Spooky Technology

The ethereal and otherworldly as a resource for design

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ABSTRACT

Our everyday technologies could have appeared terrifying to our ancestors: instantaneous disembodied communication, access to knowledge, objects with 'intelligence' that talk to us (and each other). Black boxes and intangible entities are omnipresent in our homes and lives without our necessarily understanding the hidden flows of data, unknown agendas, imaginary clouds, and mysterious rules that govern them. Have humanity's ways of relating to the unknown throughout history gone away, or have they perhaps transmuted into new forms?

In an ongoing project, we have inventoried examples, encounters and reflections on contemporary technology, framed through the perspective of the haunted, spectral and otherworldly. In this paper, we excerpt this collection to illustrate the value and opportunity of an unfamiliar, disquieting perspective in helping to frame the frictions, beliefs and myths that are emerging around interactions with everyday technologies. We posit and demonstrate 'spooky technology' as an accessible framework to reflect and respond to our increasingly entangled relationships with technology.

AUTHOR KEYWORDS

Research through design, everyday tech, otherworldly, invisible, spooky, entanglement HCI, hauntology, numinous, disembodied interaction.

CCS CONCEPTS

- Human-centered computing~Human computer interaction (HCI)

INTRODUCTION

We sometimes hear that the technologies in our everyday lives would appear to be 'magic' and potentially terrifying to people in the past—instantaneous communication with disembodied people all over the world, access to a vast, ever-growing resource of human knowledge right there in the palm of our hand, objects with 'intelligence' that can sense and talk to us (and each other). But rarely are these 'otherworldly' dimensions of technologies explored in more detail. There is an often-unspoken presumption that the march of progress will inevitably mean we all adopt new practices and incorporate new products and new ways of doing things into our lives—all cities will become smart cities; all homes will become smart homes. But these systems have become omnipresent without our necessarily understanding them.

They are not just black boxes, but invisible and intangible: entities in our homes and everyday lives which work through hidden flows of data, unknown agendas, imaginary clouds, mysterious sets of rules which we perhaps dismiss as 'algorithms' or even 'AI' without really understanding what that means. On some level, the superstitions and sense of wonder, and ways of relating to the unknown and the supernatural (deities, spirits, ghosts) which humanity has felt in every culture throughout history have not gone away. Instead, they have transferred and transmuted into new forms. The systems we produce and invite into our homes today are so vast, distributed, complex and intangible, that they defy a complete understanding. While specialized research work in explainable AI [1] is teasing out the dimensions and implications of this complexity at an academic level, it is investigations behind the scenes of everyday technology experiences, such as Crawford and Joler's *Anatomy of an AI System* [30] that reveal the hidden and intangible tangle of "each small moment of convenience". Whether it is "answering a question, turning on a light, or playing a song [it] requires a vast planetary network, fueled by the extraction of non-renewable materials, labor, and data." The beautifully rendered system map lays bare the staggering complexity of even the most simple interaction in the smart home.

The otherworldly, and its histories, are entwined with everyday technologies. The idea of other times (or places, or people, or presences) intruding into, or being present in our time is, on one level, what much technology has brought us, from camera to telephone to the endless Zoom calls: ways to get access to memories and minds, our own and others'; ways to talk to or see people and places we couldn't otherwise, from across the world or across time, an incomplete yet boundless archive. As Fisher [40] noted, "in conditions of digital recall, loss is itself lost". It might not be how we routinely think about technologies which have become prosaic and mundane, but a slight shift in frame can cause us to think somewhat differently about the enmeshed systems we exist and live within. The action-at-a-distance notions in time and space, whether an IoT heating system being switched on remotely, or even the idea of code itself—written instructions to a physical object—are actually quite profound,

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a way of humans finally approaching the long-sought affordances they had once imagined were possessed only by supernatural beings. The seeming simplicity of domestic technologies and the smart devices now occupying our homes is intentional. They have been designed to be elegant, ornamental, and present as benign, knowledgeable (although the façade can break down [86, 89]). This creates a clear tension between the way they appear (simple, usable, harmless) and the way they operate (complex, unwieldy, destructive). Simply put, our systems are no longer explainable. Yet, we crave explainability. The supernatural is a possible vehicle for this interpretation: a way of dealing with failures and difficulties in sense-making.

So, in the moments where Alexa wakes without being prompted, when we receive text messages from a year ago out of the blue, when clairvoyant adverts predict our future needs, where is the line from 'bugs' to 'gremlins' to 'daemons'? What ghosts lie in the machine? If our systems are inhabited by—even at the very least as abstract, conceptual and tangential conceptions of—references to otherworldly, supernatural and superstitious beliefs, how has this influenced how people interpret these systems? How do these myths and legacies complicate the explanation of technology breakdowns and system errors? And if steeped in such symbolism and imaginaries, what hands do otherworldly influences have in inspiring the design and development of our contemporary technologies?

THE STRUCTURE OF THIS PICTORIAL

This pictorial is based around some ideas emerging from Spooky Technology, a project where students and faculty members at Carnegie Mellon University, flung into remote collaboration in summer 2020, explored ideas of spookiness in technology, including creating an inventory based on collecting and reviewing work across art, design, and HCI research, both historically and more recently, along with forays into writings on the supernatural, myths, and superstitions, in the form of a book. Our aim was to produce, collaboratively, a set of examples, from which we could extract possibilities, insights, and opportunities.

We present a series of short vignettes from the Spooky Technology project, which, taken together, suggest and lead to opportunities for critical and exploratory work in design and HCI research and practice. Figure 1—which somehow appeared to the authors when a 1950s cybernetics book fell open, pushed off the shelf by an unseen force—shows how these vignettes, over the next few pages, tie together.

In stage 1, we ask 'Where is the haunted in HCI?' and look at parallels in related disciplines. Together, insights from this feed into stage 2, where we illustrate our approach and method in developing the inventory and book. Stage 3 looks more deeply into one aspect which emerged across many of the examples we looked at: the notion of 'breakdowns in explainability', how these can be related to conceptions of mental models, and how a process of defamiliarizing building on these ideas could be employed as part of user research. Stage 4, in parallel with 3, explores how the 'spooky' framing could be an opportunity for Research through Design briefs, and the production of new work embodying and enabling critical reflections, with reference to some recent projects and early experiments with students, applying the 'spooky' frame. We then conclude by linking this work back into the question of the haunted in HCI, and where it could go next.

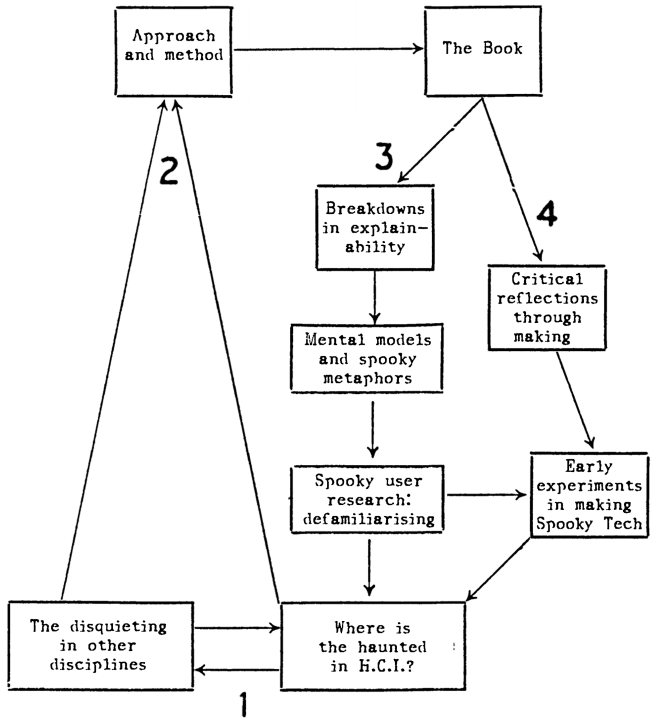


Figure 1.

WHAT IS NOT SPOOKY

We have avoided covering work explicitly framed as 'horror', and also—intriguing as the concept is—have not specifically adopted the 'monsters' lens as explored by researchers such as Karpashevich et al [63]. Blythe's [11] concept of 'overcoming monsters' as a metaphorical way of considering problems in HCI also felt out of scope for this work. However, Dove and Fayard's use of metaphorical monsters [39] in a different context is discussed further later in this pictorial. Equally, although questions of spirituality intersect significantly with the supernatural, we have chosen not to include work on religious or theistic approaches to technology here. Others have done this thoroughly—from explicitly religious approaches such as Ibtasam's work on Islamic HCI [57], to Wyche and Grinter's use of religion as a lens to approach technology [113] including among Charismatic Pentecostals in Brazil [114], to Buie and Blythe's [12, 18] work on techno-spirituality, including perceptions of AI as a 'god', there is a range of excellent work rooted in cultural and anthropological dimensions of belief.

However, we are reluctant to characterise spiritual belief and faith as 'spooky'—and while superficially there are overlaps in the sense of engagement with unseen beings, forces, and even ghosts or apparitions — our assumptions are that the feelings of 'spookiness' and unease evoked by the perspectives and projects discussed in this pictorial are, for most people, qualitatively different to religious and spiritual belief.

Similarly, perhaps, we do not engage specifically (although it is fascinating) with work which uses neurological stimulation technologies to induce the perception of apparitions [e.g. 10]. Although, we note and recognize the long tradition of using technologies to create the illusion of apparitions, from Pepper's Ghost (1863) [26] to an intriguing-if-horrifying idea buried in a paper by the US Air Force's Institute for National Security Studies, of a somewhat Shakespearean projected 'death hologram'—"a drug lord with a weak heart sees the ghost of his dead rival appearing at his bedside and dies of fright" [19: p15].

THE DISQUIETING IN OTHER DISCIPLINES

Media theory and new media art have often employed the frame of the supernatural, unseen forces and ethereal actors to examine our collective relationship to technologies, analog and digital. Below are just a few perspectives.

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Last login: Wed Oct 17 18:13:08 on ttys000
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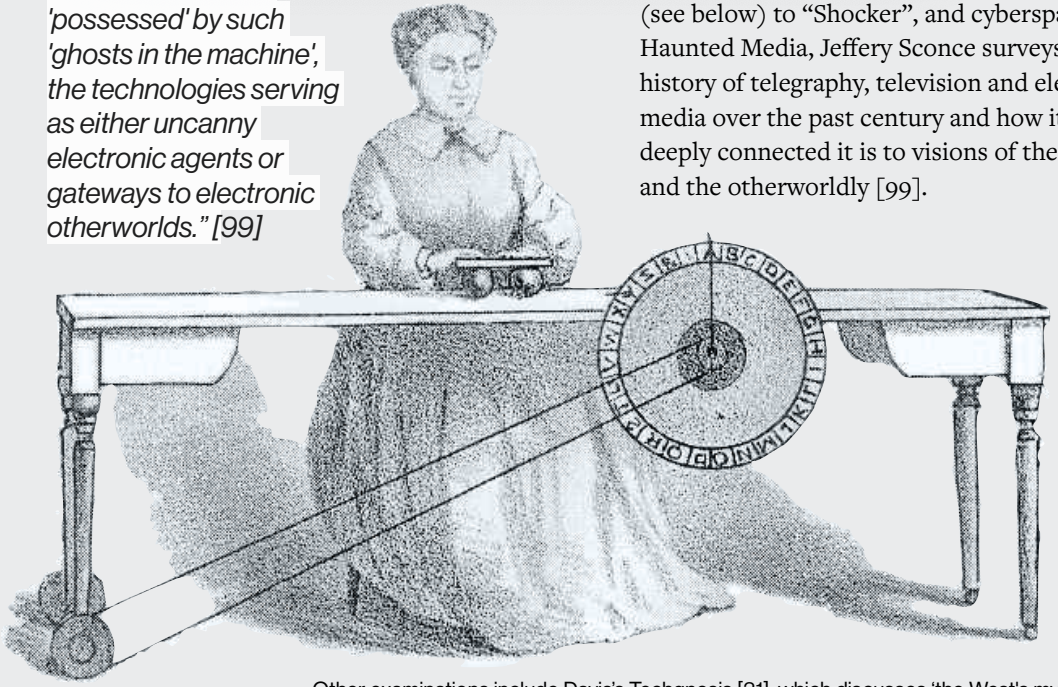


McKelvey examines how the otherworldly and its histories are entwined with networking technologies [82]. Underlying them, are `daemons` – a background process that is often shorthanded as 'd' and probably overlooked by most who encountering the Linux processes like 'sshd' which is notionally inspired by the thought exercise Maxwell's demon (in turn borrowing from Greek Mythology). These notionally and metaphorically couple the backbone of modern computing with old mythologies and supernatural entities.

Derrida's concepts of spectrality [35, 36] and hauntology have recently seen increased interest in music, writing, and art about 'nostalgia for lost futures' and the notion of ideas 'haunting' societies or places [29]. Among writers working at this intersection of history, place, and imagination, the late German author **W.G. Sebald**'s work perhaps offers some interesting perspectives for interaction design, particularly around how people 'access' and experience memories. Sebald's narratives offer "sustained meditations upon relationships between place, memory and subjectivity" in notable works such as *The Rings of Saturn*, centered on wandering or voyages of landscapes entangled with photographs and glimpses of other places and times. "Characterized by irruptions of the surreal and the phantasmagorical" [115] often to unsettle, trouble and complicate the landscapes being explored, we might wonder what a kind of 'Sebaldian Interaction Design' could be, or offer us. Perhaps this hauntological approach could even be part of an expanded palette of reflective methods [67] in design futuring.

"In media folklore past and present, telephones, radios and computers have been similarly 'possessed' by such 'ghosts in the machine', the technologies serving as either uncanny electronic agents or gateways to electronic otherworlds." [99]

From the Foxes' rapping, spiritual telegraphs (see below) to "Shocker", and cyberspace, in Haunted Media, Jeffery Sconce surveys the history of telegraphy, television and electronic media over the past century and how it is deeply connected it is to visions of the occult and the otherworldly [99].



HAUNTED MACHINES

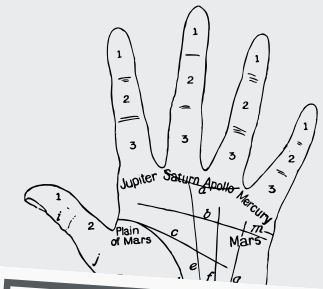
~~Any sufficiently advanced technology is indistinguishable from magic.~~

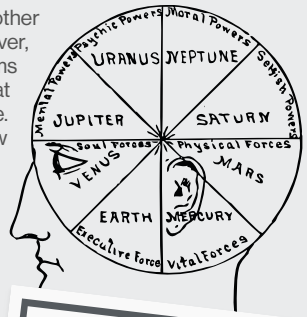
Led by Natalie Kane and Tobias Revell, Haunted Machines is an arts-based research project, curatorial effort, conversations and convening "exploring stories of myth, magic and monsters in technology." [96] It has repeatedly highlighted the problematic nature of the term 'magic' as a too-convenient explainer for how complex systems and processes operate. Revell and Kane note the term 'magic' is applied to new technologies, and in so doing shrouds the true intentionality and behavior behind these systems. This slowly erodes our agency over the technologies that influence and affect us.

Any sufficiently advanced HACKING is indistinguishable from a HAUNTING.

Other examinations include Davis's Techgnosis [31], which discusses 'the West's mystical heritage of occult dreaming, spiritual transformation and apocalyptic visions' of technology. Similarly, Thurschwell explores the occult, magical thinking and technology from a literary perspective [106], while Gell takes an anthropological lens [49, 50]. In critical software studies, Chun unpacks the coupling of coding, 'sourcery,' and 'primitive causal thinking' [28]; in media studies, Tanner explores vaporwave and its intersections between nostalgia, commerce, and the uncanny. [104]

This is a subset of the many contributions at DIS, CHI, TEI and other conferences that explore the haunted, supernatural or occult. However, most appear in extended abstracts, or in forums like alt.chi, so it is somewhat at the periphery of discourse. Attending to this, we try to draw together this disconnected, but extensive body of work, perspectives and imaginaries.





Dourish and Bell's choice of the term 'mythology' indicates how contemporary fables, lore and beliefs are entwined with research and understanding of socio-technical systems [38].

MYTHOPOEIA

"Enchantment" is an approach to preparing designing ambient and tangible computing. Intended to evoke our collective imaginary of fantasy, fables and fairy tales in interaction design [92], it is not without its critiques [100].

THE ENCHANTER

Othered practices of witchcraft, spirituality and indigenous belief-based practice was the subject of recent inquiry by Sultana and Ahmed; they argue for the occult as an under-explored but valuable lens on post-colonial computing [103].

THE WITCH

Haunted houses or haunted hoaxes. HCI has build haunted houses to test mid-air displays and projection rigs [65, 97], to explore social communication [24], as a design probe for displays [5] and to explore biodata in performance [105].

THE TRICKSTER

With much recent conversation about death, dying, and design [51, 80. 81, 109], projects like 'Fenestra' [107] suggest how we might give presence to the deceased with new technologies and rituals enabled by our digital legacies.

THE DEAD

Gatehouse [41] combines hauntology with participatory design to help LGBTQ+ youth re-enact and design alternatives to past encounters with hate. Hauntology supports the process by "preserving the otherness we encounter."

THE HAUNTED



Tropes of 'technology-as-monster' and 'overcoming' monsters [11] are oft used. As discursive frames, Dove & Fayard materialize imagined monsters to explore ML [39] while Karpashevich et al. probe a monstrous shape-changing garment [63].

THE MONSTER

Marenko & Van Allen's recently recast animism — the belief that inanimate objects can be imbued with a supernatural essence —as an approach to design interactivity between a human and a non-human, such as voice-assistants [78].

THE ANIMIST

Tarot is appropriated in critical/reflective designs as a metaphor to discuss patterns in algorithmic analysis [83] and in satellite positioning [111], reveal entanglements with IoT data [34], and consider relationships to food [32, 37].

THE READER

Unsettling, creepy sides of smart homes are probed by recent alternative designs [69]. 'Network Anxieties' proposes network scrying and ghost modes [90, 91]. eGregor's eldritch horror confronts privacy & consent in voice AI [48]

THE UNCANNY

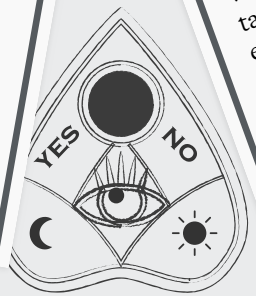
The *"wand"* is perhaps the most used metaphor in gestural, embodied interaction [7,22,110]. Other tropes of wizardry, illusion, and conjuring crop up in these contexts, including many recently inspired by Harry Potter [4,84,112].

THE SORCERER



Horoscopes, crystal balls, and fortune-telling are culturally familiar but ambiguous practices suited to "open-ended interpretation and orientation" around systems and processes [45, 46]. Grounded in prediction, they also offer vehicles for performance, dialog and speculation on possible futures [58].

THE CLAIRVOYANT



Ouija boards are often appropriated as analogs in HCI: in 'data whispering' [27]; as a tangible tool for design exploration and ideation that 'ambiguity of context' [14, 17]; or as metaphor to demonstrate haptic technologies [68].

THE SEER



Approach and Method: Our Disembodied Interactions

Spooky Technology is an ongoing research-through-design project that uses multiple methods in order to interrogate strange, unsettling and otherworldly encounters with technology.

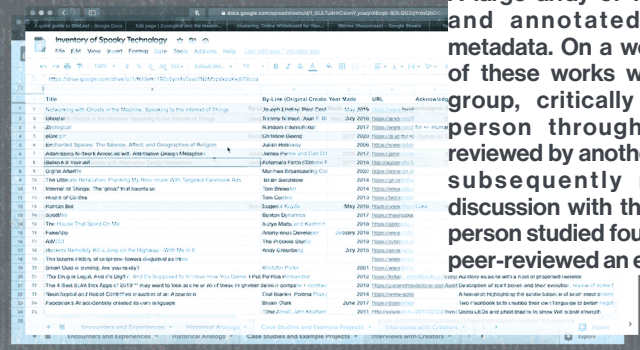
The first phase of this project has been organized around the development of a design-led interpretive framework. Our approach takes inspiration from efforts such as *New Art Science Affinities* [33]—a book sprint that reflects on the intersections between new media art and emerging lines of scientific and computational inquiry intended to inspire new collaborative explorations and interdisciplinary exchange—and *Curious Rituals* [87], a seven-week research project that documents gestures and rituals that emerge around digital technologies to inform design practice of future physical computing.



Our team never met in person. Work on Spooky Technology took place during pandemic stay-at-home orders and entirely through video conferencing and digital collaboration tools. This added a poetic quality to the process as well as a timely way to examine domestic technologies. Required to shelter in place, this was an opportune, albeit surreal, moment for us to question the status quo of our everyday technologies and to be receptive to 'otherworldly' influences [41].

We started each meeting with debriefs and reflections on 'what is spooky tech' using the Zoom chat.

Similarly, our work focused on curating diverse perspectives and experiences with 'spookiness' through a series of complementary activities: cataloging diverse examples, gathering first-person experiences, conducting interviews with creators, continual facilitated reflection, and iterative synthesis. Our work was supported by a large distributed team of twelve; working entirely remotely over a ten-week period in 2020.



A large array of works were gathered and annotated with structured metadata. On a weekly basis, a subset of these works were selected by the group, critically examined by one person through analytic writing, reviewed by another team member, and subsequently re-presented for discussion with the whole group. Each person studied four to five projects, and peer-reviewed an equal number.

This began with a review of scholarship and creative practice that engages themes of the supernatural or unexplainable. For the first five weeks, our group reviewed interdisciplinary creative work across art, design, and human-computer interaction research, both historically and more recently, along with forays into writings on the supernatural, myths, and superstitions. Our aim was to produce, collaboratively, a set of examples from both academic fora and popular media, from which we can extract possibilities, insights, and opportunities.

We also gathered first-person accounts of strange, unexplainable or haunting encounters with everyday technology. To do this, we shared a short survey via known networks and via Twitter, interviewed acquaintances, and mined social media, including Reddit posts, blog posts, tweets and Facebook stories. These stories of people's responses to, and beliefs about technology allowed us to complicate the narrative offered by creative works. Additionally, semi-structured interviews with project creators were conducted via Zoom to further unpack precedents and approaches.



Synthesis organized historical precedents, contemporary works, stories and encounters and interviews initially around nineteen possible dimensions.

This was later distilled to six common themes shared by over fifty examples.

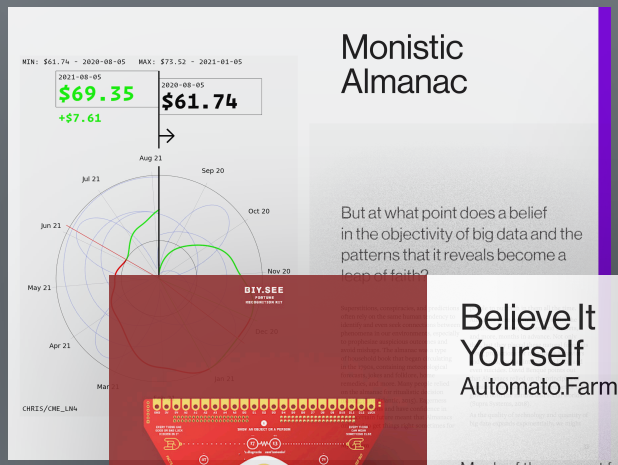
For the remaining five weeks, we iteratively organized these sources into light taxonomies based on affinities and dimension of Spooky Technology. In addition, relevant historical cases and practices—such as familiars, numerology, seances, hauntings—were related to these categories to further contextualize the otherworldly qualities.

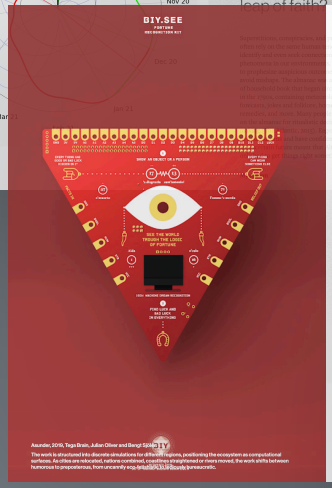
The output of this work is a printed book and an accompanying website that offers a compendium of 'otherworldly' qualities in contemporary technologies[1]. The inventory is partial and incomplete but it draws together history, theory, research, practice and experiences from across the domains of art, design, HCI, media and technology in new ways. It recognizes and responds to increased interest among designer, artists and scholars in the supernatural as an interpretive frame, metaphor for interactions, and context of inquiry. It provides organization and visibility to this emerging landscape of creative inquiry situated around the occult.

The volume is intended to offer a metaphorical mechanism to reflect on and negotiate our collective frictions with contemporary technology and the beliefs and practices that emerge as a result. These effects — from small-to-large, subtle-to-overt, existent-to-speculative — are charted through six sections of this book: Glitches, hacking and hoaxes; mysticism, rituals and practices; hauntings, presence, and ubiquitous computing; explainability, black boxes and creative AI; uncanny valley, robotics, avatars and deep fakes; digital legacy and post-humanism.

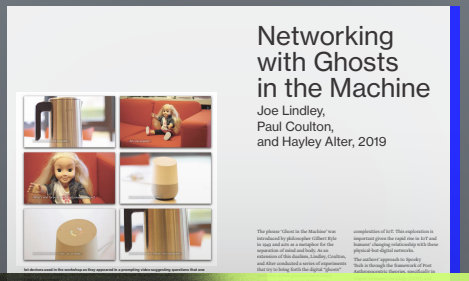
Reflecting on this output, we next share some opportunities, illustrated with excerpts and examples from the volume, that highlight possibilities to leverage this spooky framework in research-through-design.



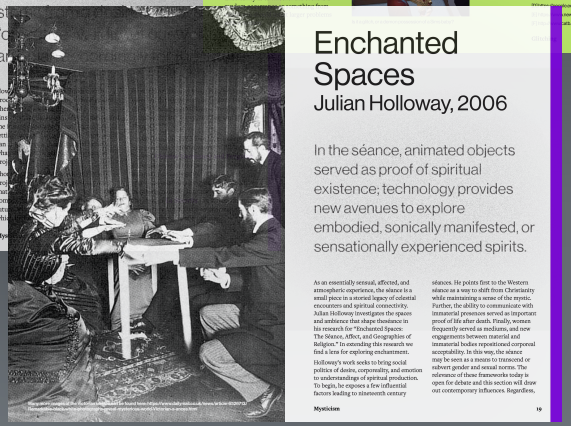












[1] The final book is available as a free and open resource. A copy PDF can be accessed ay the companion site at https://spookyte.ch
A printed copies can be ordered from Lulu a print-on-demand service. This is not-for-profit and sold at cost. With the exception of some third-party materials, the content licensed under CC BY-NC-SA 4.0).

Anonymous Contributor
21h ·

Is my phone spying on me? It probably is. I can remember dozens of times over the last few years where I have had a verbal conversation about something important to buy like insecticide or chocolate or even travel destinations and I don't recall ever searching for these items on Instagram or Facebook and always exactly two days later... I start seeing advertisements for those products that I was talking about.

16 10 Comments

Like Comment Share

[redacted]
When scrolling through social media I frequently see advertisements for stores I have browsed online but I have started to notice sponsored posts appear on my feed which link to something I have only thought of buying and haven't discussed with my friends at all. I feel like it's reading... **See More**
2
Like · Reply · 40m · Edited

Top Fan
[redacted]
Time for class action lawsuits.
1
Like · Reply · 15m

[redacted]
My Amazon Echo may be haunted, help please? Of course, it probably isn't, but something very weird happened to me a couple days ago. I was sitting at my desk, when suddenly my Echo Dot has the green light circle (like during a drop-in) and does a little four-note tune. Then, the Echo says "It's home, It's home" and then stops. This happened every hour or so for a day and it hasn't happened since. No one set an alarm or anything to go off and say that, so I'm a bit spooked!
7
Like · Reply · Share · 11h

[redacted]
So I'm having an eerie situation as well... We were watching football in the next room and there was no one commentating on the play at the time. Alexa says "That's funny...." and something else that I couldn't make out because i was like "WHAAA?!?!" Fast forward to 10 minutes ago. We just wrapped up dinner. I'm sitting with my son and my husband is cleaning up. In a different voice (lower than usual) Alexa says something about "How about dessert?" We asked it to repeat itself and it said in the normal voice it says "I can't do that."
9
Like · Reply · Share · 11h

[redacted]
Asked this guy's Alexa if she worked for the CIA. She shut off!
1
Like · Reply · 15m

[redacted]
They hear everything. Domestic violence, sexual assaults, burglaries, ... everything.
2
Like · Reply · 15m

BREAKDOWNS IN EXPLAINABILITY



Conspiracy theories have long been with us, but the rise of large audiences via social media [43] for phenomena such as QAnon, anti-5G activism, anti-mask and anti-vax beliefs during the COVID pandemic, and revelations of behavioral advertising driven by political actors such as Cambridge Analytica, is coincident with an increase in everyday experiences of hard-to-explain algorithmic or AI-driven decisions. From job allocation in the gig economy [21] to interactions with voice assistants in the home [14], even the grading of school exams [16], the technologies of everyday life become an "echo chamber of conspiracism" [85] amidst perceived breakdowns in explainability—and the intersections with the wider field of efforts in explainable AI (XAI) have largely not yet been explored in design and HCI research.

We believe there may be value here in a 'spooky' framing as a way into discussing some of these issues with people. How many of these phenomena are considered 'spooky' to different people probably differs depending on the existing knowledge, expectations, and contexts involved. But collecting instances of specific comments and queries from forums, Facebook, Reddit, and so on (**some of which we have re-compiled and synthesized here [left], in a Facebook style**) reveals a kind of intersection of paranoias, from eerie behaviors of Amazon Echos to beliefs about hyper-targeted advertising or government surveillance, to recognition that 'always listening' devices hear everything that happens in a household, the tragic and traumatic, and the mundane. In many cases, there is the presence of an 'other'—with agency—in people's explanations and speculation on unexplained behaviors. Even the framing of AI as an 'intelligence' rather than solely a 'computer' lends it a degree of presence which potentially aligns with animism, as discussed earlier.

In some ways, mid-20th century notions of 'gremlins' in systems, as subversive, tricksterish entities [54], or ideas of *resistentialism* [59], parallel late-century concepts such as the media equation [95] and as well as echoing older superstitions, potentially present possibilities for research around people's mental models, folk theories and imaginaries of the systems around them.



MENTAL MODELS AND SPOOKY METAPHORS

How do people imagine and make sense of complex, systemic issues, from technology (e.g. privacy [61, 88]; energy [15], how their smart home operates [25, 116], machine learning [39]) to the personal (e.g. mental health [75]), or professional (e.g. disciplines [71])? Traditionally there have been research methods in social sciences, ethnography, cognitive anthropology, HCI, cognitive ergonomics and human factors, educational research, and other fields, which use different kinds of exploration, from formal analysis of mental models to informal clustering techniques. But there is the potential for more creative explorations, involving sketching [53,102], 'materializing' abstract concepts [71], developing new metaphors [73], or story completion [20]. These 'creative research methods' [62], or inventive methods [77,79] are emerging as new ways for Research through Design to be a form of critical enquiry relevant to other disciplines [e.g. 70].

Yet, with many of today's technologies, almost all of us have what can be seen as a somewhat superficial understanding—Clark [25] notes that abstractions have a "significant priming effect on users' mental models and the kinds of interactions that users expect to have with the home." Recent work exploits this to decenter and reframe explanatory encounters with technology. Dove and Fayard [39] employ metaphorical monsters to generate "new perceptions, explanations, and inventions, and bring new features relevant to the problem at hand into focus." Additionally they suggest this is a particularly valuable frame to acknowledge transparency and explicability and include 'territories of concern'. 'Spookiness' could be a similarly effective thinking tool to reframe and decenter mental models around technology. For example:

THINKING WITH WITCHES' FAMILIARS

A historical folklore that has parallels with contemporary technology is the familiar, or a witch's companion animal, often a cat, or some kind of spirit or imp. According to some accounts [56], Elizabeth Clarke had a familiar polecat, Newes, which, along with its companions, was often delegated to gather information about other people's lives, and their secrets. Clarke talked to the familiars to issue them commands, ask them questions: did she essentially have a smart home? The ideas of familiars have interesting parallels with current technology, and provide a frame to think about voice assistants, AI, chatbots, and even 'pet' metaphors for domestic robots [74, 76]. *What does the familiar Alexa know about you? Would it tell the space wizard Bezos about you? What could you do to appease Alexa each day? What would happen if you didn't? What if you're the witch?*



Elizabeth Clarke & her familiars, from The Discovery of Witches [56], a 1647 book by 'Witchfinder General' Matthew Hopkins (who had her hanged).

We suggest this frame as a productive broadening of Dove and Fayard's work: it affords an agency to smart appliances, it suggests other presences and actors operating behind the scenes, and it allows mental models, beliefs and explanations to be playfully explored in a way which plays with both fears and recognition of power and agency.

SPOOKY USER RESEARCH

DEFAMILIARIZING OUR ENCOUNTERS

As Pierce and DiSalvo [90.91] argue with their work exploring network anxieties in creative ways, a process of defamiliarization [8] and recontextualization can enable inventive reframing of problems, and suggest new kinds of responses. We suggest here that elements and entities drawn from 'spookiness' could be an accessible way not only to generate new ideas, but also to interrogate and explore questions of mental models of technology and socio-technical systems in research with people, enabling defamiliarization in ways perhaps playful or at least valuing folk theory.



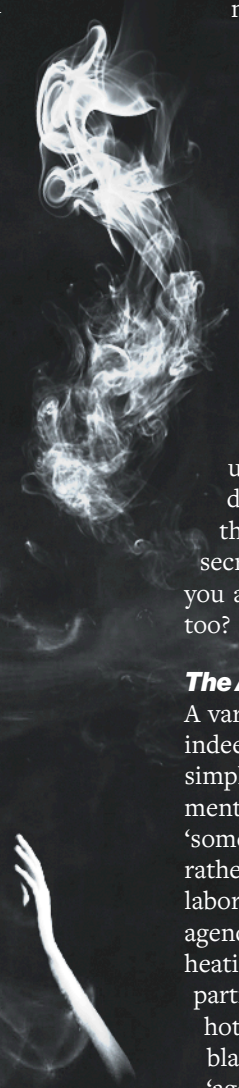
LETTING IT IN

A first, most basic move could be to encourage or admit the discussion of 'spookiness' in interviews or conversations as part of participatory research. This could be done in playful ways if appropriate, or building on cultural norms in particular communities. Speculation around the potential role of ghosts, spirits, or other kinds of unseen forces—or even admitting that there are occurrences which are hard to explain—can be an initial step towards different kinds of thinking, for the researchers as much as the participants.

What goes on with technology in your life that you can't explain? What do you find 'spooky'—even if you believe the cause to be techbros, Zuckerberg, or Bezos, rather than the spirit world?

REMOVING THE OPPOSITIONAL FRAME

These kinds of approaches could practically reveal needs and worries as part of research with people, but could also be used to investigate people's mental models, and understandings, of the systems around us. One advantage of employing devices such as spookiness, and invoking potentially fantastic entities such as ghosts or gremlins in doing research with people is that the playful, or at least semi-fictional dimension can help to remove the 'oppositional' frame sometimes present in this kind of research, where participants may feel they are being 'tested' on their knowledge or judged for deficient or incorrect technical understanding by researchers. When the spooky is invoked, the framing inescapably changes to one less scientific in its connotations, more open to speculation and emotion.



ROLE-PLAYING PRESENCES

Methods such as 'Six Thinking Hats' [13] or lenses [72,98] are well-known in design and creativity practice as ways of prompting participants to adopt unfamiliar perspectives or points of view when examining an issue. By being provoked to 'role-play' as someone (or something) with a different worldview, priorities, or frame of reference when approaching what might seem to be a familiar situation, a process of defamiliarization can be generative and revelatory. (In some ways, thought experiments such as Rawls' 'veil of ignorance' [93] also fit here). Perhaps along the lines of Reddy et al's work on 'making everyday things talk' [94], in which people adopt the voice of different objects in their domestic environment to shift perspectives on conversational technologies, or Alves-Oliveira et al's work on new metaphors for robots [3] we can imagine an activity where participants role-play different presences in the home (or in their lives in other ways).

The Poltergeist

What could it offer to ask someone to think about a 'smart' home from the perspective of a poltergeist seeking to disrupt their everyday life in subtle (or not-so-subtle ways)? This could be a way into exploring anxieties around connected technologies, but also reveal dimensions of social practices which might be missed by a more conventional approach.

The Helpful Ghost, or Imp

What would a 'helpful' ghost or perhaps some other folkloric entity, such as an imp, do in a situation, if it had supernatural powers of knowledge and technological connectedness (and maybe foresight)? We can imagine asking people this question as part of user research, probably revealing mundane concerns around domestic or workplace chores, but also something touching on the idea of the **familiar**—carrying out your bidding for you in a secretive but effective way. What would it see, or know, that you are unable to? Would you like to have access to that data too?



The Agentive Frame, or Invisible Hands

A variety of supernatural or otherwise 'spooky' entities—or indeed living humans—could be placed into the role here, but a simple variety of question to ask participants when investigating mental models or imaginaries of systems could be around where they believe 'someone' is doing something, making a decision, choosing one course of action rather than another, but hidden from view. This might be revealing hidden human labor in 'AI', or even online moderation, but might also be revealing imagined agendas. For example, one of the authors once studied people's mental models of heating and air conditioning systems in office buildings, and found that a subset of participants imagined a mysterious group of people 'in the basement' deciding how hot or cold the building should be that day, sometimes apparently on a whim, and blame-able for deficiencies in comfort. Where do people imagine there is hidden 'agency' in a system? How does that affect their trust in it?

Critical Reflection through Making

We have highlighted “spookiness” as metaphorical or interpretive lens for analysis of complex everyday systems and the myths and explanations that emerge around them. However, and as the case study above highlights, this lens also has affordances for research-through-design and inquiry-driven production of new critical and discursive designs, and functioning systems. We next suggest a series of opportunities to leverage this lens in enacting new technologies.

Generative Workshops: are well suited to creative engagements with experts and non-experts. For example, Dove and Fayard's format [39] could be adapted and extended to support other systems and processes, while "Ghosts in the Machine" [69] suggests an experimental animistic methodology: casting IoT products in a short film.

Revealing Unseen Forces: Drawing inspiration from Ghost Bug and Wave Detectors [91], Immaterials by BERG, and speculative sketching [34], these prototypes and enactments suggest provocative ways to detect electronic ‘spirits’, reveal and perform Hertizan forces, or help to make visible the hidden systems and data we are entangled with for dialog.

Unsettling IoTs: Projects like eGregor [48] indicate how counterfactuals, material speculations and alternative presents offer valuable strategies to re-interpret smart home devices to present issues of explainability [69, 90]

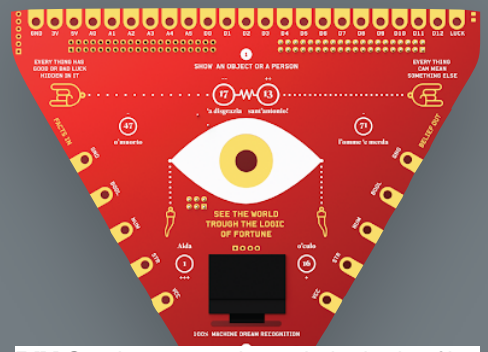
Machine Assisted Beliefs: BIY (see below) taken with a lineage of work in rituals [23, 46, 48] suggests the value of new material enactments that examine and support alternative, occult, otherworldly rituals and practices.

Haunting Research Products: A (super)natural extension of this is to position intentionally haunted or hauntologically-informed research products [108] in situated encounters in the conditions of everyday life. This could enable rich reflection on questions of entanglements, agency, presence, and explainability.

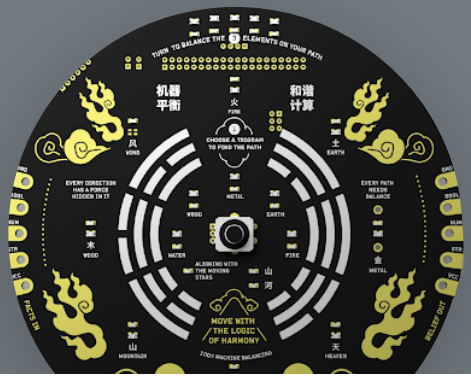
We are cautious about making this suggestion. as much prior work has shallowly mined the supernatural and superstitious as a convenient tropes or metaphors (e.g. wands and haunted houses.) Instead we call out the engaged exploration by automata.farm (see below) and others’ recent work [91, 103] as they reverently attend to the aesthetics, systems and cultures of these non-normative traditions and practices.

Believe it Yourself: A Case Study

BIY™, a recent project by Automato.farm [6], presents a set of three belief-based computing kits. Each is comprised of a Raspberry Pi, sensors, and outputs for machine learning processes. A critical but playful exploration is grounded in close work with experts in belief systems like divination and fortune telling from different cultures to translate their knowledge authentically into digital forms. By digitizing divination practices, BIY empowers non-objective interpretation of the world through AI-powered microcontrollers; it offers a nuanced interchange between belief, explainability and systems. Not only does this suggest a process for critical production, but it highlights the broader potential for divination, superstition, and ritualistic practices to be embedded into new digital devices and critical prototypes.



BIY. See interprets through the logic of La Smorfia (an Italian dream reading practice). It uses an AI-enabled camera module to recognize objects, generate numbers on them and signal unlucky configurations.



BIY.Move reinterprets location and context sensing, that through the logic of Chinese Geomancy and Fengshui. It guides you towards harmony and balance, spatially and personally, by planning your optimal path.



BIY.Hear is trained on Indian Numerology and Astrology, and leverages natural language processing to recognize voice input; it outputs predictions of destiny hidden as spoken words or printed text.

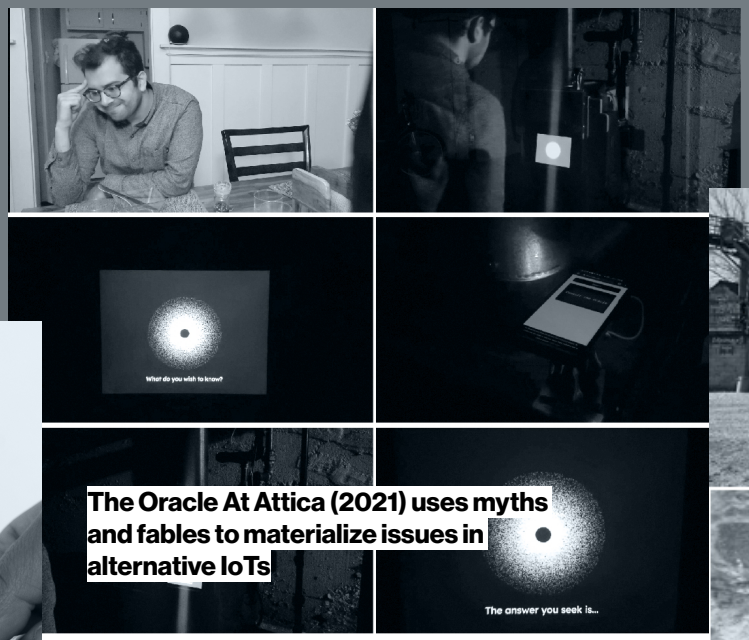
EXPERIMENTS WITH AND ENACTMENTS OF SPOOKY TECHNOLOGIES

We next conducted several early explorations to examine how spookiness could inform new discursive technologies. Below are three examples of alternative systems that reflect alternative values and otherworldly perspectives. They illustrate how a *spooky* frame can inform and enrich design-inquiry.



SneezeLove (2021) suggests superstitions as a resource for design

Remote and tangible digital communication devices are well explored. Within *SneezeLove* [64], we explored the role that shared superstitions might play in making the communications stories, more relevant to the specific people in dialog, and culturally specific. The device's concept plays on a superstition in Chinese culture that attributes an additional layer of meaning to sneezes that signify that someone is missing you. This design suggests the potential for superstitions, beliefs, or folk wisdom to help design culturally relevant communications and to reinvigorate a range of work in tangible, embodied and social computing.



The Oracle At Attica (2021) uses myths and fables to materialize issues in alternative IoTs

Using a mythic parallel to contemporary technologies, *The Oracle at Attica* explores how interactions with AI-systems for question answering have, to the end-user, almost no apparent cost. Yet, hidden behind them are enormous extractive processes, algorithmic economies, and the consumption of energy and natural resources. Approached as material speculation and discursive design, and rendered as a short illustrative video and a working prototype, the concept imagines an alternative voice assistant that draws from the ritual of pilgrimage and sacrifice to the Oracle at Delphi.

Here, to gain knowledge, a person's smart phone must be placed on the altar where CPU cycles and battery life are consumed to pay for each request for knowledge. The work aimed to make some of the costs more immediate, material, and visible to those seeking information. This is just one example of how myths, lore, and fables offer resources to surface concerns and raise dialog about voice assistants and other forms of machine intelligences.



Evoking the Post Industrial Landscape (2021) makes mixed-reality hauntologies for cultural heritage

Drawing on on Derrida's concept of spectrality to haunt a landscape with its own history, *Evoking the Industrial Landscape* [43] explores how spatialized soundscapes may evoke the spectral memories of physical landscape. Orchestrated as a site-specific mixed reality audio walk at Carrie Furnace, a national historic landmark in Pittsburgh, each visitor takes a unique path through the spectral memories -- curated as a range of ambient, environmental and archive sounds, as well as oral histories — of the site's industrial past and post-industrial relics. This work suggests the design opportunities of a hauntological approach to technology-mediated cultural heritage experiences.

DISCUSSION, CONCLUSIONS, AND FUTURE DIRECTIONS

In this pictorial, we drawn together disparate strands of activity—and highlight related work in other domains —that can connect an emerging area of inquiry that has largely been on the periphery of discourse. We believe and suggest that 'spookiness' and related ideas, as concepts, have value in design and HCI. In this brief tour of ideas and approaches, we recognize that we have only scratched the surface of the field; however, our intention is not a complete survey but to offer some possibilities and provocations—and to bring attention to the value of the work others have already been doing and that offers examples of this way of thinking. We highlight that spookiness is a compelling, evocative, and timely way to organize and synthesize diverse work around belief, explainability, and frictions in everyday technological contexts, and that it is a fertile field for other explorations and expansions, via Research through Design and other approaches.

We suggest two practical directions for employing spookiness as an applied concept within future work in design and HCI research. Firstly, spookiness can be mobilized as part of investigating people's experiences and encounters with, and understandings of, existing systems and critical and creative works. Secondly, it can also inspire and inform the production of new ideas and new types of discursive, reflective, or critical technologies from tricks, subversions, hoaxes, glitches to alternative smart home products and designed technologies.

The early experiments we introduce demonstrate these approaches and suggest the value of and affordances of our discursive approach. In investigating people's experiences of intelligent objects, revealing mental models with spooky metaphors allowed playful interpretation of behavior and action, as well as, new imaginaries of how smart devices operate to emerge. For us, these speculations not only informed, but inspired creative interpretations and responses. While this approach is formative, our future work will continue to investigate opportunities and refine methods for inquiry-driven, discursive design at the intersection of complex everyday systems and otherworldly and supernatural phenomena. In addition, some of the intersections we have explored in this pictorial, such as questions around privacy, imaginaries of systems, and user research, spookiness has a relationship with emerging directions in HCI such as entanglement [34, 42], the more-than-human turn [2, 101], and greater attention to (in)tangible qualities of embodied experience [55].

This work, it's important to acknowledge, takes a largely Western perspective on spookiness: it was developed in a large US-based university, interviewee are from US, UK, and Europe, and the examples, online accounts and first-person experiences gathered reflect these frames. Yet, the perception of what is spooky can vary widely across cultures and contexts. Equally, broadening this work from exploring individual accounts to sociocultural understanding would be useful in more fully examining *what are the conditions that make technology spooky?* In this, anthropologically-informed approaches offer many opportunities. Gell's examination of technology and enchantment [49, 50] and Sultana and Ahmed's study of witchcraft [103] suggest ways to consider the social relations, roles, and forces of unsettling technologies, and do so in a way that recognizes and is sensitive to the non-Western traditions, practices, and beliefs that contrast often rationalist Western frames.

Highlighted by our discussion of working remotely on this effort during the ongoing pandemic, there is an increased relevance of a *spooky* frame in present circumstances. Our lives are largely operating through remote technology, mediated communication and work and life is the new normal; and traumas small and large are being normalized as everyday experiences. We will be living with these experiences for some time to come. While spookiness might be viewed as a fanciful, idiosyncratic approach, it can also ground potent and impactful means to navigate the individual and collective legacy of this time. For example, Gatehouse's workshops highlight how we are haunted by our pasts and how a hauntological frame can aid both navigating these histories and in designing responses to them [44]. Similarly, the work of Odom and colleagues illustrates how re-presencing the dead can be poignant and affecting [e.g. 81, 107]. Additional creative responses to HCI's ongoing conversations in planning and managing death and dying may not not only be productive and valuable, but necessary. Finally, both Sconce [99] and Davis [31] highlight the long tail of anxieties over early electronic communication through supernaturally-framed historical analysis. In this moment of upheaval, HCI and design must similarly consider what the legacy of remote technology might be: using spookiness can we attend to the short and longer-term effects on people's everyday lives and interactions?

For us, these are pressing questions guiding our current ongoing design inquiry. With the frame of spookiness articulated, we in particular turn our attention to ways to leverage superstitions, unseen forces, and hidden entities as design resources for the production of alternative smart home products, alternative systems and alternative design approaches. We plan to do this within research investigations, workshops, courses and educational experiences, the production and exhibition of new technologies, as well as, things people can engage with in everyday situations. This pictorial is, in a sense, an invitation to others to think about positioning their work (past, present or future) in the 'spooky' frame: *what could it offer?*

Regular shifts in aesthetic, arrangement, and tone are deliberate and aim to further unsettle the reading of this paper. We thank our readers for indulging us .

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