillatory nature of interoceptive engagement with involuntary biosignals and translate into design considerations such as curatorial mediation, scaffolding ambivalence, supporting plural vocabularies, and legitimising tinkering and non-events.
(2) **Empirical Insights:** From a seven-day in-the-wild study with ten participants, we show how augmented listening reshaped bodily awareness, provoked affective responses, inspired metaphorical framings, and prompted small acts of tinkering and care. These empirical insights ground and illustrate the four bodily perspectives.

2 RELATED WORK

Our work on GastroPod draws from interoception and bodily awareness, sensory augmentation and somaesthetics, and multisensory engagement with physiological signals.

2.1 Interoception and Bodily Awareness

Prior work has shown that technologies can scaffold interoceptive engagement through techniques such as multimodal journalling, body-mapping, and reflective biofeedback [71, 102, 115, 122]. These systems often draw from therapeutic and somatic traditions, where practices of noticing, naming, and articulating internal sensations are used to cultivate bodily awareness. Staab et al. [102] synthesised strategies from therapeutic and HCI practices, highlighting opportunities to scaffold noticing, articulating, and interpreting interoceptive sensations in mental health contexts. Their synthesis informed our study design and the development of reflective prompts within the sound journal, helping structure how participants documented and externalised moment-to-moment sensations.

Most interoceptive systems in HCI focus on controllable signals such as heart rate, respiration, or posture. These signals are comparatively easier to sense, interpret, and socially share, leading to a wide range of biofeedback systems for breathing and heart rate [35, 36, 53, 85]. Examples include Bright Beat [36] for breathing modulation, Walking Carpet [25] for embodied somatic reflection, Soma Bits [121] as a tangible prototyping toolkit, and affective health systems [55, 75]. Beyond these, speculative projects such as Loupe and Lightbox [12] explored slow approaches to self-tracking of the gut microbiome through externalisation, inviting long-term relationships with data. These projects often framed awareness through monitoring and optimisation. Gut sounds, by contrast, are ambiguous and stigmatised, pointing to a design space less about optimisation and more about curiosity, speculation, and personal meaning-making [33].

Early explorations in HCI include GutIO [78], which linked abdominal sounds to emotional gut feelings, and the Gut–Brain Computer Interface [116], and Going with our Guts [117], which investigated electrogastrography for affective computing. These studies demonstrate the feasibility of gut sensing but focus largely on classification or affect detection, leaving everyday engagement with gut sounds and their reflective potential underexplored.

Gut sounds may be read as natural, humorous, embarrassing, or emotionally significant [10, 115]. These interpretations also shape how people negotiate what to reveal, when, and with whom—a process understood as privacy boundary negotiation in social computing [41]. These framings shape whether people notice, share, or

suppress interoceptive cues, making design for reflection complex and highly context dependent. Playful and critical approaches have explored digestion and gut health as sites for engagement. The Gut's Game [62] uses ingestible sensors to turn gut temperature into a game mechanic, highlighting both the potential for heightened bodily awareness and the discomfort of ingesting technology. Gooey Gut Trail [83] fostered dialogue on microbial balance through board play, enabling participants to share everyday habits and negotiate health knowledge while witnessing the outcomes of their "health actions" in the game. Digestive Tumble [56] externalised digestion via a tangible mechanical system. Go-Go Biome [82] extended this work through a casual digital game that encouraged everyday activity engagement to balance microbial diversity. Together, these projects show how socially sensitive gut processes can be made accessible through playful externalisation and embodied interaction. At the same time, they rely heavily on metaphor or simulation, leaving the direct, lived dynamics of gut sounds unexplored.

Beyond game-based engagement, Go-Go Biome also introduced four design lenses: bio-temporality, visceral conversations, wellness comparison, and inner discovery [82]. These informed GastroPod's study design, shaping journaling and interviews so participants could perceive rhythms, compare across days, and explore new meanings. Prior research suggests that the perception and interpretation of bodily sounds are shaped by cultural context [123]. Ambiguous sounds are often harder to interpret or remember because they lack perceptual anchors [2]. Research in HCI also shows that uncertainty and indeterminate signals can function as generative resources, provoking curiosity, speculation, and new interpretive possibilities [28, 34]. Gut sounds, with their irregular acoustic properties, tend to acquire meaning only through repeated exposure and personal sense-making. Together, these insights motivate GastroPod's design, which scaffolds subjective interpretation while accommodating cultural variability, extending somaesthetic, inbodied, and interoceptive design traditions [45, 90, 102]. Cross-cultural research further shows that interoceptive sensations are understood through culturally embedded vocabularies and metaphors [115, 123] reinforcing the need for systems that support plural, user-generated interpretive repertoires.

2.2 Somaesthetic and Body-Centric Interaction Design

Somaesthetic interaction design [97], positions the felt body, not just sensed data, as a primary site for design [45]. Body-centric interaction design complements this by integrating movement, posture, and embodied modalities [73]. Where much of this work engages voluntary capacities, our focus turns to involuntary, internal acoustic signals. Other strands of HCI have used "bodies" as analytic lenses, for example, Mueller et al.'s exertion framework, which articulated Responding, Moving, Sensing, and Relating Bodies [74]. We extend this lineage by attending to involuntary biosignals, positioning gut sounds as a new material for interoceptive design.

Most body-centric systems extend voluntary capacities, for example, enhancing proprioception through movement sonification or augmenting gestures with haptics [7, 46, 51, 61]. Inbodied Interaction [90, 91] instead treats technology as a temporary scaffold for subtle cues. In GastroPod, this translates to short-term scaffolding that helps participants notice and reflect on gut sounds, recognising them as the primary interpreters of their experiences. This aligns with calls for self-authored, plural understandings of embodiment [115], which we adopt by centring participant-led meaning-making.

Phenomenological accounts similarly position the body as the ground of perception [94], aligning with somaesthetic methods such as Feldenkrais and yoga to cultivate awareness [46]. Adapting this to gut sounds requires attention to signals that are unpredictable and socially charged [50]. Somaesthetic systems like Soma Mat, Soma Bits, and others [3, 49, 106] indicate how reflection can be supported through sensory modalities, but internal acoustic signals remain underexplored [109]. GastroPod extends somaesthetic and inbodied approaches into a domain where interpretation is contingent, affectively charged, and culturally mediated.

2.3 Multisensory Engagement with Internal Bodily Signals

While auditory biofeedback remains central to our work, bodily signals are rarely encountered in isolation; they often combine with tactile, visual, and proprioceptive cues [29, 40, 57, 79]. Sonic interaction design has extended biofeedback into affective domains, for example, through heart-rate sonification [52] or breath-based soundscapes [99]. These systems rely on voluntary signals, whereas gut sounds are irregular and less culturally normalised, posing distinctive interpretive challenges.

Designing with such signals requires not synthetic mappings but amplification and framing of the body's own events. Following Ceraso [19], listening can be understood as a multimodal experience that engages the whole body. Uotinen [114] describes this as "unbeknown knowledge," a tacit bodily understanding emerging from lived sensory experience. GastroPod leverages this by combining auditory listening with journaling and body-mapping, turning fleeting sounds into tangible, communicable artefacts.

Beyond HCI, artistic and cross-disciplinary practices highlight the value of multimodal expression. For example, Stuff Change externalised and synchronised gut rhythms as collective encounters [66]. Nanogami used a bioresponsive garment to externalise the microbiome through visual and haptic feedback, embodying "extimacy" by making internal states perceptible [77]. I've Gut Something to Tell You amplified bowel sounds into poetic text to provoke reflection on gut–brain connection and bodily taboos [100]. Other projects, such as Stomach Ache Project [22], Digesting Gut Feelings [37], and Gut Feelings Project [69] surfaced lived digestive experiences through narrative and material practices, while Hadzi-Vasileva's Art from the Gut [16] transformed visceral materials into large-scale installations. These works reduce stigma and foster curiosity, but rarely explore personal, everyday listening. GastroPod extends its multimodal framings to focus on individual, situated engagements with gut sounds.

Technological research, by contrast, has prioritised precision over ambiguity. Deep learning approaches to gastrointestinal acoustics achieve high diagnostic accuracy [31], while studies on stress inference from abdominal sounds suggest novel biofeedback pathways [70]. Smartphone-based sensing methods further demonstrate that portable, low-cost tools can capture gut activity outside clinical contexts [30, 105]. Yet these approaches emphasise classification

Figure 2: GastroPod Study Kit.

and analysis rather than cultural or experiential engagement. GastroPod instead integrates auditory biosignals with multisensory journaling, reframing gut sounds from diagnostic anomalies into cultural and experiential material.

In sum, these prior works suggest that gut engagement has been explored as an artistic metaphor, clinical data, or speculative design, but rarely as everyday multisensory listening. By extending auditory interaction into journaling and multimodal practices, GastroPod contributes strategies for interoceptive design that are open-ended, affectively resonant, and socially situated.

3 GASTROPOD DESIGN JOURNEY: FROM EXPERIMENTATION TO ASSEMBLY OF THE STUDY KIT

We followed a Research through Design approach [124], using first-person, soma-informed explorations to trial, reject, and refine system configurations. While the initial user was the designer, this aligns with RtD practices where embodied experimentation [47] is a valid method for surfacing parameters and guiding design. In GastroPod, this meant wearing and listening through different hardware setups in everyday situations, such as feeling how straps pressed on the abdomen, how headphones amplified gut sounds, how placement altered sonic clarity, and how journaling supported interpretation. These bodily encounters surfaced somatic qualities such as pressure, vibration, sonic clarity, intensity, and affective shifts that directly shaped subsequent design decisions.

These early explorations align with soma design's emphasis on attentional tuning, felt experience, and bodily change as design material. The experiential parameters identified through this process influenced both the sensing–listening configuration and the design of the journalling tools that support reflection in the study.

To preserve real-time, intimate listening without visual or analytic mediation, we adopted a sensing–listening configuration with a microphone placed on the abdomen and headphones for direct auditory engagement. This preserved the vibrational and textural qualities of gut sounds—qualities that would be flattened in visualisation—and enabled participants to attend to low-frequency, rhythmic sensations as lived bodily phenomena. Using headphones created a dedicated attentional channel while maintaining environmental awareness, supporting soma design values of temporal sensitivity, sensory discrimination, and embracing ambiguity over premature abstraction [45, 47].

Through this iterative embodied exploration, the first author compared multiple sensing and listening configurations before selecting the final assembly of the GastroPod study kit. While practical considerations shaped final choices, they were continually informed by soma design principles around comfort, wearability, and situated bodily engagement [45, 47, 48, 84, 93, 107].

3.1 Balancing Portability, Wearability, and Fidelity In Selecting an Auscultation Device

Evaluation of potential sensing devices was guided by parameters including portability, form factor, wearability, and Bluetooth

Table 1: Parameters guiding selection of the auscultation and listening device.

Parameter	Reasons for consideration	References
Portability	The device needed to be lightweight and unobtrusive to support seamless integration into everyday routines.	[4, 49]
Small form factor	A compact design minimised bulk and enabled secure attachment to the body without restricting movement.	[84]
Tubeless design	Avoided the long tubing of traditional clinical stethoscopes, which limited portability, mobility, and self-use.	[58, 84]
On-body comfort	Essential for prolonged wear and for embedding the device into everyday and domestic contexts.	[45, 93]
Bluetooth connectivity	Enabled wireless audio streaming to headphones and non-proprietary mobile devices, increasing accessibility and flexibility.	[95]
Recording capability	Access to a companion application for capturing sound files supported reflection, review, and optional data sharing.	[18, 23]
Signal fidelity	High signal amplification (100×) and a wide frequency range (20–2000 Hz) ensured reliable capture of subtle gastrointestinal sounds.	[24]

connectivity (Table 1). Several low-cost, clinical, and smartphone-based auscultation devices were examined, but their ergonomics, bulk, or poor sonic isolation made them unsuitable for repeated self-administered listening in everyday contexts (Appendix A1).

Seeking a balance between comfort, usability, and sonic clarity, we adopted the Stemoscope Pro, a digital wireless Bluetooth enabled miniature stethoscope with a compact tubeless form and 100× amplification across a 20–2000 Hz range. Although limited to 1.5 hours per charge, its portability, comfort, and ease of placement aligned with our goal of seamless daily use. Prior work on wearables emphasises that unobtrusive, low-burden designs support sustained everyday engagement [4, 45, 49, 84].

3.2 Supporting Comfort and Adjustability in the Wearable Device Placement

Achieving stable abdominal placement required experimenting with multiple suspension methods, including brand-provided straps, medical monitoring straps, and adhesive mounting. Many options were uncomfortable or unsuitable in social contexts (Appendix A2).

A universal belt with an adjustable strap and carabiner provided a practical solution, supporting both fixed positioning and retractable scanning across abdominal quadrants. Consistent with soma design arguments that material fit and bodily alignment shape experience [45], we found that gut sounds were clearest when the device made direct contact with skin.

3.3 Ensuring Comfort, Social Presence, and Fidelity in Selecting a Listening Device

Headphones were essential for this system because they allowed participants to listen in an embodied way. When choosing headphones, we prioritised comfort for prolonged use, battery life, and social presence (Table 2), as these factors determined the experience rather than informational readout. Therefore, when choosing headphones, we prioritised comfort for prolonged use, battery life, and social presence (Table 2), as these factors determined whether listening could be integrated into daily routines without signalling withdrawal. Initial trials with in-ear devices highlighted issues of discomfort, short battery life, and social withdrawal signalling (Appendix A3).

We selected Shokz OpenRun Pro 2 bone- and air-conduction headphones [96], which supported long-term wear, environmental awareness, and seamless switching of attention between internal and external stimuli. Their open-ear design maintained social presence—an important consideration given prior HCI findings that ear-occluding devices can signal disengagement [17, 81, 92], while providing sufficient fidelity for visceral sounds [68, 80].

3.4 Identifying a Portable and Lightweight Power Solution

The Stemoscope Pro's limited battery life required a supplemental power solution. We selected a compact 5000 mAh power bank that balanced portability and comfort. This choice follows HCI arguments that reducing charging friction is central to supporting ongoing everyday engagement with sensing systems [58, 59] (Appendix A4).

3.5 Designing a Multimodal Journal to Scaffold Reflection

We developed a multimodal sound journal inspired by soma design methods that surface bodily sensations through first-person, multimodal articulation [19, 112, 113, 115]. Early first-person trials across a week, conducted by two members of the research team, revealed that gut sounds varied with posture, activity, and time of day. These sessions shaped the journal's early structure and highlighted the need for temporality and multimodality to capture subtle, fast-shifting experiences.

Table 2: Parameters guiding selection of the listening device for GastroPod.

Parameter	Reasons for consideration	References
Battery life	Longer run-time minimised interruptions during use and reduced the burden of frequent recharging.	[58]
Openness vs occlusion	An open-ear design supported situational awareness, encouraged approachability and social presence, and avoided cues of withdrawal from the surrounding environment.	[17, 81, 92]
Comfort	Critical for prolonged everyday use without causing ear fatigue or physical discomfort.	[45, 93]
Fidelity	Ensured visceral sounds could be transmitted clearly without masking environmental awareness.	[68, 80]

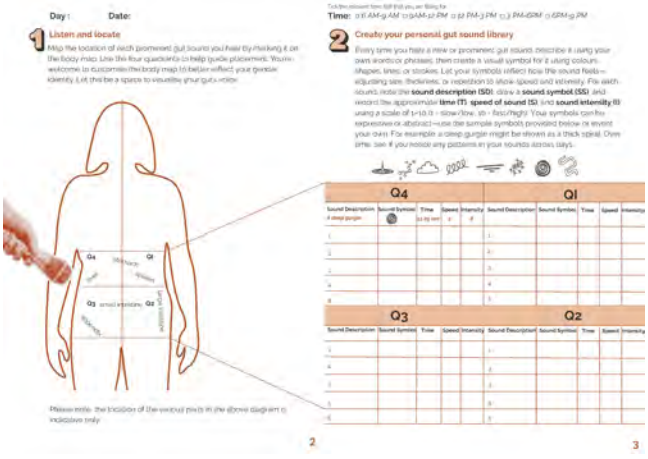

Figure 3: Body map and sound library of the GastroPod sound journal.

Figure 4: The four quadrants on which participants map and describe their gut sound experiences.

Initial sketches began with a simple body map divided into quadrants (Q1–Q4) following medical auscultation protocol [24], but static maps risked obscuring temporality and variation. The journal was iteratively expanded to include daily pages capturing context (meals, activities, time of day), up to five sound observations, and participant-generated symbols and descriptors. Silhouettes were adapted into male, female, and gender-neutral forms for inclusivity, following Turmo Vidal et al. [112].

Early soma-informed trials revealed that affective shifts during listening were subtle and difficult to recall retrospectively. To support moment-to-moment articulation, we incorporated the Self-Assessment Manikin (SAM) scale [39], enabling participants to register changes in valence, arousal, connectedness, and social comfort. This multimodal layering aligns with Ceraso's [19] argument that listening is distributed across hearing, memory, vibration, and inscription. The final journal (Figure 3-5) balanced structure and flexibility, extending traditions of diary studies [18], experience sampling [23], and design probes [32, 119] into embodied multimodal reflection [107, 112].

4 METHODS

GastroPod was deployed in a seven-day in-the-wild study to explore how participants perceived, documented, and interpreted gut sounds in multisensory, socially situated contexts. Our aim was not to measure, record, or optimise digestive activity, but to investigate how participants engaged with involuntary gut sounds in everyday life and how this engagement shaped bodily awareness and reflection. Study approval was obtained from the University Ethics Board.

Figure 5: The end-of-day SAM scale and prompts to scaffold participant experiences.

4.1 Participants and Recruitment

Participants were recruited through university mailing lists, posters, and social media, with snowballing methods also used. Inclusion

criteria required adults (18+) to be comfortable wearing a light abdominal device and keeping a multimodal journal. Exclusion criteria removed those with ongoing gastrointestinal, heart-related issues, or hearing disabilities (Appendix B1). Ten participants (six females, four males, none non-binary, all self-identified; aged 22–36) took part, representing cultural backgrounds including Sri Lankan, Dutch, Chinese, Indonesian, Taiwanese, Australian, and Pakistani. Participation was motivated by curiosity, and participants were a combination of students and working professionals.

4.2 Study Stages

The study comprised three stages. First, participants completed a 30–45-minute semi-structured pre-study interview (Appendix B2, interview guide), covering perceptions of gut health and well-being, bodily awareness, social and emotional associations with gut sounds, and factors such as diet, lifestyle, and environment. They were then introduced to the GastroPod study kit (Figure 2). Initial interviews revealed that participants joined not only out of curiosity but also to better understand the triggers, rhythms, or discomforts shaping their daily experience.

The second stage was a week-long deployment in everyday contexts, including meals, rest, work, and social activities. Participants were asked to use GastroPod consistently (e.g., approximately 2 hours per day) and to document their experiences in the multimodal journal. Most participants engaged across the full seven days, except for two who participated for less than five days. Entries included contextual notes, SAM ratings, body map markings, sound descriptions, and reflective questions. Periodic reminders from the research team supported engagement.

As the device required skin contact, hygiene routines were established. Participants cleaned the skin before each session with Medi-Swab wipes, which also improved adhesion when securing the device with sticky labels, and wiped the Stemoscope surface between uses. The research team sanitised, charged, and replenished the kits before and after deployment.

Finally, participants completed a 45–60-minute post-study interview, reviewing their journals and elaborating on their listening experiences, bodily changes, and engagement contexts. Broader reflections were also invited, including how making gut sounds audible shaped awareness, affective responses, and imagined futures for interoceptive systems.

4.3 Data Collection and Analysis

Data was collected through semi-structured interviews [9] (audio and video recordings, later transcribed), multimodal sound journals (sketches, body maps, reflective notes), and optional audio snippets captured by participants. Journals provided complementary data that contextualised and enriched verbal accounts [39, 112].

We employed reflexive thematic analysis, aligning with the ontological and theoretical commitments of interoceptive interaction design [14]. This method foregrounded participants' subjectivity while acknowledging the researcher's interpretive role. Two authors with complementary expertise in health engagement and body-centric computing led the analysis and theme refinement. The process followed Braun and Clarke's six phases [13], using both inductive and deductive coding [14].

Initial coding was inductive, capturing experiences of interacting with GastroPod, journaling practices, and reflections on bodily awareness, social settings, usability, and comfort. Deductive coding then drew on prior frameworks from soma design [48, 110], inbodied interaction [90], reflective HCI [6, 82], and interoceptive engagement [102]. Higher-level topics were iteratively consolidated into eight and later refined into six themes: tuning in, tuning out; sense-making and the desire for reassurance; the sociality of gut sounds; mediating interoception through body–device practices; the gut as sounding body; and the gut as relational other (or not). In total, the study generated 720 coded data units (one question plus one response), from which 42 codes informed the six high-level themes (Coding progression and SAM trajectories are in Appendices E and F).

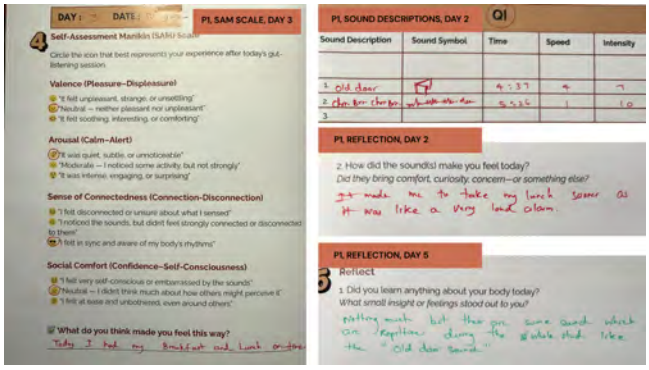

Figure 6: A collage of P1's journal entries describing recurring sounds and instances of altering their mealtime.

5 FINDINGS

Across six themes (Table 3), our findings characterise how GastroPod's daily amplified listening reconfigured participants' attention, meaning-making, and social practices around gut sounds, revealing shifting interoceptive awareness, affect, and relations to the gut.

5.1 Theme 1: Tuning In, Tuning Out

This theme describes how attention shifted across the week from focused listening (tuning in) to moments when sounds faded into the background (tuning out). These fluctuations appeared alongside a shift from novelty to familiarity (F1), with links from daily routines to bodily states (F2), and mixed affective responses (F3).

5.1.1 ***Amplified and repeated listening changed gut sounds from a novel to a familiar, special ability (F1).*** Participants reported that their first exposure felt strange or startling; however, repeated listening to gut sounds improved familiarity (Figure 6). P1 reflected, *"The sounds were surprising, but two days later, I could recognise repeating sounds."* P8 explained further and said, *"By day 4 or 5, I started to hear clearer and surprising sounds. It felt like finding treasure [smiles]."* In contrast, P10 described the experience as *"novel, but trivial [. . .] almost like a fun fact: 'Oh, my stomach is making these sounds.'"*

At the same time, amplification occasionally introduced unusual sonic details that startled or puzzled participants. P2 described a

Table 3: Summary of themes and findings

Themes	Findings
Theme 1: Tuning In, Tuning Out	Amplified and repeated listening changed gut sounds from a novel to a familiar, special ability (F1)
	Opportunistic listening around daily routines anchored the meaning of gut sounds in bodily states (F2)
	The continuous presence of amplified sounds surfaced a spectrum of affective states (F3)
Theme 2: Sense-Making and the Desire for Reassurance	Multimodal journal enabled the construction of personalised vocabularies for gut sounds (F4)
	GastroPod's exploratory framing prompted a desire for reassurance (F5)
Theme 3: The Sociality of Gut Sounds	Bone conducting headphones amplified self-consciousness in public by blurring the boundary between private and shared sound (F6)
	Sharing the device in trusted contexts reframed gut sounds from embarrassing signals into playful, connective experiences (F7)
Theme 4: Mediating Interoception Through Body–Device Practices	The non-directional microphone prompted adaptive placement strategies to isolate gut sounds from other bodily rhythms (F8)
	The system encouraged active 'body tinkering,' as users deliberately provoked sounds to test their gut's reactions (F9)
	Technical limitations in filtering and directionality revealed a desire for curatorial control over their bodily soundscape (F10)
Theme 5: The Gut as Sounding Body: Shifts in Meaning and Emotion	Mediated listening reframed the affective meaning of gut sounds from public embarrassment to a private spectrum of emotion (F11)
	GastroPod prompted exploratory reflection on gut-emotion connections (F12)
Theme 6: The Gut as Relational Other (Or Not)	Listening to the gut invited relational metaphors that framed it as a non-human 'other' (F13)
	Engaging with gut sounds led some to perceive the gut as an integrated bodily process rather than a relational 'other' (F14)

"rumbling burp, like a person saying 'uh-humm' in a low baritone voice," while P5 noted recurring yet puzzling sounds, like a *"dropping stone."* These surprising auditory events were only perceptible because of the device, adding curiosity and playfulness to the process of becoming familiar with gut sounds.

Through repetition, some sounds even became cherished *"favourites"*, leading them to be expressed in descriptive text and visual forms (Figure 7). P1 highlighted the *"old door opening,"* which was *"scary at first but later reassuring."* P2 singled out playful metaphors such as *"the dragon"* and *"whale sounds"*, while P6 imagined *"glacier creeks."*

For a few participants, this progression extended further: the ability to hear inside their body felt like a special capacity. P3 explained, *"Yes, the power to listen to my gut [...] when the device ran out of battery, I felt like I lost the power."* Similarly, P6 reflected, *"Technology gave me access to insights I wouldn't have thought about otherwise [...] when the battery died, it felt frustrating to lose that 'power.'"* These accounts suggest that GastroPod may have turned brief curiosities into recognisable patterns, at times even experienced as a temporary *"superpower."* Together, these moments of noticing and intermittent attention illustrate how gut sounds entered participants' sensory field before becoming objects of interpretation or response, grounding what we later describe as the *Registering Body*.

5.1.2 ***Opportunistic listening around daily routines anchored the meaning of gut sounds in bodily states (F2).*** Beyond novelty, participants reported using GastroPod at different times of day, which influenced how they noticed and interpreted hunger, digestion, or fullness. P1 explained, *"Listening to the sounds go loud made me feel hungrier around lunchtime, causing me to take my lunch earlier."* P6 also acted on these cues: *"I realised skipping breakfast made my gut very active, so I started eating breakfast daily."* For others, the device heightened awareness without changing behaviour. P10 reflected, *"Because I hear the sounds, it amplified the thought of hunger."*

Figure 7: P2's doodle depicting their tummy as a "little dragon that is content with its hoard" captures the friendly associations participants built with their gut.

P2 described how hunger and digestion were retextured across meals: *"Hunger pangs sounded like crackling."* Breakfast produced *"very cosy digestion sounds ('babbelen'), like bubbling,"* and *"pruttelen, sounding like horses eating in a stable."* Drinking coffee was *"fun, like bubbling rather than a waterfall."* Similarly, P7 noticed, *"Most of my listening was in the morning, right after a large meal, so there was a lot going on: growling, gurgling, different sounds."*

At other times, participants encountered puzzling bursts of activity that did not align with routine. P8 reflected, *"On day 6, I had the noisiest experience [...] I don't know why that day was noisier, since my routine and food were the same."* These accounts suggest that GastroPod captured sounds linked to hunger and digestion, but also exposed the unpredictability of bodily rhythms as people listened opportunistically during daily routines rather than to a set schedule.

5.1.3 ***The continuous presence of amplified sounds surfaced a spectrum of affective states (F3).*** Ongoing use of GastroPod elicited varied emotional responses, with some finding it soothing and reassuring. P2 described it as *"like self-produced white noise, very calming,"* and digestion after meals as *"cosy, like a content creature in my belly."* P6 added by saying, *"It gave me comforting images of my body."*

Others, however, found listening disruptive. P9 explained, *"Loud sounds sometimes pulled my attention away from work and even stopped my thinking."* P7 echoed this, describing how workflow was fragmented: *"The sounds were so distracting, it slowed things down. I stopped, wrote it down, then went back. It created start-stop moments that broke the flow."* Some experiences sat between comfort and discomfort. P10 reflected, *"I didn't feel a strong connection [...] it was right in the middle, neither calming nor disrupting."*

These accounts suggest that continuous listening shaped sensory experiences in multiple ways. Reactions ranged from calming to unsettling to neutral, shifting with context and sometimes fluctuating for the same person. Such variation hints that listening did not remain a novelty. Instead, it may have helped participants link daily events, such as meals, stress or timing, with changes in sonic activity they were already trying to make sense of.

5.2 Theme 2: Sense-Making and the Desire for Reassurance

This theme describes how participants used the multimodal journal to develop personalised vocabularies for gut sounds through metaphors, sketches, and cultural references (F4). In this context, metaphors served as descriptive aids for characterising sonic qualities, not as relational framings. When sounds felt strange or uncomfortable, participants sought reassurance, while familiar or calming sounds supported playful exploration (F5).

5.2.1 ***Multimodal journaling enabled the construction of personalised vocabularies for gut sounds (F4).*** The multimodal journal encouraged participants to translate fleeting sensations into communicable forms. P1 labelled a sound *"an old door opening (drrrrr),"* P4 used Indonesian (*"kribuk"*), P5 wrote *"boiling water"* and *"UFO,"* P6 imagined *"glacier creeks,"* and P8 described *"the big blorp."* Others visualised through sketches: P1 said, *"Adding visuals was very helpful [...] it's impossible to remember so many sounds."* P2 noted, *"Symbols on the body map helped more than just writing."*

For some, journaling itself became a practice of translation. P8 described it as *"building a small personal vocabulary."* Yet participants also asked for richer tools: P3 wanted more space for detail, and P6 suggested *"a digital version with recordings."* These accounts indicate how multimodality enabled participants to construct vocabularies that words alone could not capture.

Figure 8: A collage capturing P2's mixed experiences with the GastroPod across a few days.

5.2.2 ***GastroPod's exploratory framing prompted a desire for reassurance (F5).*** While GastroPod was framed as exploratory, some wanted clearer guidance. P5 suggested, *"A system that could recognise recurring sounds and provide analogies."* P4 wished for *"someone to explain what each sound meant."* This desire surfaced when amplified sounds were puzzling or linked to discomfort. P3 recalled a *"metallic clicking"* that felt incongruous with the body, while P4 linked a sound to diarrhoea after drinking milk. Yet novelty sometimes turned to comfort. P1 said, *"I was scared at first by the old door sound, but later I found it comforting,"* especially when tied to familiar meals. Others stayed in playful exploration without needing meaning, describing *"cosy digestion sounds, like bubbling"* (P2) or *"echoey glacier creeks [...] comforting images of my body"* (P6).

Some even imagined speculative futures: P2 envisioned *"a Tamagotchi-like visualisation of the microbiome,"* while P9 suggested *"Machine-Learning to translate sounds into music or personalities."* These affective shifts—ranging from reassurance and curiosity to unease—highlight how listening often prompted immediate bodily and emotional responses, providing the experiential basis for what we later describe as the Reacting Body.

5.3 Theme 3: The Sociality of Gut Sounds

This theme describes how GastroPod listening was socially situated, shaped by device affordances and context. In public, amplification blurred the line between private and shared sound, heightening self-consciousness and overstimulation (F6). In trusted settings, the same features supported playful sharing, reframing gut sounds as humorous and connective (F7).

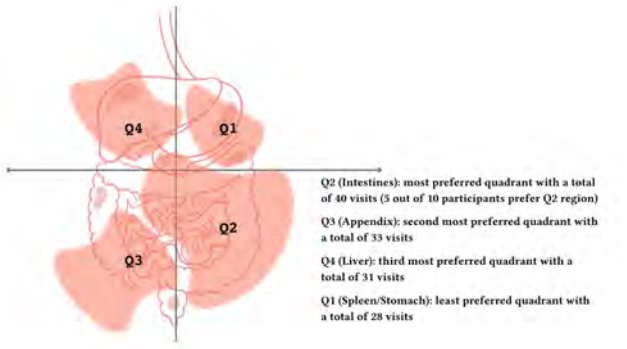

Figure 9: Analysis of sound journals showing participant use of GastroPod across abdominal quadrants, ordered from most to least visited across the seven days.

5.3.1 ***Bone conduction headphones amplified self-consciousness in public by blurring the boundary between private and shared sound (F6).*** The open-ear design, while supporting embodied listening, often caused discomfort in public. Amplification not only revealed gut sounds but also picked up surrounding noise (Figure 8), creating echoes that made listening feel porous. Some worried their amplified gut sounds might *"leak"* socially, even though contained in headphones.

P2 said, *"I felt overstimulated quickly when listening around people."* P3 added, *"I avoided listening in social contexts because of the echo."* P4 recalled, *"During class, my gut made a loud sound, and I felt embarrassed in front of everyone, although the sound was only in my ear."* Similarly, P9 avoided use in meetings, fearing, *"If people knew I was hungry from the sounds, they might laugh."* These accounts suggest that amplification reshaped how participants imagined their bodies in social space, heightening a sense of vulnerability even in the absence of actual sound leakage.

5.3.2 ***Sharing the device in trusted contexts reframed gut sounds from embarrassing signals into playful, connective experiences (F7).*** In private settings, the same affordances seemed to support playful sharing. The wireless format made it easy to hand over or co-listen, turning gut sounds into shared curiosities. P1 said, *"I gave my headset to friends. They laughed, asking, 'Why is your gut so noisy?'"* P4 shared with her husband, who joked, *"This is the sound I always hear from you!"* P9 said gut sounds prompted laughter with roommates: *"Some were funny and made me laugh, and I told them I was listening to my gut."* Here, participants invited others in, turning private rhythms into shared artefacts. These contrasts suggest a social dynamic in which public contexts brought discomfort, while trusted settings enabled humour and connection.

5.4 Theme 4: Mediating Interoception Through Body–Device Practices

This theme describes three forms of body–device mediation: experimenting with placement (F8), provoking the body to elicit sounds (F9), and negotiating the system's filtering limits (F10), indicating different ways listeners worked with the device to shape their experience.

5.4.1 ***The non-directional microphone prompted adaptive placement strategies to isolate gut sounds from other bodily rhythms (F8).*** This subtheme captures how users adjusted placement to refine what they could hear. Participants often experimented with placement, since the microphone amplified not just gut sounds but also rhythms like the heartbeat when positioned higher on the torso. P2 said, *"In the spleen quadrant I heard my heartbeat very prominently, and that made me nervous."* P1 noticed, *"In the upper quadrants, I could hear more of the lub-dub sound."* P3 described, *"Hearing my heartbeat through my stomach was disturbing."*

In response, some adjusted where they listened (Figure 9). P1 found sounds *"clearer in the lower quadrants,"* while P2 avoided a quadrant altogether. P10 added that *"placement was guided by anatomy rather than quadrants."* These adjustments suggest that placement became an exploratory practice that helped participants learn how different positions shaped what they could hear.

5.4.2 ***The system encouraged active 'body tinkering,' as users deliberately provoked sounds to test their gut's reactions (F9).*** This subtheme focuses on instances where participants actively intervened to elicit sonic responses. Listening often became a way to experiment with the body, with participants altering their food or beverage intake to prompt gut sounds. P3 recalled, *"I drank water to test the sound [...] I could clearly hear it going into my stomach."* P9 said, *"If I didn't hear sounds for a while, I'd drink water or eat a plum to 'make it work.'"* P5 tested milk, which usually caused discomfort, to see if it altered sound. These practices suggest that some listeners treated the body as an experimental site, using food and drink as tools for eliciting feedback. GastroPod, in this sense, fostered tinkering in which interoception was shaped by small acts of bodily provocation.

5.4.3 ***Technical limitations in filtering and directionality revealed a desire for curatorial control over their bodily soundscape (F10).*** This subtheme reflects how participants negotiated the system's technical limits and their desire for control over the soundscape. Participants noted that non-directional amplification sometimes introduced interference, such as static, clothing noise, or ambient artefacts, making subtle gut sounds harder to discern. P7 suggested, *"Filtering out small, meaningless sounds and reducing static would make it less distracting."* P10 wished for *"more*

amplification, since mine felt faint." P2 noted that noise cancellation *"removed the underwater sound,"* while P9 found *"clothing noise interfered with listening."*

These reflections indicate a desire for greater agency over what counts as a meaningful signal, with participants hoping for curation tools that highlight certain rhythms while reducing interference. This expectation points to the role of interoceptive systems not just in amplifying sensation but in shaping how bodily meaning is surfaced. Together, these practices provide the experiential grounding for what we later describe as the Responding Body.

5.5 Theme 5: The Gut as Sounding Body: Shifts in Meaning and Emotion

This theme captures how mediated listening reshaped the meanings attached to gut sounds. What felt awkward in public could become curiosity, comfort or joy in private (F11). Listening also prompted reflection on links between digestive activity and emotions such as stress or nervousness, though these links were inconsistent (F12).

5.5.1 ***Mediated listening reframed the affective meaning of gut sounds from public embarrassment to a private spectrum of emotion (F11)***. Participants described how their gut sounds carried longstanding associations with awkwardness, especially in public. P1 recalled, *"When my gut makes such sounds, people have asked me if I had breakfast [...] it's awkward."* P4 said, *"In social places it felt embarrassing [...] I tried covering it up with coughs."* When mediated through GastroPod in personal or trusted contexts, however, these same sounds were reframed as curious or even comforting. P6 likened them to *"echoey glacier creeks"* that offered *"comforting images of my body."* P3 described a shift toward reassurance: *"They comforted me, because they sounded like a sleepy cat or bear, which made me feel my body was resting well."* For P8, the change was more dramatic: *"On day 6, I had the noisiest experience [...] I was smiling because it felt exciting, like a discovery."*

Not all responses were positive. P4 noted feelings of *"disgust"* after drinking milk, while P10 described a neutral stance: *"Right in the middle, neither calming nor disruptive."* These reflections suggest that mediated listening expanded gut sounds from awkward social signals into a broader emotional range spanning disgust, neutrality, comfort, curiosity and joy.

5.5.2 ***GastroPod prompted exploratory reflection on gut-emotion connections (F12)***. Alongside shifts in affective meaning (Theme 1), participants also reflected on whether gut sounds aligned with emotional states. For a few, links felt evident. P1 remarked, *"When I'm stressed, my gut is more active, and the sounds are coming more often [...] a clear connection between stress, lack of sleep, and sound intensity."* P4 similarly noted, *"When I was thinking a lot while working on my project, my gut also produced sounds. It felt synchronous."* Regarding participants' awareness of how emotions showed up in their bodies. P3 often connected *"losing appetite"* with feeling upset or nervous, while P5 associated conflict at work with *"gut discomfort,"* saying GastroPod made him notice "how often bloating and burping occurred," though the reasons still felt *"puzzling."*

Not all participants perceived a link. P8 described stress shows up as headaches or a fast heartbeat, while P10 admitted, *"I was hoping to hear my gut respond to stress [...], but I didn't hear any sounds."*

These accounts suggest that GastroPod encouraged participants to reflect on how emotions manifest in their bodies. While some made direct links to gut sonic activity, others still sought reasons and wished for stronger connections. For several participants, mediated listening offered clarity or reassurance around sensations linked to food, stress, or discomfort, reinforcing why they sought such understanding in the first place. The inconsistency highlights the ambiguity of gut–emotion relations and points to opportunities for technologies that support reflection without prescribing fixed interpretations, providing experiential grounding for what we later describe as the Reflecting Body.

5.6 Theme 6: The Gut as Relational Other (Or Not)

This theme captures how GastroPod listening prompted participants to reimagine their gut in relational terms. Unlike the metaphors in Theme 5.2, which helped participants describe the qualities of specific sounds, the metaphors here assigned agency, mood, or temperament to the gut itself. Some framed it as a semi-autonomous "other," drawing on child-like, worker, or ecological metaphors (F13). These interpretations positioned the gut as something with its own rhythms or intentions. Others resisted such framings, treating gut sounds as integrated bodily processes rather than distinct agents (F14).

5.6.1 ***Listening to the gut invited relational metaphors that framed it as a non-human 'other' (F13)***. Some participants positioned the gut as separate from themselves. P1 described it as *"a little baby [...] reminding me that I'm here,"* while P9 likened it to *"a child rolling around in a park."* Others emphasised function, such as P3's *"typical worker, following a routine,"* or P7's *"notification service, like my phone buzzing."*

Some turned to ecological or animal imagery: P4 imagined *"an old house, sometimes kind, sometimes noisy,"* P6 described *"glacier creeks"* flowing through the body, and P8 captured variety with *"trumpet, bird, [or] frog."* These reflections suggest how amplification and attention led participants to project relational, environmental, or creaturely qualities onto gut sounds, framing them as companions or landscapes that extended bodily awareness.

5.6.2 ***Engaging with gut sounds led some to perceive the gut as an integrated bodily process rather than a relational 'other' (F14)***. Not all participants revealed metaphor-based connections with their gut. Some resisted anthropomorphising or externalising the gut, instead situating it within integrated bodily processes. P8 explained, *"I didn't feel a strong connection [...] mostly I just recognised the sounds."* P10 described them as *"external events passing through me,"* while P4 grounded her account in labour: *"My body produces many different sounds, each with meaning [...] organs work hard, silently or loudly, every day."* Others moved between framings. P9 at one point likened the gut to *"a child rolling around in a park,"* but elsewhere stressed integration: *"It's part of me, like my arm or leg [...] I see it as input and output, where I'm the input, the gut is the output."* Such oscillations in their perception illustrate how

listening sometimes invited metaphors of the gut as an 'other' and at other times reinforced its inseparability from the self.

6 DISCUSSION

Our findings indicate shifting forms of interoceptive engagement shaped by amplification, timing, social context, and metaphor. Beyond initial novelty, participants used GastroPod to make sense of recurring sensations, showing how interoceptive systems can support situated reflection in daily life (F1). Listening anchored attention in hunger and digestion, sometimes prompting behavioural shifts such as eating earlier or reinstating breakfast (F2), including small acts of bodily tinkering (F9). Affective responses varied: for some, listening was calming or comforting, while for others it was disruptive or unsettling (F3, F11). At times, participants sought reassurance despite the study's exploratory framing (F5). Social settings further influenced listening, heightening self-consciousness in public while enabling playful sharing in trusted environments (F6–F7). Engagement was also co-constructed through body–device practices, as participants experimented with placement, tinkered with food or drink intake, and adapted to limitations such as clothing noise or heartbeat bleed (F8–F10). Meanings attached to gut sounds shifted over time, moving from neutral or embarrassing to curious, comforting, or relational, sometimes described through anthropomorphic or ecological metaphors and at other times as "just processes" (F12–F14).

A small subset of participants completed an optional follow-up survey one month after the study, providing insight into how these engagements extended beyond mediated listening. While not all participants responded, those who did reported subtle changes, including noticing quieter gut activity, feeling less anxious about gut sounds, and becoming aware of others' gut sounds. Although not generalisable, these reflections help disentangle novelty effects from emerging attunement and suggest that interoceptive awareness can persist after the device is no longer worn.

To make sense of these varied interoceptive engagements, we introduce four bodily perspectives – the *Registering*, *Reacting*, *Reflecting*, and *Responding Bodies* – as an analytic bridge between the empirical findings and interoceptive interaction design. Rather than abstract categories, these perspectives arose from recurrent orientations in participants' accounts, capturing how they shifted between noticing, feeling, interpreting, and acting on involuntary bodily cues. By naming these orientations, the perspectives offer a structured yet flexible vocabulary for design, without implying progression or linear change.

These shifts in experience resonate with soma trajectories [110], which describe how embodied experience moves across dimensions such as comfort–discomfort and familiar–strange, and align with Staab et al.'s [102] account of interoceptive attention as oscillating between noticing, articulating, and interpreting. We therefore articulate the four perspectives as design lenses that clarify how interoceptive systems might scaffold such shifts. Their formulation was shaped by multiple HCI traditions: soma design, which foregrounds sensed experience and the cultivation of bodily awareness through practice [45, 46]; inbodied interaction, which emphasises attentive scaffolding for subtle, involuntary cues [90, 91]; reflective HCI, which treats interpretation as ongoing and situated rather than fixed [6]; and health-reflection design lenses such as bio-temporality and visceral conversations, which highlight how people negotiate bodily meaning over time [82]. We also draw on prior uses of "bodies" as analytic devices in exertion and ingestible play [63, 74], adapting this logic to interoceptive acoustics to articulate how people engage with internal rhythms that are involuntary, irregular, and socially mediated. Together, these influences situate the Registering, Reacting, Reflecting, and Responding Bodies as a concise way of linking empirical findings with broader theoretical commitments in HCI.

Importantly, these perspectives are not sequential stages or developmental steps. Instead, they function as modular entry points that interaction designers, HCI researchers, and digital health practitioners can use independently or in combination—whether to enable momentary registration of internal rhythms or to scaffold transitions from reflective exploration to small acts of responding.

6.1 The Registering Body

The Registering Body perspective concerns how participants first became aware of gut sounds and how this awareness stabilised through repeated encounters. Initial listening was often marked by surprise or strangeness, yet over time, many described the sounds becoming familiar, patterned, or even endearing—sometimes framed as a temporary "special ability" (F1). This sense of a temporary "special ability" aligns with HCI work on superpower experiences [64], where novel embodied sensing is felt as an extension of the self and gradually normalised through repeated use. Participants began recognising recurring rumblings, linking sounds to hunger or digestion, and noticing rhythms tied to meals, coffee, or time of day (F2). Amplification thus operated not merely as exposure but as an invitation to tune into involuntary rhythms that typically remain tacit. Food and drink acted as the primary temporal anchor for registering, with many participants noting that gut sounds clustered around eating activities and meal-related rhythms.

We use registering, rather than sensing, to characterise this layered process of perceiving, tuning in, and stabilising attention. While Mueller et al.'s "sensing body" centres exertion-based detection [74], registering captures how awareness of involuntary internal cues must be re-established iteratively. This aligns with soma design's emphasis on cultivating awareness through practice [45, 46] and with inbodied interaction's view that attentional sensitivity to subtle internal cues requires scaffolding rather than continuous vigilance [90, 91]. Registering is therefore a mediated practice shaped jointly by daily habits, bodily rhythms, and technological curation.

This process was contingent on both bodily rhythms and technological mediation. Participants adjusted placement to avoid heartbeat bleed (F8), navigated static or clothing noise that disrupted attention (F10), and sometimes wished for analogies or recognition aids to identify sound patterns (F5). These examples show that awareness of gut sounds emerged through situated, periodic encounters rather than continuous monitoring. Interoception research similarly highlights that sensibility and metacognition develop through brief, contextually anchored attention, as constant exposure can produce signal fatigue [89, 108].

6.1.1 Consider designing wearable systems that act as a curator rather than an amplifier to support meaningful registering. Previous HCI work suggests that biofeedback systems may benefit from filtering rather than exposing raw signals [20, 59]. Our findings indicate that amplification alone could feel puzzling or overwhelming, with participants wanting systems that filtered artefacts such as static or clothing rustle (F10), amplified faint rhythms that might otherwise be lost (F5, F10), or recognised recurring motifs as patterns rather than presenting undifferentiated noise (F8). Designers might therefore consider microphone filter presets, adjustable gain controls, or sound-tagging features to help recognise motifs such as bubbling before meals or rumbling after coffee.

Conceptually, this aligns with work on creative curating in online collections, where mediation—selecting and arranging material to support user-driven exploration—replaces undirected data dumps with guided discovery [8]. In our context, curatorial mediation means balancing filtering and recognition by foregrounding some sounds while backgrounding others, or translating raw audio into symbolic forms such as ripples, chimes, or playful animations. Such curation can reduce sensory overload, preserve curiosity, and create openings for interpretation, helping users treat fleeting gut sounds as events that are easier to notice, stabilise, and share.

6.1.2 Consider designing for periodic over continuous listening to align with bodily rhythms. Biofeedback systems are more effective when aligned with bodily rhythms than when administered continuously [58, 59]. Our findings indicate that participants engaged most meaningfully when listening was tied to daily cycles such as hunger, meals, or coffee breaks (F2), whereas continuous listening often produced fewer insights, partly due to artefacts such as heartbeat bleed or static noise (F8, F10). Importantly, the "period" was not fixed: engagement varied with food choices, time of day, meal quantity, beverages, and social context.

Designers might therefore support periodic engagement through timed presets (e.g., pre- or post-meal check-ins) and meal-based reminders that act as gentle prompts rather than strict schedules [82]. Such scaffolding can foreground bodily rhythms without overwhelming users, helping them recognise how gut activity varies with diet, stimulants, and daily routines, and supporting registering as a situated, cyclical practice.

6.2 The Reacting Body

The Reacting Body concerns the affective and social responses that arose once gut sounds became perceptible. Building on somaesthetic accounts that frame discomfort as meaningful rather than problematic [44, 46, 111], affective biofeedback research that foregrounds ambivalence [36], and work on social wearables that mediate vulnerability and intimacy [72, 98], reacting is best understood as fluid, situated, and oscillatory—not a stable emotional stance. Participants frequently moved from registering to reacting within seconds, illustrating how perceiving and feeling were tightly intertwined.

Reactions spanned a wide range. Some sounds were calming or reassuring (F3, F11). Others disrupted concentration or provoked aversion, particularly in work contexts or after specific foods (F3, F11). Neutral responses also surfaced (F3), indicating that interoceptive cues do not always demand emotional interpretation. This challenges assumptions in affective computing that internal biosignals reliably map onto discrete emotional states [102].

Social context strongly shaped participants' reactions. In public, amplified listening often felt overstimulating or embarrassing (F6). In trusted settings, however, the same sounds became humorous, connective, or intimate, for example, when friends or partners recognised familiar rhythms (F7). These patterns extend work on social biosensing [72].

Reactions also shifted over time. The same sound could soothe in one context, unsettle in another, and amuse when shared. These variations should not be interpreted as contradictions between the Reacting and Reflecting Bodies; rather, they illustrate the oscillatory interoceptive engagements described in the Discussion introduction, suggesting how people fluidly traverse orientations of attention, affect, and meaning.

6.2.1 Consider designing for affective ambivalence by allowing flexible exit when biosignals disrupt rather than soothe. Consistent with prior HCI work showing that discomfort and mixed emotions can be productive sites for reflection [45, 63, 107], gut sounds evoked a shifting palette of comfort, disruption, disgust, and neutrality (F3, F11). Affective biofeedback research similarly reports that internal signals rarely yield consistently soothing outcomes [36]. Interoceptive systems should therefore support flexible exit via pause, fade-out, or adjustable intensity controls, allowing users to modulate exposure when sounds become unsettling rather than forcing continued engagement.

6.2.2 Consider designing for negotiating social boundaries to balance privacy and intimacy. Prior research emphasises that biosignals expose vulnerability while also enabling novel forms of closeness [72, 98], and that privacy is dynamically negotiated rather than fixed [51, 101]. Our findings reflect this duality: amplified listening felt too exposing in public (F6) yet became playful or bonding in private settings (F7), showing how socially stigmatised internal acoustics can shift between embarrassment and intimacy depending on relational context. Interoceptive systems should therefore support boundary negotiation, for example, through clear privacy indicators, reassurances about personal listening, or opt-in co-listening with trusted others.

Insights from privacy-boundary negotiation research highlight how decisions about what to reveal, when, and to whom are shaped by context, identity, and social norms [41]. Supporting such negotiations allows gut sounds to shift safely between private and shared registers, thus becoming resources for humour, care, or connection without risking unwanted exposure.

6.3 The Reflecting Body

The Reflecting Body concerns how participants interpreted and made sense of gut sounds over time. Reflection involved slower, interpretive work: documenting sensations through journaling and drawing, generating metaphors, and linking sounds to daily rhythms, emotions, foods, or routines.

Participants developed varied vocabularies that rendered fleeting acoustics communicable, ranging from mechanical *"old door"* and *linguistic babbelen, pruttelen, kribuk* to ecological or relational metaphors *"glacier creeks," "a child rolling in a park"* (F4, F13–F14).

Reflection also involved attempts to connect sounds with meals, coffee, hunger, or stress (F2, F12), though these links were not always stable. For some participants, ambiguity of the sounds was *playful and exploratory*; for others, it prompted *reassurance or a desire for explanation* (F4, F5). These shifts show that reflecting was not linear but entered and exited in response to uncertainty, curiosity, or concern.

The Reflecting Body perspective aligns with HCI traditions that treat reflection as interpretive labour requiring appropriate scaffolds rather than definitive answers. Pasumarthy et al.'s lenses [82] were evident across participants' practices: bio-temporality, as sense-making was anchored to meal cycles (F2); visceral conversations, where journaling enabled dialogue between bodily events and context (F4, F12); wellness comparison, as patterns were tracked across days (F1, F5); and inner discovery, where playful metaphors reframed the gut as *lively or relational* (F1, F11). Cultural specificity further shaped reflection. Prior work shows that languages vary in how bodily sensations are conceptualised and named [123], helping explain why participants drew on Dutch, Indonesian, and other linguistic resources.

6.3.1 Consider designing for plural vocabularies to support participant-led interpretation. Participants generated mechanical, ecological, linguistic, and relational metaphors (F4, F13–F14), suggesting the need for systems that accommodate heterogeneous interpretive strategies. This aligns with arguments that bodily sensations gain meaning only when situated within cultural and experiential frames [113] and extends Pasumarthy et al.'s "inner discovery" lens [82] by showing how externalising sensations stabilises fleeting acoustics into communicable artefacts. Designers might therefore support plural vocabularies through optional metaphor libraries, visual glossaries, sound-sketching tools, or selective sharing features, thus treating gut sounds as interpretive resources rather than data to be classified. Such supports could help stabilise fleeting interpretations without fixing meaning, allowing users to revisit, adapt, or abandon descriptors as bodily experience evolves.

6.3.2 Consider designing toggles between open-ended ambiguity and guided reassurance to accommodate varied interpretive needs. Reflection was oscillatory: some participants embraced playful ambiguity, inventing metaphors such as "gut as worker" or "gut as baby" (F13), while others sought reassurance when sounds felt puzzling or uncomfortable (F4, F5). Prior HCI work shows that ambiguity can support speculative interpretation [33], yet it may sometimes require stabilising cues to prevent anxiety [43]. Inbodied interaction reinforces that systems should scaffold attentiveness without prescribing meaning [90, 91].

Designers might therefore provide toggles between open and guided modes, using progressive disclosure, optional analogy libraries, or simple contextual cues so users can decide when to stay with uncertainty and when to seek explanation. Such toggles acknowledge reflection as plural, situated, and sensitive to fluctuations in bodily state and emotional need.

6.4 The Responding Body

The Responding Body concerns the small actions, adjustments, and experiments participants made after sensing and reflecting on gut sounds. Food and eating contexts played a central role: participants used meals, snacks, and beverages as triggers for experimentation, such as drinking water, eating a plum, or testing foods that typically caused discomfort (F9). Others made small temporal adjustments, such as eating earlier or reinstating breakfast (F2). Responding also took relational forms, with participants describing their gut as a "baby," "worker," or "companion" (F13–F14), suggesting that response sometimes meant reimagining the body rather than altering behaviour.

Conceptually, this perspective extends inbodied interaction by illustrating how scaffolds support tinkering with involuntary rhythms rather than training voluntary control [90, 91]. It resonates with lived informatics, where experimentation, breakdowns, and improvisation shape engagement with personal data [88], and with everyday design, which positions appropriation as central to how technologies acquire meaning [118]. Responding aligns with work showing that bodily sensations gain meaning when situated in lived practice [33, 34], complementing research on uncertainty as a generative design material [28]. In this sense, the Responding Body extends Mueller et al.'s formulation of "responding" beyond exertion [74] to subtle, intermittent internal cues.

Together, these accounts illustrate movement across perspectives: tinkering often emerged from earlier reflection, while relational framings gained traction once affective reactions softened. Post-study survey responses report noticing subtle gut activity or feeling less anxious when encountering odd sounds, suggesting that responding may also shape longer-term interoceptive awareness.

6.4.1 Consider designing for gentle, low-stakes tinkering to encourage playful bodily experiments. Participants treated GastroPod as a prompt for small, safe provocations, such as drinking water, trying specific foods, or shifting mealtimes (F2, F9). These exploratory engagements align with inbodied interaction, which advocates scaffolds that support attentiveness without prescribing behaviour [62, 90, 91], and with lived informatics, where tinkering and breakdowns drive meaning-making [88]. Because digestion is one of the most salient contexts for gut acoustics, many experiments are centred on food and eating. Future interoceptive systems could scaffold similarly low-stakes experimentation through optional prompts (e.g., "listen after a large meal"), multimodal logging tools (photos, emoji, quick notes), or feedback that foregrounds variability rather than compliance. Such designs frame tinkering as playful discovery rather than optimisation, supporting bodily meaning as it emerges through situated practice [113].

6.4.2 Consider designing for valuing absence and unpredictability as part of bodily engagement. Some provocations produced no audible change (F9), and other sessions were marked by silence or noise artefacts. Participants often reframed these "non-events" as reminders of bodily variability rather than failures, echoing lived informatics research showing that pauses and absences can be meaningful [88]. Information-visualisation work similarly cautions against treating zero values as errors (e.g., "0 heart rate" does not indicate dysfunction). Interoceptive systems could therefore legitimise unpredictability through features that allow users to log "no change," visualise variability rather than consistency, or include gentle prompts (e.g., "sometimes bodies are quiet, and that matters

too"). Such approaches frame absence not as a sensing failure but as part of the rhythms and contingencies of bodily life [123].

7 LIMITATIONS AND FUTURE WORK

This study has some limitations that also suggest avenues for future research. The small sample size and short study duration limit claims about long-term behavioural change or generalisability. While participants vocalised adjustments such as earlier lunches or reinstating breakfast, we did not track whether such micro-adjustments stabilised into sustained practices. Future longitudinal and more diverse deployments are needed to examine longer-term trajectories and how cultural framings shape gut sound awareness. While our study focused on healthy adults, the practice of expressing moments of comfort and discomfort through journaling may also foster communicable awareness of bodily states. Such practices could be relevant to contexts such as gut health, where articulating subtle shifts in well-being and discomfort is central to care and self-management.

Prototype fidelity also influenced engagement; the microphone's lack of directionality, artefacts such as heartbeat bleed, clothing noise, and limited battery life shaped what participants heard as much as their gut activity. These shortcomings nevertheless revealed design opportunities such as placement strategies, filtering, and curatorial control, pointing to future work on higher-fidelity designs and adaptive sensing.

Our four perspectives provide a useful way to articulate interoceptive engagement, but categories can sometimes blur, for example, when relational framings are read as both reflection and response. This overlap reflects the complexity of lived experience and suggests the value of evaluating these perspectives alongside other involuntary signals, such as vascular, respiratory, or reproductive rhythms, where perspectives may merge or take different forms.

Finally, our focus on digestive acoustics narrows the scope. While gut sounds are uniquely ambiguous and socially stigmatised, future research should examine how our design strategies apply in public contexts where negotiation is more pronounced, and in clinical contexts for gastrointestinal conditions such as Irritable Bowel Syndrome (IBS) or a Leaky Gut syndrome [42, 76]. For these groups, gut sensations are often tacit, difficult to articulate, and stigmatised [11, 21]. HCI has a role in scaffolding communication by externalising such experiences in ways that are shareable with family or clinicians [60], though this requires careful collaboration with medical researchers. Importantly, any extension to contexts such as IBS would build on the conceptual value of the four perspectives rather than on the GastroPod system itself, which is not designed for symptom tracking, monitoring, or clinical interpretation. Such future work would require new sensing systems, study designs, and medical partnerships, and remains beyond the scope of the present study with healthy adults.

8 CONCLUSION

Using GastroPod, a wearable system that amplifies digestive sounds, alongside a multimodal journal, our week-long study with ten participants shows how listening to involuntary gut sounds can reshape bodily awareness and prompt situated meaning-making in everyday life. Participants engaged with gut sounds not as signals to optimise, but as experiential material that invited attention, interpretation, and care.

From these empirical accounts, we articulate four bodily perspectives—Registering, Reacting, Reflecting, and Responding as the central contribution of this work. These perspectives capture how people notice, feel, interpret, and act on interoceptive signals over time, and provide a design-oriented vocabulary for understanding oscillatory interoceptive engagement.

Together, these perspectives position interoceptive interaction design as a practice of scaffolding curiosity, ambivalence, and communicable bodily awareness. By foregrounding gut sounds as socially situated experiences, this work opens new directions for HCI to engage with involuntary biosignals as resources for reflective, embodied interaction in everyday contexts.

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A GASTROPOD SYSTEM AND SOUND JOURNAL DESIGN

This appendix documents the early material explorations, device comparisons, and prototype iterations that informed the final GastroPod study kit. These iterations were essential for informing soma-informed design decisions but were relocated from the main paper to streamline Section 3 and to maintain transparency of our design rationale.

A.1 Auscultation Device Exploration and Comparison

Before selecting the Stemoscope Pro, we tested multiple auscultation devices to evaluate portability, form factor, comfort, and sonic clarity (Figure 10). We initially explored low-cost consumer stethoscopes wired to a microphone that can be connected to a laptop. While inexpensive, these systems produced inconsistent audio and required stationary, two-handed operation, making them unsuitable for everyday use.

Figure 10: A sample of auscultation devices considered before finalising the Stemoscope Pro device as our auscultation device.

We considered clinical digital stethoscopes such as the 3M Littmann CORE Digital Stethoscope [1], and Eko Core 500 [26]. Although they offer high fidelity, the long tubing, two-handed operation, and in-ear ear tips make them impractical for self-administered use during daily routines. These constraints conflicted with soma-aligned values around freedom of movement and reducing bodily burden. Systems such as Steth IO [105] and E-murmur [103] required placing a flat phone surface directly against the abdomen. This caused discomfort, unstable contact, and poor sonic isolation. These trials highlighted the need for a compact, dedicated sensing element that supported comfortable, repeatable placement.

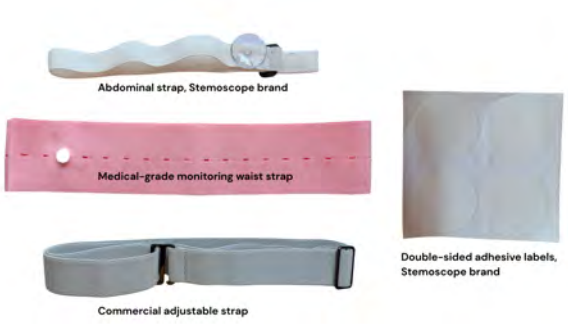

Figure 11: Experimentation with waist straps and adhesive labels to mount GastroPod device.

A.2 Suspending the Wearable Device: Belt and Adhesive Iterations

We trialled multiple suspension methods to ensure stable abdominal contact during movement (Figure 11). The Stemoscope brand provided a commercial elastic strap [104] that was too small for adult users and caused discomfort during prolonged wear. Next, we tried a medical-grade monitoring strap, which allowed stable placement but was bulky under clothing and uncomfortable during social or work activities. Following that, we tried a universal belt with a carabiner, which helped balance stability and flexibility. A fixed carabiner enabled stationary listening, while a retractable carabiner supported exploratory scanning across abdominal quadrants.

As an alternative to suspending the wearable device, we tested double-sided sticky labels to reduce movement-related noise and secure the device during transit. Labels improved sonic clarity but caused skin irritation for some users, so they became optional rather than mandatory.

A.3 Headphone Iterations

Before selecting open-ear bone-conduction headphones, we evaluated alternative listening devices such as the Apple AirPods Pro 2 [5] came with a set of pros including comfort and noise-cancellation feature with transparency modes, while the cons included frequent pairing interruptions battery battery-limited battery (6 hours) with an in-ear design that often signals social withdrawal and other iPhone-dependent customisation limited to iPhone users. The ear-occluding form conflicted with the goal of maintaining social presence during everyday activities. We tested generic over-ear Bluetooth headphones, which offered comfort but were bulky, socially intrusive, and impractical for mobile listening. These trials highlighted the importance of an open-ear, unobtrusive design that supported continual awareness of surroundings, consistent with soma design concerns around bodily presence and situated action.

A.4 Power Bank Trials

Several portable power banks were tested to extend the Stemoscope Pro's limited runtime (1.5–2 hours). High-capacity power banks (10,000–20,000 mAh) were long-lasting but too heavy and bulky for everyday use. We ultimately selected a compact low-weight power bank (104 g), with 5000 mAh, which balanced portability, ease of use, and reliable runtime extension without compromising comfort. This avoided frequent recharging cycles—an issue highlighted in prior research as a barrier to routine use of wearables [58, 59].

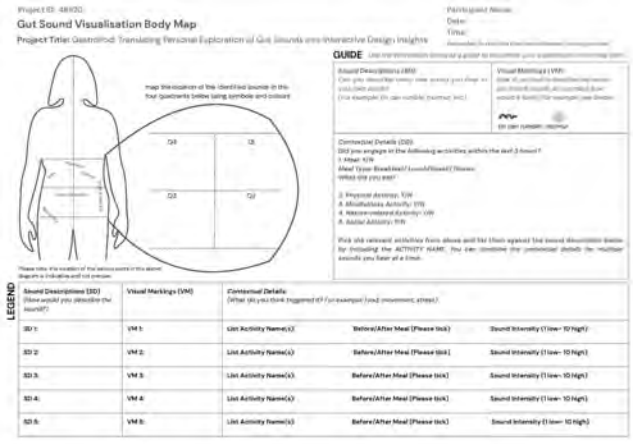

Figure 12: An initial version of the sound journal designed as a traditional body map with a legend through first-person explorations.

A.5 Early Journal Prototypes and Layout Iterations

The multimodal journal underwent several early iterations, informed by first-person soma-based trials:

- **Static body map prototype:** The earliest prototype used a single silhouette divided into four quadrants (Q1–Q4, Figure 12). Participants could annotate sound types and draw symbols. Although simple, it failed to capture temporal variations.
- **Temporality-focused redesign:** Based on insights from Turmo Vidal et al. [112], we introduced daily pages to track sounds across different contexts (e.g., meals, posture, time of day).
- **Inclusive silhouette redesign:** We expanded the silhouette options to include male, female, and gender-neutral outlines to support a diverse participant cohort.

- **Multimodal layering:** Iterations explored hand-drawn symbols, descriptive lexicon lists, intensity markers, affect tags, and free-form doodle spaces.
- **Affective-scale integration:** First-person trials demonstrated the difficulty of recalling subtle emotional shifts. We incorporated an adapted Self-Assessment Manikin (SAM) scale [39] to support immediate articulation of valence, arousal, connectedness, and social comfort.

B STUDY DESIGN

B.1 Exclusion Criteria

People with the following conditions were excluded: diagnosed deafness or temporary hearing impairment requiring hearing aids or cochlear implants; cardiac arrhythmia; gastrointestinal disorders such as IBS, Crohn's disease, or ulcerative colitis; current pregnancy; abdominal surgery within the past six months; or current use of medications that significantly affect digestion (e.g., laxatives, antibiotics). These criteria were applied to prioritise participant safety, comfort, and well-being within the study procedures.

B.2 Interview Guide

Pre-Study Interview Questions

Awareness of Gut Health and Bodily Sensations

(1) How would you describe your awareness of factors that affect gut health?
(2) Do you think factors such as diet, lifestyle, physical activity, or environment influence your gut health? How?
(3) Do you engage in activities such as balanced eating, physical activity, mindfulness, or time outdoors? How often?
(4) On a scale of 1–10, how aware are you of your gut sounds day-to-day?
(5) Have you noticed prominent gut sounds before (e.g., abdominal sounds, flatulence, burps)?
(6) Have you ever documented these sounds in any way?
(7) Have you associated specific gut sounds with activities or triggers?
(8) How often do gut sounds catch your attention?
(9) Have you noticed any recurring sounds linked to specific events or habits?

Social Context and Emotional Associations

(10) Have you experienced social situations where your gut sounds were audible to others? How did that make you feel?
(11) How do you typically react in such situations?
(12) Have you consciously felt emotions (e.g., excitement, fear, stress) expressed in your gut?
(13) Have you noticed emotions affecting your digestion or appetite?

Responses to Discomfort and Personal Motivation

(14) How do you usually respond to digestive discomfort (e.g., reflux, bloating, stomach pain)?
(15) What motivated you to participate in this study?

Post-Study Interview Questions

Perception and Documentation of Gut Sounds

(1) How would you describe the experience of listening to your gut sounds?
(2) How was your experience using the sound journal?
(3) Did you record any sound clips? Why or why not?
(4) Can you walk through a significant listening moment from the study?
(5) Did you use particular words or imagery to describe the sounds?
(6) Which formats (text, visuals, symbols) helped you make sense of the sounds?
(7) Did you revisit earlier entries? How did that feel?
(8) What physical or technical aspects of the device shaped your experience?
(9) Were certain contexts (e.g., mealtimes, activities, time of day) linked to specific sounds?

Impact on Daily Life and Felt Experience

(10) Did GastroPod disrupt or enhance your daily activities?
(11) Did the experience shift how you understand or relate to your body?
(12) Were there moments that felt calming, disruptive, or neutral?
(13) Did any aspects of daily life change due to the device?
(14) Did the experience bring awareness to any habits or cultural practices?
(15) Did gut sounds remind you of external events or past experiences?
(16) Was there a sound or moment that stood out to you?
(17) Did the experience make you feel more or less in tune with your body?
(18) How did you manage listening alongside other sounds in your environment?

Temporal and Spatial Patterns

(19) Did the timing or frequency of sounds feel meaningful to you?
(20) Did you adjust meals or movement based on what you heard?
(21) Did you experiment with device placement? What changed?

Reflections on Bodily Awareness and Understanding

(22) Did the device help you become more aware of bodily signals?
(23) Did you feel physically better or worse during the study?
(24) Did listening change how you recognise when something feels "off"?
(25) Did the experience help you understand how to care for your body?
(26) Did it encourage you to seek further information or support?
(27) Did you find yourself more curious about your body?
(28) Did listening lead to any changes in diet or habits?
(29) What outcomes would you want from a future system like this?
(30) What would make the experience feel right for you?

Device Usability and Feedback

(31) How was your overall experience with the GastroPod device?
(32) Were there times you wanted to stop using it? Why?
(33) What improvements would you suggest?
(34) Were there any discomforts or challenges? How could these be addressed?

Closing Questions

(35) Would you recommend this experience to someone else? Why or why not?
(36) Do you feel you understand yourself or your body differently after the study?
(37) Did you experience awe, surprise, or moments of reflection?

(38) How do you imagine such a system might be used in the future?
(39) If this were a product, what price range would feel appropriate?
(40) Would a simpler or more affordable version still be valuable?
(41) Were there situations where you avoided using the device? Why?
(42) How would you feel about sharing or co-listening experiences in social settings?

Follow-Up Questions (Two Weeks Post-Study)

(1) Since using GastroPod, have you noticed any changes in how aware you are of your gut activity or sounds in your daily life? If yes, can you describe them?
(2) Have you found yourself thinking differently about your gut activity, such as what might be causing certain sounds, compared to before the study?
(3) Since the study, have you found yourself paying attention to your gut sounds or sensations even without using GastroPod? If yes, what do you usually do when you notice them?

C GASTROPOD STUDY KIT DESCRIPTION

Participants were then introduced to the GastroPod study kit (Figure 2), which included the wearable system (a Stemoscope Pro digital stethoscope worn on the abdomen with a strap, paired with Shokz OpenRun Pro bone-conduction headphones for discreet real-time listening), a multimodal sound journal (containing contextual prompts, affective ratings using the Self-Assessment Manikin (SAM), and a gender-aligned body map for marking sound locations, intensities, and qualities), and sketch pens to support visual and creative expression.

D ENGAGEMENT INSTRUCTIONS

Participants were asked to use GastroPod in their everyday environments, during meals, rest, work, activity, or social contexts, and to document their experiences in the sound journal. They were encouraged to engage daily and consistently for at least 2 hours/day. Journaling included contextual notes, SAM ratings, body map markings, sound descriptions, and end-of-day reflective questions. To support engagement, participants received periodic reminders from the research team.

E CODING PROGRESSION

This process generated 14 higher-level topics, such as bodily awareness, bodily knowledge, scientific curiosity, social experiences, exploration, amplification, device placement, sense-making, bodily rhythms, tinkering, wearability, discomfort, reassurance, and embodiment. These topics were iteratively grouped and refined into eight themes, which were then collaboratively reorganised into six high-level themes: tuning in, tuning out; sense-making and the desire for reassurance; the sociality of gut sounds; mediating interoception through body–device practices; the gut as sounding body; and the gut as relational other (or not).

F PARTICIPANT SAM SCORES

The following images show participants' SAM trajectory across Valence, Comfort, Arousal, and Connectedness scales over the seven-day study period.

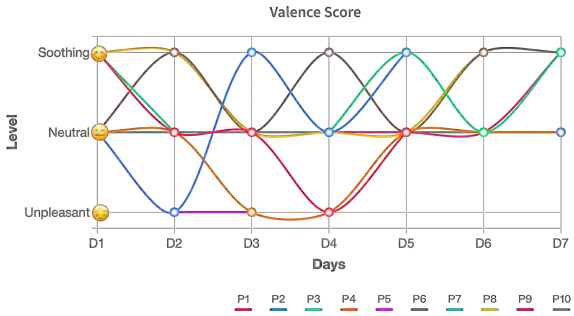

Figure 13: Valence ratings revealed shifting experiences across the week, with some participants oscillating between unpleasant and soothing, while others remained consistently positive.

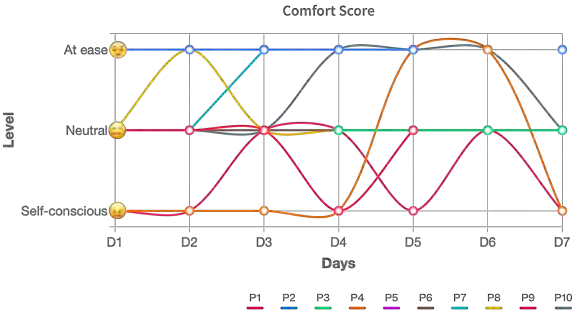

Figure 14: Comfort ratings showed contrasting bodily orientations, with some participants feeling at ease throughout and others cycling between ease and self-consciousness.

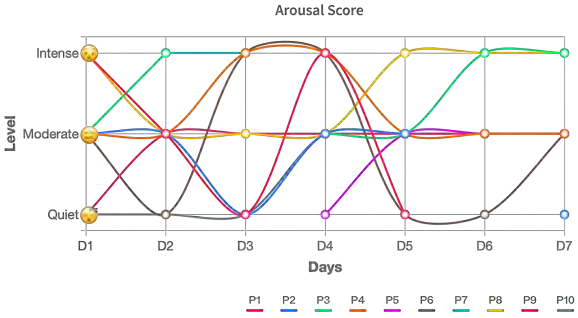

Figure 15: Arousal ratings highlighted divergent listening experiences, with some participants reporting increasingly intense sounds and others settling into quieter perceptions. These trajectories reflect the varied sensory effects of gut-sound amplification.

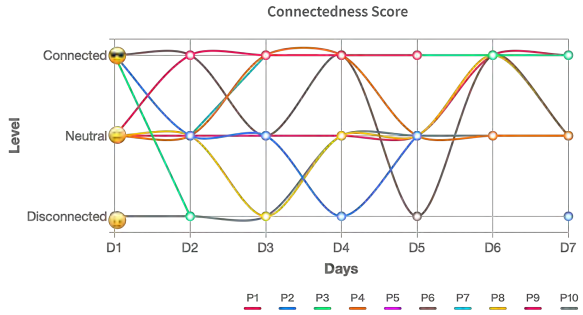

Figure 16: Connectedness ratings indicated a general upward trend, with moments of disconnection typically brief and situational.