Resound: A Moment of Reflection in a Techno-Spiritual RtD Inquiry

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ABSTRACT

We present 'Resound', a Research through Design inquiry into alternative techno-spiritual practices of a UK Buddhist community, informed by a first-person and participatory approach with the members. In this pictorial we portray a moment of reflection as we consolidate our design work towards deployment with the community. We introduce the *Resound Sphere*, a materialisation of our learning and speculations to date, designed as a research product to empirically explore alternatives for how tangible interaction could mediate religious/spiritual practices. We contribute with the framing of a design space, the presentation of our design approach and artefact response to this design space.

Authors Keywords

Research through Design; Material Exploration; Design Process; Techno-Spirituality; Community.

CSS Concepts

•Human-centered computing~Interaction design

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INTRODUCTION

The COVID-19 pandemic has intensified our dependence on screen-based devices, re-shaping how we connect with one another. Motivated by a yearning for alternative and post-pandemic religious and spiritual (R/S) practice, we have developed the *Resound Sphere* to reimagine what interactive technologies in and for R/S connections within faith communities may be. Inspired by recent accounts of techno-spiritual re-purposings [10,29,40], **we investigate alternatives to off-the-shelf technologies (i.e. Zoom) through designing for tangible interaction [24] to support and mediate R/S practice, advancing the discourse in techno-spirituality.** Exploring alternatives involves not only the type of technology (online vs. tangible) but also larger questions such as the intended purpose of the technology (e.g., general vs. specific use), the values embedded within the design, who gets to design, or how the design process can support the community sustainably.

Our Research through Design (RtD) inquiry involved interaction designers, Human Computer Interaction (HCI) researchers and community members located in the UK who are connected to an international Buddhist organisation: Soka Gakkai International (www.sgi-uk.org). Inspired by a previous study with this community [10], we designed the *Resound Sphere* to explore alternatives to commercial designs and off-the-shelf technologies, addressing sociological considerations about technology production and consumption for techno-spiritual design contexts. Alternative making proposals are of longstanding interest amongst RtD practitioners in the field of HCI (e.g. [1,11,12,19]). This is partly because RtD offers alternative material ways of knowing through the discipline of designing and making. In this way, the *Resound Sphere* is a tangible embodiment of our developing understanding including the ways we have progressed different lines of inquiry. It is not intended as a market proposition, but rather as an ultimate particular [27,33], a research product [32] built purposefully for long-term encounters in this world with mediated others.

With this pictorial, we make the following contributions; first, we contribute by **visually framing a design space** around designing to support and mediate community R/S practices in the home. Second, **we document our approach to addressing this design space** further contributing to documentation of RtD in Tangible Embedded and Embodied Interaction (TEI), HCI, and related fields [3,11,17,33]. Finally, we present **our response to this design space contributing to the field with an artefact**. We start this pictorial by introducing our design space. We then present our design response: the *Resound Sphere* and show how it was iteratively developed and refined through material exploration, autoethnographic accounts and participatory engagement with members of the community. We conclude by reflecting on our process to discuss our wider contributions.

> Design researchers need to be attuned to parts of the story (or events) before telling a full story. Using the vocabulary to see and name events* along the way is an important step. [33, p9]
>
> *We have highlighted these events in this pictorial.

FRAMING OUR DESIGN SPACE

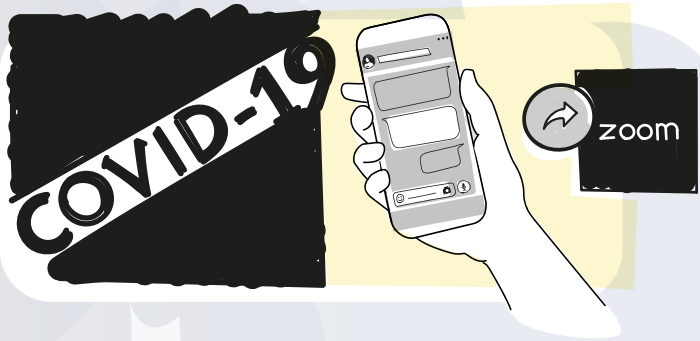
Most recently, HCI researchers have highlighted novel and under-explored design spaces for tangible interaction in R/S contexts [30] and community aspects of R/S practices [38]. They call for more design exploration that can better account for the tangible artefacts and embodied experiences that are so central to R/S practices. Work in this space is critical particularly following the COVID-19 pandemic, which intensified our dependence on screen-based devices, re-shaping how we connect with one another. HCI research has documented how 'off-the-shelf' technologies were appropriated by R/S communities [41] – a phenomenon known as 'techno-spiritual re-purposings' [2]. Whilst these forms of techno-spiritual practices have persisted post-pandemic, limitations of online and screen-based interactions have also been highlighted [10, 40] and HCI researchers have started exploring alternative avenues for creating meaningful techno-spiritual connections and experiences through tangible and embodied interactions [38]. And although research on R/S has experienced a shift towards design in the last ten years [38], the design processes in these contexts remain poorly documented [30].

Critical perspective

HCI researchers have criticised how experiencing the world through the lens of technology (i.e. the screen of our smartphones) risks to reduce our reality and arguably hinder our daily experience including how we relate to our own body, other people and the wider world [26]. Such works call for designers to expand what off-the-shelf or existing technologies have provided their users so far, to consider alternative and richer ways of being in the world [35]. Our RtD inquiry speaks to these critical discourses whilst using design as a vehicle to explore the potential of tangible and embodied interaction for our design space, which is represented here.

Buddhism as our RtD context

Our community includes members who practice Nichiren Buddhism as part of an international grassroot organisation called Soka Gakkai International (www.sgi-uk.org). Here ***practice*** refers to the act of chanting or praying in front of an altar located in members' home, ***faith*** relates to actively sharing this philosophy with others, and by ***studying*** Buddhist principles, members are encouraged to understand how these can be applied in daily life for value creation. Members repetitively chant a mantra (Nam Myoho Renge Kyo) and recite chapters of a sutra twice-a-day, in the morning and evening. The Buddhist community plays an important role in the practice with members regularly visiting each other to chant together towards personal and collective determinations. Members often organise to practice together remotely by deciding on a specific time to chant. Since COVID-19, the Buddhist community has adopted online technologies (i.e. Zoom) to connect remotely when unable to meet in-person. Members have continued using Zoom to facilitate hybrid meetings and chanting sessions.



A paper led by Author #1 reporting on her experience and findings from interviews with other Buddhists [10] was shared with the team to help frame an RtD inquiry, which we describe on p3.

Illustrations by Author #1

Excerpt from First author's autoethnography:

We did try to chant together but it was just impossible because of the delay experienced with Zoom, we could not be in rhythm. So, to avoid the cacophony of sounds, every time before starting, one of us would offer to lead the session and everyone else would mute themselves. [10]

Framing our RtD inquiry

Our RtD inquiry was informed by scoping and autoethnographic research conducted by Author#1 in dialogue with Author#5 who consolidated insights to share with our design research team. In this process, findings from a previous interview study [10] were shared together with a document including key related works, initial research directions, research questions and objectives. Sharing this document with the wider team marked a transition from scoping research to design-led exploration, which was led by Author#2 and Author#4 in dialogue with Author#1 . The document was intended to function as a discursive and boundary object [11] for our team to create shared understandings of our design space, goals and vision for the project. It was also a way to formalise and negotiate our expectations and organise our collaborative work.

AIM: Explore through design new ways of feeling connected spirituality with and through community practice of faith

Research questions

1. How can interactive systems be designed to support community aspects of R/S practice?
2. How can interactive systems help Buddhist members feel connected remotely and what features, interactions and qualities may be considered to enrich the remote experience of the community?
3. In what ways may connections be facilitated and what impact may this have on the individual and broader community?

With the aim to explore the qualities of the Buddhist practice and consider how interactive technologies may enrich experiences of community-based R/S practice, we set out to:

- → Broaden the design space by exploring the potential of tangible interfaces for enhancing mediated spiritual connections.
- → Support community R/S practice through a design artefact that will facilitate a sense of connection between a group of Buddhists.
- → Develop an alternative design that privileges more experiential and sensory qualities of interaction for community R/S practice.

This marked an important transition in our research and from then, further development was scaffolded by weekly team meetings.

Positionality Statement & Main Role

Caroline Claisse – R/S Practitioner & Project Initiator (Author #1), is a design researcher who developed a research interest in R/S contexts using her own experience as a member of a Buddhist community [10]. She has been involved in *Resound* from the start with a particular focus on exploring first-person methods and leading participatory sessions with different stakeholders.

David Chatting – Lead Design Researcher (Author #2), is an interaction designer and design researcher, with a long-standing critical technical practice, often applied to matters of everyday domestic IoT. He has led the RtD response to Author #1's first-person accounts, working closely with Author #4. Chatting is an atheist but knows a Protestant tradition.

Sara Wolf – Participatory Ritual Designer (Author #3), is an HCI researcher and designer who came across the R/S context through her research on rituals and interactive technologies. She currently works with Protestant theologians to explore novel technology-mediated religious rituals and education [e.g., 39]. She joined the *Resound* project at a mid-stage to support the design development and participatory sessions.

Ben Morris – Creative Technologist (Author#4), is a creative technologist with a background in physical computing and digital fabrication. He is dedicated to creating meaningful interactions that connect people and communities. He has provided design and manufacturing expertise to support development, contributing from an agnostic perspective.

Abigail C. Durrant – Project Co-Initiator (Author#5), is a designer and researcher with a long-standing interest in technology design for the home and to mediate cultural expressions of self, identity, family and community. She further explores tangible interaction for wellbeing and self-care through RtD practice. Her analytic perspective within this project is informed by her experience of being raised in a Christian tradition.

Domestic artefacts

artefact-led

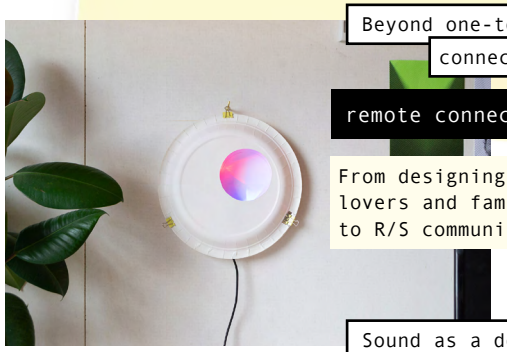
Design artefacts to support participation and dialogue with R/S community.

The God-I-Box [39]

Beyond one-to-one connections

remote connections

From designing for lovers and family to R/S communities.



YoYo Machines [20]
© Interaction Research Studio

Sound as a design material

voice intra-active appliances

Objects being energised by the human voice.

Blendie [13]

The Voice [6]

Related works inspired a series of design experiments [6], which included 'The Voice' in which the visual interface responds to Author #1's chanting voice.

These experiments informed our focus on sound as a design material, which led to designing Resound, which we describe next.

OUR DESIGN RESPONSE: RESOUND

Our design development (p5) led to the design of the *Resound Sphere* – an interactive community-oriented technology designed as a research product [32]. Its size, shape and materials are evocative of ritual paraphernalia (bells, beads, candles, etc.). The device is intended to exhibit functionality that is similar to familiar connected domestic technologies (e.g. voice assistants), but with material and behavioural choices that render it appropriate for use by Buddhist practitioners whilst inviting speculation about other ways it could be. Here we describe the main interaction and functional features of the *Resound Sphere*, which will be deployed in a longitudinal study where Buddhist members will be invited to use the device in their daily practice. We use research product as a design-oriented strategy to explore alternatives for meaningful techno-spiritual connections whilst critically investigating what it might mean for the community to live with the device and develop a relationship with it over time.

Ritual paraphernalia

Device is off. Chanting/ prayer counts are displayed.

Another member joins the network; their chanting is being filtered and transmitted through the device.

Device is turned on by being turned over, light gently warms up when the user starts chanting.

Device is turned off by being turned over. Updated prayer/chant counts is displayed.

> The device broadcasts the frequency of the voice and not actually the words. It's transmitting the actual harmonics and quality of the person's voice.

These quotes are extracted from encounters with Buddhist participants (described on p9) where the team explained what the device does.

> It's almost like a shared radio station. Anyone having their sphere up, it would send their filtered voice to the network.

e-ink display

accelerometer

RGB LEDs

speaker

microphone

power cable

First Author has been practicing with different frequencies at home [8]. This has informed ongoing experiments with sound design.

For more details about the interaction flow, see scenario on page 9.

> Microphone inside will pick up the frequency of your voice and cast that to another device.

Design Development

Building on Author's #2 previous work, we adopted a Pace Layer design approach [5, 7] to support our iterative and collaborative approach, in which the prototype is intentionally designed to adapt and learn to facilitate emergent opportunities [18]. As such, we knowingly make distinctions between the devices' layers of **shell**, **hardware**, **software** and the display **surfaces and sensory volumes** they create. Each layer is prototyped with different material/immaterial affordances to change. The **shell** and **hardware** were defined early on and are relatively resistant to change reflecting the necessary qualities of independent research products for longitudinal domestic studies [32]. The choice of circuitry (and manufacture of a PCB) has then allowed for an exploration of alternative orchestrations of functional features and behaviour through **software** configurations.

PROJECT TIMELINE

Weekly team meetings

These helped establish a rhythm for collaborative team work and enabled us to develop a shared understanding of the Buddhist practice.

First-person exploration

Author #1 regularly shared about her Buddhist practice with other team members. This included demonstrating her chanting practice and trying out work-in-progress versions of the *Resound Sphere* [8]. Reflections on this is beyond the scope of our pictorial and will be reported separately.

Design crits

We organised encounters with three community members who were invited to our studio to interact with the *Resound Sphere* as a work-in-progress, and to provide in-person feedback (see p9, p10).

Roundtable session

We will invite Design / HCI experts to take part in a roundtable session to gain their perspectives on the *Resound Sphere* whilst discussing research questions related to our design space and Interaction Design more

Transition to RtD inquiry

TEI Pictorial

Making the pictorial marks a moment of reflection and transition through which we consolidate our insights.

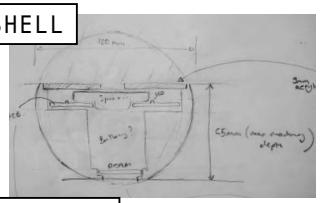
Deployment

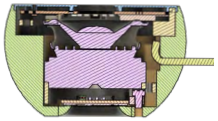
PACE LAYER APPROACH

resolution

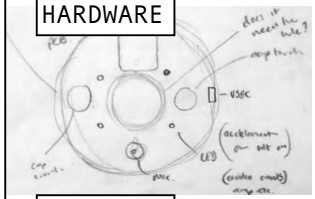
ease of adaptation

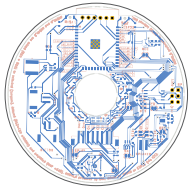
SHELL

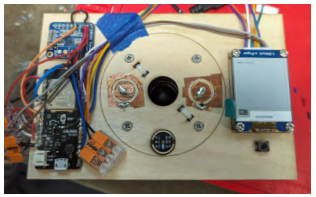


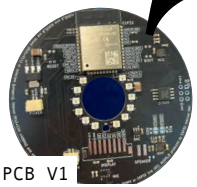


HARDWARE

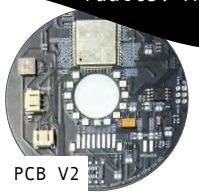








PCB V1
(printed circuit board)

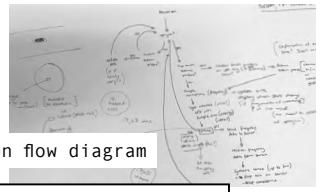


PCB V2

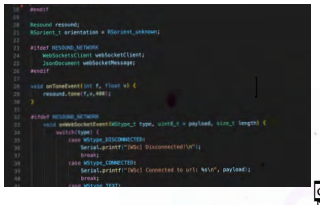
> I knew that the first version of the PCB would be unlikely to be the last and there would be unanticipated faults. Author#2

Our Pace Layer approach means that the PCB was designed with a level of flexibility to accommodate different design directions/desired features: the touch pads are designed to be used either as buttons or to detect gestures (like rotations), the audio circuitry can be configured to mix different sources – either using the ESP32 for sound synthesis or the additional ATtiny 85 processor.

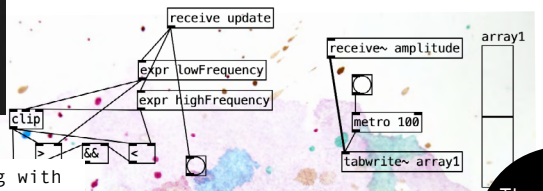
SOFTWARE



Interaction flow diagram

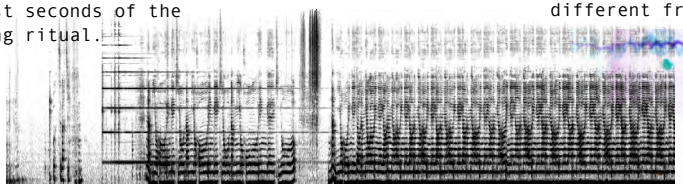


Visual programming
Pure Data

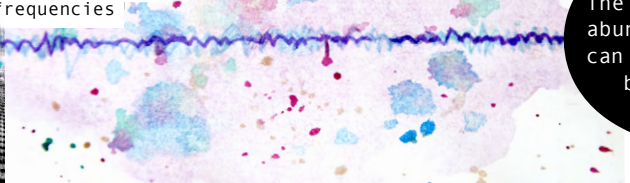


SURFACE & SENSORY VOLUMES

Spectorgram representing the first seconds of the chanting ritual.



Practicing chanting with different frequencies



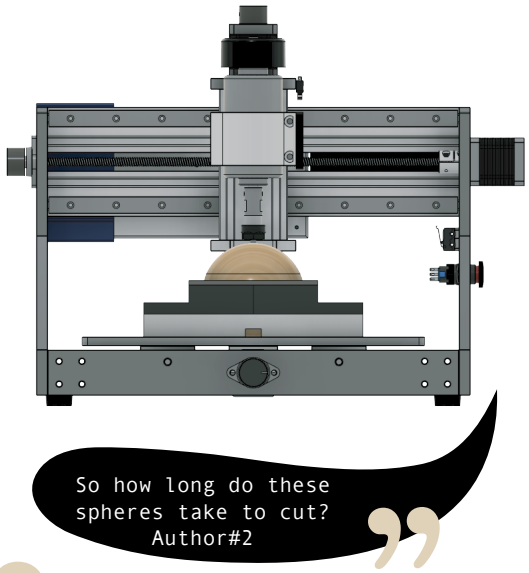
> The intention is to to create an abundance of hardware resources that can then be orchestrated and selected by software in different flexible ways. Author#2

DESIGN EVENTS IN MATERIAL EXPLORATION

We have found the **temporal vocabulary** for reporting on RtD [33] helpful to articulate key design events in our process. We highlighted a clear transition from scoping research to RtD (p3) and later, we report on rich encounters with community members (p9-10). Here we zoom in on a series of critical events in our material exploration. As we were preparing this pictorial, we interviewed Authors #2 and #4 who led the design development and asked them to talk through sketches, rendering, prototypes and electronics. We took notes and, based on these, Author #2 worked closely with Author #4 to develop narrative excerpts. The vocabulary highlighted in [33] helped us frame temporal qualities whilst articulating meaningful instances and important design decisions made in our RtD inquiry. In the next pages, we use the first-person plural pronoun 'we' to communicate insights by both Authors #2 and #4, in close dialogue with the rest of the team.

Event #1: Wired power. Battery power seems like a given for a device such as the sphere, granting it the freedom to roam far beyond an electrical socket. However, batteries add complexity necessitating ways to monitor and report low power, and requiring a battery life appropriate to the application. Batteries must also be accommodated inside the case. We reflected on previous projects in which Author #2 found these circuits and interactions hard to get right. At one specific meeting, (Encounter) we began to realise that there are definite advantages to wired power in this specific context. The paraphernalia (see p4) of this Buddhist practice is relatively static, being situated in and around the altar, where it is reasonable to expect that an electrical socket is available nearby – evidenced by the use of laptops during the pandemic times. A wired connection would give us reliable power for an extended period. We also found the presence of a physical cord satisfying as it reminded us of the string of a tin-can telephone and helpfully denotes a connection to an unseen infrastructure.

Event #1 dramatically simplified the circuit and interaction design, while solidifying specific modes of the Buddhist practice into the design.



Event #2: Cutting time. In anticipation of the deployment of the spheres in the community, our attention was drawn to the practicality of assembling a small batch of five. Up to this point, we had been making one-off prototypes, each focused on refining the form of the last. Now we needed to pragmatically consider the fabrication of a small-scale batch [4]. Our design had three parts: an outer wooden shell, into which fitted an internal core 3D printed by our machine in PLA, which supported the electronic elements. However, the wooden shell was so intricately cut that it took over 20 hours of milling time and was prone to failure. As we watched the spheres getting cut, (Other-time) it became clear that this process would not be practical, even for our small batch. The 3D printing in contrast was completed within an hour and after reflection, we realised that the cutting of the wood could be simplified with a relatively minor modification of the 3D print, saving hours of fabrication time. With this new design, we were able to engage with colleagues with wood crafting expertise, who helped us to consider how this design might ultimately be fabricated in the community with tools that we might reasonably assume they would have access to.

Event #2 led us to a point where we were questioning how such technologies might be built and maintained in the community, where they would implicitly not be enabled by Silicon Valley capitalist logics.

Design iterations of the shell and hardware


#1


electronics


#2


internal core 3D printed

#3

#4

outer wooden shell

Event #3: Slow and peripheral design. The initial framing for our RtD inquiry (see p3) directed us to seek 'alternatives to screen-based interactions' and to explore 'tangible interfaces'. Taking this literally, our design would likely prioritise direct touch, with the absence of any display technology. Yet of the inspirational designs we engaged with [21, 26, 37], few exemplified this, instead they often had display capabilities and were not primarily interacted with through touch. What they did have was a physical form that afforded a specific (rather than general) use and a slow [37] or peripheral [25] interactional quality. At a meeting with Author #1, (Encounter) we discussed the importance of focusing on the altar when chanting and this transformed our understanding from falsely assuming that the practice was primarily a meditative act, to understanding that it instead demanded consistent directed attention towards the scroll placed in the altar. Our design would not and should not be the centre of attention and yet it would be present amongst the existing paraphernalia of the practice. The sounds it makes should not be disruptive and there should be no elaborate light show; any physical interactions should be direct and require little attention. This marked a moment of clarity.

Event #3 surfaced the qualities of slowness and peripherality, which became rather central to the design, but this did not ultimately preclude a display.

Developed-stage rendering, which presents an outline of all design elements to facilitate discussions on component orientation, visual alignment, and proportion. The bottom view features an e-ink display.

Photograph of the Resound sphere (bottom view) featuring the e-ink display with an example of quantification (i.e. chanting count).

Author #4 holding hardware enclosure prototype: The e-ink display and reset button are slotted onto the base of the speaker, enabling a bottom viewing angle when the entire assembly is flipped.

Event #4: Quantifying the practice. We had assumed that technocratic quantification would be actively resisted when the endeavour was a spiritual one. However, through encounters with Author #1 and members of the community, it became apparent that target making and record keeping was an important element of this Buddhist practice. Indeed, one of the design crit participants showed us how he would use a record keeping app [16]: 'The app records how long you chant. You can also set your determination and your prayers, so it can also be that people can support you or chant for it'. On closer inspection, this is true of other faith-traditions (e.g. counting with prayer beads) and that this desire for accountancy necessitates forms of spiritual counting technologies as recently observed in [9, 30]. This design direction consequently shifted the archetype for the sphere away from a voice assistant or Bluetooth speaker, towards a Fitbit tracker but targeted at monitoring chanting practice. However, we started to question how then to quantify the practice whilst maintaining a slow and peripheral design? This prompted us as a team to consider new research questions i.e. *Could we draw from more poetic approach and alternative views on quantification [15, 34] to move away from efficiency and productivity, which may not sit so well with spiritual aspects of life?*

Event #4 made us reconsider the use of screens in our design not for mediating interaction but to afford quantification.

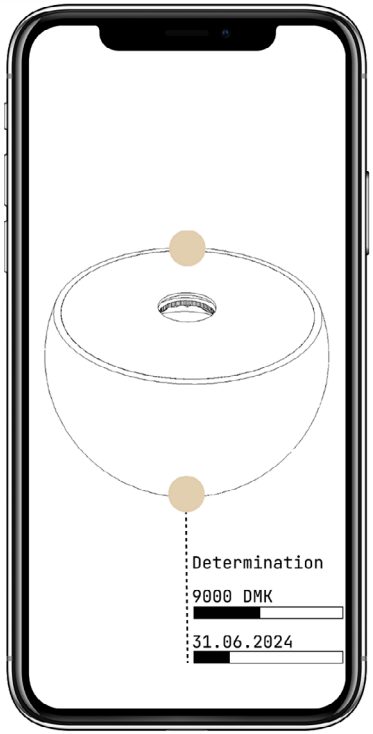
Broadening our inquiry

A trend for **Spiritual Informatics** was recently highlighted in HCI in which tracking functionalities are used for monitoring and supporting prayer or worship activities [30]. Existing designs supporting such a trend are inspired by the quantified phenomenon and Fitbit culture based on efficiency and productivity. A recent provocation has questioned to what extent the values communicated through these designs are aligned with R/S values and purposes [9]. Through our RtD inquiry, we critically investigate the potential for Spiritual Informatics for the Buddhist community.

A series of wireframes was developed by Author#3 to speculate on how tracking features could support members using Resound to set determinations* together and monitor their collective chanting towards these determinations (see also sketches on p9).

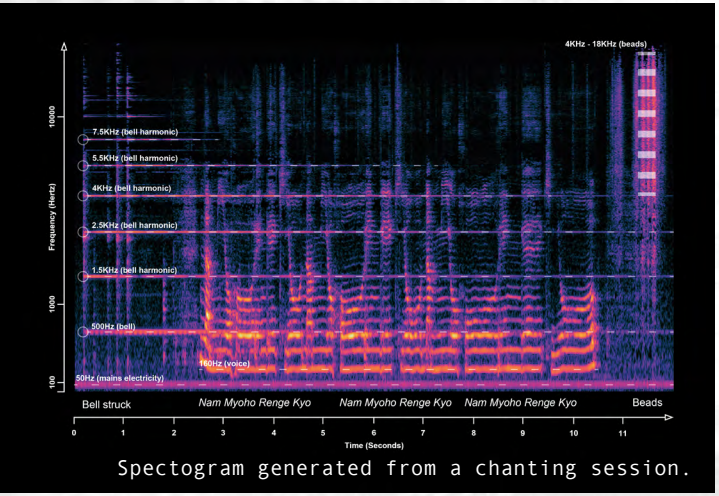
DMK (Daimoku) is the unit used in [16] for tracking one's chanting practice.

*As part of the practice, members would usually chant towards personal and collective determinations, which can be set up by individuals, a group or the wider organisation. The aim is to create unity through the practice.



Companion app prototype developed following Design Crit #1

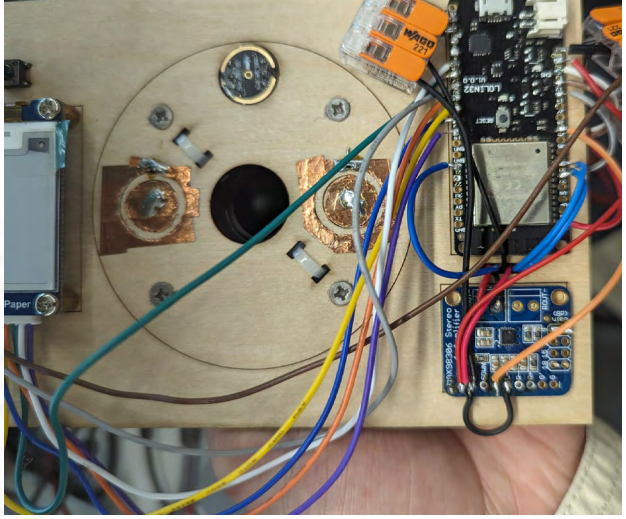
Event #5: Sound as a design material. Early in our inquiry we considered what signal or information we might meaningfully (and practically) share between remote members of the community. The sounds, vibrations and resonances created by the practice were obvious candidates, but we did not want to conceive this as a straightforward listening device that sent unprocessed veridical audio – not least for privacy and surveillance reasons. The question then became: *what essence of the sound performance might be extracted?* We collected a few samples of Author #1 initiating a chant, from which we could hear the striking of the bell, the chanting of her voice and the rubbing of the beads; events that punctuate the practice in prescribed ways [6].



Spectogram generated from a chanting session.

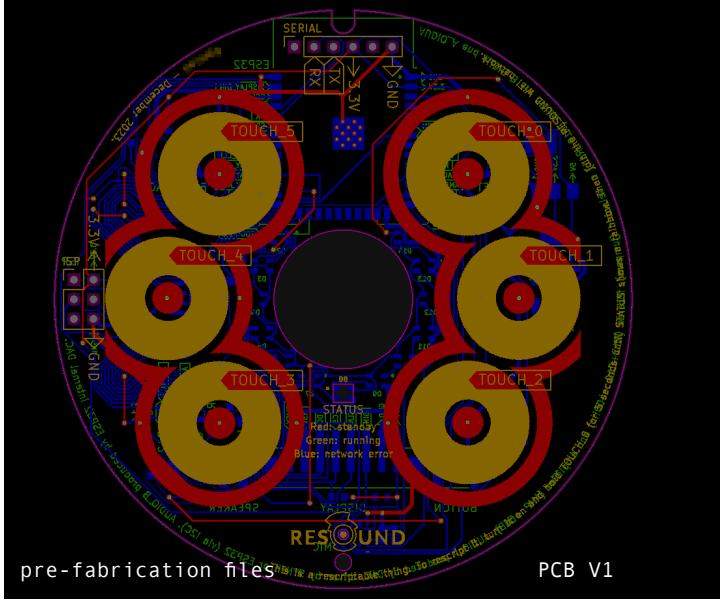
In a moment of curiosity, we used the Audacity audio tool to generate a spectrogram image of a sample, a well-known way to visualise the component frequencies of sound. This became a powerful image which we used to talk to the team about the sound in material ways. The spectrogram makes clear the bright harmonics of the bell and the texture of the beads.

Event #5 sensitised us to the consistent fundamental drone of the chant, which inspired our subsequent experiments in extracting and synthesising its frequency.


Moving from 'a rat's nest' of modules wired together to PCB design.

Event #6: Intricacy and resilience. Our ambition to create a research product with the fit and finish to be found useful and to be resilient in the homes of community members for weeks at a time, coupled with the intended complexity of the device, made the commercial fabrication of a PCB (printed circuit board) a necessity. However neatly assembled, a rat's nest of modules wired together would be hard to maintain and contain in a compact way. Furthermore, if the sphere was opened and inspected by our participants, it would likely fail to convey our trustworthiness and professionalism. The process of designing and fabricating a PCB structured a collaborative rhythm of work between us (Authors #2 and #4) over a year as the design was iterated, involving the repetition of a specific series of steps, decisions and interactions.

We started by identifying the space available for the PCB. This was determined by the speaker we had identified (with an appropriate volume and frequency range) and physical shell designs that we had already developed. It was then a matter of identifying the key components (WiFi module, microphone, amplifier and LED lights) and determining if they could be physically accommodated within the area of the PCB. With some iterations of the shell design (see p6), this was accomplished. We also needed to resolve the circuit; ensuring these components (and others) were interconnected without conflict and orchestrated by the ESP32 processor. This activity alone took several weeks.



pre-fabrication files PCB V1

Furthermore, as we wanted a fully fabricated PCB with the components in place, there was a *'toing and froing'* as we negotiated the stock held by the factory and made pragmatic alterations to the circuit in response. Once the components and the circuit were settled, we routed the board by hand in KiCad, specifying exactly how the cooper tracks make the circuit and numerous adjustments of component positions. While this was careful and deliberate work, we knew that the first version of the PCB would be unlikely to be the last and there would unanticipated (perhaps unanticipatable) faults. The fabrication of the PCB was relatively cheap and even a partially working board would disclose these issues and allow us to make significant progress with the software – at this stage a finished PCB was more valuable than a correct PCB. We formatted the fabrication files for the factory, sent away our order and waited – a welcome pause.

Whilst we worked through the first version of the PCB, faults and potential refinements to the board became clear (Moments): a second version of the PCB was necessary. Therefore, we began again the process of refining the circuit (including a new power circuit) and rerouting the board.

Event #6 made us appreciate the interplay of material and immaterial properties. For the second PCB version, we slowed down with the intention of getting the version 'right'. To date we are happy with this second version.

DESIGNING IN DIALOGUE WITH THE COMMUNITY

Additional key events that further advanced our RtD inquiry were our encounters with the Buddhist community. We conducted a series of design critiques (crits) with our team and three Buddhist practitioners who took part in a previous interview study [10] conducted by Author #1. We used design crits as a way to get feedback from community members whilst aiming to build a shared understanding of the opportunities and challenges for future design development. The sessions were organised in our studio with one Buddhist community member and three to four members of our team attending each time. Participants were asked questions about the look and feel of current iterations of the design, their speculations about using something like the *Resound Sphere* for chanting remotely with other members, and anything they found interesting or challenging about the design concept.

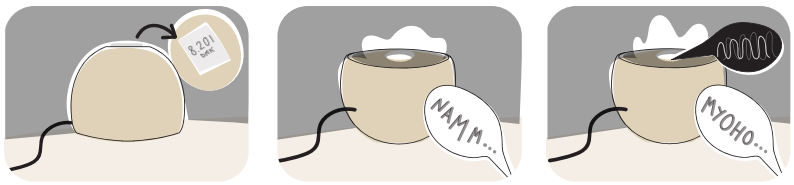
Each session started with an introduction to the project. The *Resound Sphere* was displayed on the table with supporting materials (i.e. spectogram). We first invited participants to hold the sphere and asked them to respond to its 'look and feel'. We then demonstrated how it would work using a Wizard of Oz approach: Author #1 started the demo by ringing the bell and chanting alone. After one minute, Author #2 would play a recording of the sound frequency to mimic someone else joining the session remotely (see interaction vignettes). Author#1 chanted with the recording and invited Buddhist participants to join in if they were comfortable to experience what it felt like to chant with the sound frequency. We also used a scenario to contextualise key interactions and features. The scenario was slightly adjusted from one crit to the next to reflect the conversations and suggestions made by participants. Additional supporting materials were developed to accompany the demo (i.e. packaging, leaflet).

Scenario

A group of four members decides to chant together at a specific time. They have the Resound Sphere set up in their home and displayed by their altar. When ready, they flip the sphere over to turn it on and as they start chanting, the light responds to the individual's voice; it flickers and gently warms up from blue to orange. As members from the group join the network, they start hearing each other's sound frequencies through the sphere. After half an hour, they close the session by flipping it over. The time and chanting count for their collective session is updated and appears on the top.

A more detailed scenario was developed for crits #2 and #3 based on conversation in crit #1. This time the sphere was presented in a box with a leaflet featuring instructions for configuring it. The scenario communicated the idea that members would form a group to support each other towards a specific determination. In crit # 3, we suggested that the box could be gifted, and members would meet at each other's home to configure the sphere together.

In crit #2, we introduced the idea of a companion app where members could see who was part of their group or network. They could also adjust the sound and see a timeline, which visualised their chanting progress towards the group's determination.



Interaction vignettes used in crit #1

Spectogram

Crit #1

Packaging and leaflet

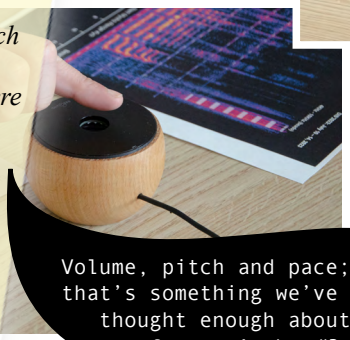
Packaging and leaflet developed for crit #2

Wireframes

We present narrative excerpts from the three Design Crits, which were generated by Author #1 & Author #3 with direct quotes where appropriate. Also included are some annotations to communicate what we took away from the Crits i.e. what was consolidated or expanded.*

* We checked in with our participants for representation of what they said.

"The purpose here is to use the prototype as a way 'to think with' and encourage creative thinking to explore a design space. Author#1"



"Volume, pitch and pace; that's something we've not thought enough about so far... Author#2"

"It's good, I think it's all those, kind of, bigger questions we want to raise with the design.Author#3"

Consolidation: Material and visual choices

Consolidation: The sphere as an alternative proposal

Appropriation: Imagining novel use case scenarios

Extension: Imagining novel features

Design Crit #1 | *'I think the **minimalism** is really good' and it does not feel like a light thing which is good 'so, also the idea of **solidity** is good'. 'I am really intrigued by the light... It's like a candle', we have candles on the altar so in a way, it replicates that idea. The interaction is different because it does not have a screen. But the sphere would not be a problem because we so got used to technology! 'We got used to just click'– this here is different. 'There is the idea of being connected in a different way'. This feels more **straightforward** and **intimate**, 'there is that **direct connection** where you don't need to log in to an iPad to see each other'.*

*I think the sphere could be introduced as a way to support each other towards a challenge or determination. It is sometimes challenging to practice with each other; we get busy and don't commit as much as we wanted to. The sphere could remind you that somebody is there and if I know that someone in my network is chanting, I might be prompted to chant as well. I'll know even without looking at my phone that a person is there. It would create a **'tangible sense of belonging'**. But I would like to set it up, so it tells me the name of people on my network.*

*The problem we have with Zoom is the delay, so I am intrigued by the sound. I would like to be able to configure the sound, 'so at this stage I want to hear it **more aligned** to what is my sound'.*

Consolidation: Importance of slow and peripheral design

Critical enquiry: Highlighting essential community values

Design Crit #2 | *I'm not much of a technological person and tend to resist new tech. So, initially, I worried that this device might be disruptive. The sound, for instance, could be jarring if the volume is too loud, or the light could be too bright and thus attract my attention while chanting. But it's all very **subtle** and could even be adjusted; I liked that. I appreciate the device's **simplicity** because anyone can use it, so it does not exclude anyone from the community. However, only allowing a small group of people to connect might be a challenge because 'that element itself creates that potential to exclude people'. At the same time, I like the **gift-giving** and **support network** idea because both are existing practices in the community.*

*The device shares similarities with other items of the practice. "It is not a faith object" like the script but more like other objects that are optional and based on **personal preference** - just like incense or a candle. 'If you want to use a candle, use a candle. If you don't, don't'. Maybe people could even have personalised versions of the device so it fits with their altar.*

*'I like this design as it is. I like **natural** materials'. I think giving people some **agency** during use is also essential. For example, a group should be able to decide for themselves what they want to share between them and how they want to use it.*

Appropriation: Imagining the device's fit with the context

Extension: Imagining novel features

Design Crit #3 | *I'm a faith leader in the community, so my perspective is focused on how technology might impact our community and practice, and I'm pretty settled in my opinions. Most importantly, 'you don't want anything come between you and your Gohonzon (scroll)'. So I see the potential for disruption with this device. I fear it might create problems similar to the Zoom experience, especially concerning (a lack of) **rhythm** or **adjustment to each other's pitch**. It might also introduce tension to my personal chanting practice. However, to be able to really judge, **I'd need to experience it.** It is the same as with the practice more generally: 'we say this always, when people start chanting […], it needs to be experienced, doesn't it? So I would imagine like you have to experience this as well'.*

*I am also reflecting on the device's place in people's homes. It definitely needs to consider the diversity of our members because 'it's always about not leaving people behind'. For example, the device would also need to fit people's styles because all objects of the practice have **practical, aesthetic, and symbolic value.** 'Everyone has their own aesthetic, and it is important to understand that all the things you have placed on the altar also "kind of represents your life state'.*

Critical enquiry: Highlighting potential impacts on the practice

Consolidation: Importance of deployment and long-term use

Appropriation: Imagining the device's fit with the context

DISCUSSION AND CONCLUSION

We have highlighted key events [33] in our design process and contextualised them to show temporal qualities, meaningful instances and important design decisions made in our RtD inquiry. We contribute with (i) the framing of a design space around designing to support and mediate community R/S practices in the home, (ii) the documentation of our RtD approach and (iii) our response to this design space - the *Resound Sphere*, which we built purposefully for long-term encounters in this world.

Framing the design space for & through RtD inquiry

Here we reflect on how we worked together and what helped us understand our design space as a team. The pictorial points to the potential of visual resources for developing a shared understanding of a design space; for instance, the illustration on p2 played an important role in communicating autoethnographic insights [10] whilst helping our team frame a critical understanding of techno-spiritual re-purposings. We also found written prompts such as provisional research questions and a list of objectives helpful as points of departure for our collective exploration (p3). Indeed, creating illustrations and coming up with research questions (p2-p3) were key for supporting our transition from ethnographic / scoping research to RtD: it supported knowledge externalisation [33] and helped us focus the subsequent dialogues in our weekly meetings and roundtable design crits. An important part of these consisted of Author #1 sharing her Buddhist practice with other team members. This was not easy at first as it can feel intimidating or inappropriate to share about R/S in work settings. In our case, making sense of the Buddhist practice through an ongoing dialogue with Author #1 became an inherent part of our weekly interactions where curiosity and question-asking were found essential to grasp what was key to the practice, that is so tacit and rooted in experiential knowledge. Here it was important to provide a safe space, which involved finding a quiet and intimate space in our lab for Author #1 to demonstrate the rituals and chanting associated with her practice.

Having different expertise and clear roles established from the start (see positionality statement, p2) helped us work together and negotiate the values each of us brought to the project. For instance, we had our own research interests and expectations such as wanting to explore different materials and modes of fabrication or building on long-standing research interests in designing for domestic IoT [7] and technology-mediated ritual experiences [38, 39,40]. Whilst this needed to be negotiated carefully to respect the sensitive nature of our research context, we felt that it was important for each team member to find something in the project that they were interested in to explore. This in turn was beneficial as it allowed us to broaden our inquiry and think beyond designing for the specific (Buddhist) context, to consider transferable insights, which will be consolidated with the upcoming roundtable described on p5.

We have relied on Author #1 first-hand experience to inform our design response, which presents similarities with autobiographical design [31]: to some extent part of Author #1's experience is embodied in the design of the *Resound Sphere* and its exploration. Here it was important to support fast tinkering early on and to build the system so it could 'really work' for Author #1 to test parts of the system herself i.e. to see how it felt like chanting with the sound / frequency generated from the sphere [8]. But we also reframed our first-person RtD inquiry to engage with other members' views and followed a more 'dialetic tradition' to support the emergence [18] of new understandings and knowledge through encounters between design researchers and potential users. To support those encounters, we found it helpful to generate new materials (i.e. sketches, scenarios) to communicate our design space to participants and this in turn helped us refine the project on both practical and conceptual levels before deployment (p9-10). Contrasting understandings and possibilities emerged from the narratives presented on p10 in which we highlighted how our understanding was either consolidated or challenged. For instance, conversations with our participants helped us consolidate our design decisions as the design of the sphere was appreciated (i.e. its materials and peripheral design). Participants also challenged our ideas through 'extension' and 'appropriation': they imagined novel features for the sphere so that it would suit their needs and proposed new scenarios of use. The sphere also prompted critical thinking around community values that are so central to the practice. These helped us figure out how we might deploy the sphere whilst progressing our critical inquiry around technology in R/S contexts; by learning more about the qualities and rituals of the practice and reflecting together with participants on how using a new interactive device like the *Resound Sphere* could support or challenge existing practices, whilst surfacing new understandings and possibilities for design. Overall, this pictorial communicates the complexity and discursive qualities of our participatory and collaborative process in terms of the different actors who contributed to reframe the design space as we progressed our RtD inquiry.

The intrinsic value of making this pictorial

We used the pictorial format to communicate our approach and response to the design space contributing to documentation of RtD in TEI, HCI, and related fields [1,3,11,17,19,33]. We recognise that RtD is inherently a non-linear, discursive and dynamic process [19], which can present challenges for disseminating knowledge in academic settings [3, 19]. We turned to the notion of design events and more specifically, the vocabulary recently developed by Oogjes and Desjardins [33] for reporting on our RtD process. Inspired by this work and similar endeavours [17], we started by reflecting on particular moments, encounters and transitions (etc.) in our design process. We reported on several of them in this pictorial, but the purpose was not to be exhaustive and list them all. Instead, making this pictorial helped us identify, articulate and curate key parts of our journey, which in turn allowed us to understand what was significant to reflect on and report on at this stage, for productive conversation with the TEI and wider HCI community. **Consequently, we frame the making of this pictorial as a moment of reflection in our RtD inquiry, which invited us to slow down, pause and reflect together.** We found this process to be very generative for progressing our inquiry: we re-engaged with our design materials i.e. iterated versions of the sphere, data generated from participatory sessions and team meetings. We generated new materials such as narratives (see p6-8 and p10) and visual representations

of our approach (i.e. see Pace Layer design approach, p5), experimented with different ways to document and communicate provisional knowledge from our design process (i.e. mini team interview, p6). In the making of this pictorial, we put a lot of efforts in using different forms of narrative and visual documentation to communicate our different ways of knowing, i.e. from first-hand experience of R/S (p2), from material explorations (p6-8) or through encounters with potential end-users (p9-10). Together with the temporal vocabulary [33], the pictorial helped us communicate more than one could say with words and we found value in using such format for remaining evocative enough to invite further interpretation and reflection among ourselves and the readers. Finally, we connect with previous work on RtD documentation, which describes 'what documentation does' to the design process and its outputs; 'it "talks back" to us as designers and researchers' [3]. Here we also highlight the affordance of pictorials for public dissemination for progressing RtD inquiry. Indeed, making this pictorial for the TEI conference marks a significant moment for us in our RtD inquiry in terms of feeling ready to share our insights (but also our doubts or critical questions) with a wider community of design researchers and whilst this presents a valuable opportunity, we are also exposing ourselves and taking some risks.

The qualities of Resound as a research product

We present our artefact contribution, the *Resound Sphere*, as a research product contributing to current discourses on techno-spirituality and what it might mean to design tangible artefacts for and in R/S contexts [9,30,39]. Developing a research product rather than a research prototype [32] was a deliberate choice to empirically explore alternatives for how tangible interaction could mediate R/S practices and to respond to the particularities of the design space.

> We say this always, when people start chanting […], it needs to be experienced, doesn't it? So I would imagine like you have to experience this [Resound Sphere] as well.
> Research participant, Design Crit #3

Our intention is to deploy the *Resound Sphere* in a longitudinal study with a small group of Buddhist members. However, we also recognise the values of research products for our design exploration pre-deployment; we were able to engage early on with the practicalities of our design proposition whilst being able to foster dialogue with community members supported by a tangible proposition instead of what it might become. As a research product, the *Resound Sphere* is **inquiry-driven** and asks 'particular research questions about potential alternative futures' [32, p2551]. It explores how technology alters the perception of chanting practices, community, and, ultimately, R/S. It proposes a specific mode of connecting with mediated others in chanting, focused on experiencing the subtle presence of others. As such, it amplifies certain qualities of the experience while reducing others. To understand how this specific design alters perception in use, the *Resound Sphere* is designed **to fit, to be lived-with** by community members in their everyday life [32]. The negotiation between familiarity and strangeness is evident throughout the material exploration and participatory engagements. The *Resound Sphere* has similarities to other Paraphernalia (e.g., the bell, candles) – not just in relation to its outer appearance but also to its status within the practice, which has been echoed in Design Crit #2 with the community member detailing how the device 'is not a faith object' but more like other objects that are optional and based on personal preference (e.g., incense or candles). However, it is also strange to the practice given how different it is compared to off-the-shelf technologies such as Zoom that are currently being used by members.

As a research product, the *Resound Sphere* is **finished** - it 'is what it is' not 'what it might become' [32]. Its finished qualities should enable community members to notice and reflect on the experiences it creates. The quality of 'finish' also encourages trust. Community members need to trust that the device does what we say – e.g., that it will not record everyday conversations. Our project unpacks the complexity of what it might mean for a research product to be 'finished', highlighting nuances between different layers such as the **shell**, **hardware**, **software**, or **surface and sensory volumes** (see Pace Layer design, p5). Different layers might be more or less finished and can also be finished at different times: whilst the **shell** reached a 'finished state' rather early in our process, the **software** or **surface and sensory volumes** can still accommodate opportunities that continue to emerge through our RtD inquiry [18]. Whilst having resolved the shell and software aspects of the design, our Pace Layer approach affords a flexibility with the sound design, which we are still refining. Although we are approaching a 'finished state' that allows us to deploy the *Resound Sphere* **independently** in the field, we believe that there are additional aspects to be considered in relation to 'independence' in our design space. Given that we expect the *Resound Sphere* to alter R/S practices and maybe even what is experienced as R/S community, do we have an obligation to stay close to the community during deployment?

To conclude, we have unpacked the making of the *Resound Sphere* as a research product and showed how it has informed our design process and scaffolded our RtD inquiry and purpose for future deployment. Here we re-iterate that our aim is not to produce an acceptable solution or to fix any problems with remote R/S practice but rather, to explore our design space by using the *Resound sphere* as a vehicle for advancing the discourse in techno-spirituality. Furthermore, our insights presented in this pictorial speak to the themes of **reclaiming focus on material knowledge** and **sustainability** in designing for TEI. First, we have demonstrated the value of making things and engaging in material exploration, which supported an experience-centered approach to RtD [14,19]. Our work also speaks to the theme of sustainability in terms of design outputs; how research products may be deployed in the long term and produced to embody the values and purposes of the community; how design outputs like the *Resound Sphere* might support a sense of belonging through feeling connected spiritually with wider implications for R/S communities to sustain themselves in post-pandemic contexts.

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