

Performing Research: Four Contributions to HCI

Robyn Taylor¹, Jocelyn Spence², Brendan Walker², Bettina Nissen³, Peter Wright¹

¹Open Lab
Newcastle University,
Newcastle upon Tyne, UK
robyn.taylor@ncl.ac.uk,
p.c.wright@ncl.ac.uk

²Mixed Reality Laboratory
University of Nottingham,
Nottingham, UK
jocelyn.spence@nottingham.ac.uk,
info@aerial.fm

³Edinburgh College of Art
University of Edinburgh,
Edinburgh, UK
bettina.nissen@ed.ac.uk

ABSTRACT

This paper identifies a body of HCI research wherein the researchers take part in digitally mediated creative experiences alongside participants. We present our definition and rationale for ‘self-situated performance research’ based on theories in both the HCI and performance literatures. We then analyse four case studies of this type of work, ranging from overtly ‘performative’ staged events to locative audio and public making.

We argue that by interrogating experience from within the context of self-situated performance, the ‘performer/researcher’ extends traditional practices in HCI in the following four ways: developing an intimate relationship between researchers and participants, providing new means of making sense of interactions, shaping participants’ relationship to the research, and enabling researchers to refine their work as it is being conducted.

Author Keywords

Performance; performing research; self-situated research; public making; design from within; practice; sense-making.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

INTRODUCTION

The scope of HCI research has been on the increase for many years. The idea of the ‘third wave’ is a decade old now [11], the seminal examination of ‘felt experience’ is twelve [38], and even the 20th anniversary reworking of ‘plans and situated actions’ is almost ten years old [53]. Less famous but just as important are Höök et al.’s call to value the contributions of art practice as it integrates with HCI research [32] and Boehner et al.’s call for an aesthetic orientation to HCI research into ineffable experiences [12]. While these texts may be more or less fashionable at the



This work is licensed under a Creative Commons Attribution International 4.0 License.

moment, their central concern is still vital: how can HCI researchers do a better job of understanding how people relate to technology? The more sophisticated and pervasive our technology becomes—and the more people expect from their devices and infrastructure—the more we need to expand our repertoire of tools, methods, and theories.

The design process has become an accepted means of creating types of knowledge that cannot be accessed by studying user responses alone [13, 21]. Autobiographical design [40] and autoethnographic practices [17] have also been introduced as valid approaches, despite their apparent violation of the norms of scientific research. In a similar vein a number of researchers have used tools, methods, practices and theories of performance to inform their work in HCI for many years (e.g. [36, 50, 54]). To varying degrees, these performance-based research projects have invited audience participation [5, 51, 64, 66] and theorised about the resulting interactions and configurations between researchers and audiences [4, 6, 15, 43, 48, 50]. There has been some effort to draw out the commonalities of these disparate approaches [8, 52] but there is still little consensus about what performance-based approaches could offer to the HCI community.

This article considers a subset of performance-based research wherein the researcher takes an active role in a live performance to interrogate experience first-hand. We offer four specific contributions that this self-situated practice makes to HCI, arguing that it enables unique methods of 1) developing an intimate relationship between researchers and participants, 2) providing new means of making sense of interactions, 3) shaping the participant’s relationship to the research process, and 4) permitting researchers to refine and shape their work even as it is being conducted. These contributions extend the abilities of design researchers to gather and interpret data in relation to the situated and emerging needs of each individual participant.

We take as case studies four projects that we have been involved with in the past, each involving various types of live performance: humanaquarium (a participatory musical performance), the Thrill Laboratory (an interactive exploration of bodily responses to thrilling stimuli), the public making practice of designer Bettina Nissen, and The Rough Mile (a theatrically staged audio walk). The case studies are intentionally diverse, intending that our findings

could be applicable to a wide range of topics in HCI research. We examine the projects using performance theories to make sense of *how* research can literally be *performed*—conducted via self-situated performance—distilling what we have learned into four proposed contributions of self-situated performance research. We explain how these integrate into current discussions in design research, relating them to broader initiatives in HCI. We believe this work will deepen the conversation around felt, situated, aesthetic, and ineffable interactions.

SELF-SITUATED PERFORMANCE RESEARCH

We refer to the four projects under discussion in this paper as ‘self-situated performance research’. The term refers to projects in which the researcher not only designs the technological intervention according to his or her own personal and research interests but also participates in the interaction along with participants. It is important to note that it is not necessary to self-identify as a performing artist or to have aesthetic research aims in order to engage in what we are terming self-situated performance research. In fact, several of the projects examined in this paper are led by researchers who have no formal performance practice or do not create what is conventionally recognised as performance; however, they still exhibit performative qualities in their interactions with the public.

The key condition of self-situated performance research is the dual role of a performer/researcher: a practitioner who conducts experience design research by staging and taking part from a vantage point that is embedded within the live interaction with the public. The relationship between ‘performer’ and ‘researcher’ roles in a single individual can be understood in terms of a concept often used in performance theory, that of ‘oscillation’. It can refer to the quick shifts in a spectator’s perception of an actor, for example: we might see a person on stage as the character she is playing *and* as the famous professional she is in real life [19]. Our perceptions shift from one to the other, sometimes so quickly that they seem to be concurrent. In the same way, a researcher does not stop being a researcher while she is performing, or vice versa. Instead, her focus and priorities oscillate between the two roles in a way that we find productive for HCI. The dual nature of the performer/researcher role is also explored through Spence’s Performative Experience Design (PED) [52] and Taylor et al.’s Design from Within (DfW) [55, 57], with PED primarily addressing the designed emergence of spectator engagement, and DfW focusing upon the autoethnographic task of making sense of and engaging in shared experience. The performer/researcher must intertwine both concerns.

Autobiographical Performance

Self-situated performance research shares characteristics of both autoethnography [17] and autobiographical performance [29]. Self-situated performer/researchers have a different relationship to their participants than is usually found in participant observation or ethnographic

approaches. As the performer/researcher plays an active role in the on-going performance, an autoethnographic [17] approach in which they examine and reflect upon their own personal participation in the encounter affords them first-hand, reflective [47] insight into the research. In addition, performer/researchers shape participants’ interactions with the technologies being studied in a way that has many parallels with autobiographical performance—performances created, staged, and driven by the professional interests of an individual in collaboration with other professionals to achieve an interaction with a live audience [29]. Spence identifies the properties of autobiographical performance as: self-making, situatedness, heightened attention, and the aesthetics of the event [52]. Self-making refers to the ways that the performer generates self on stage, both as a persona to be perceived by the audience and as part of his or her actual life experience. Situatedness refers to the ways in which autobiographical performers acknowledge their audience in the shared time and space of performance. Heightened attention is the audience’s increased sensitivity to actions taken in performance. Finally, the aesthetics of performance are most helpfully understood in terms of ‘liminality’ [19], or the potential of performance to temporarily shift an audience member’s perceptions, emotions, or attitudes.

We find autobiographical performance to be a useful lens through which we can understand the unique methodological and epistemological contributions of self-situated performance research. By definition, an autobiographical performance must be created by the person who performs it, as no one else has access to those life experiences or the motivations to explore them. The creative process may be collaborative, but it relies at least in some significant part on the drives and attitudes of the performer. In this regard, autobiographical performance is very similar to the work of a performer/researcher in self-situated performance research. The interests of the researcher drive the content of the work, and he or she then enters into an encounter with the participants making use of the technology that he or she is researching, to achieve a live moment of exchange with a co-located audience.

Schechner’s Definition of Performance

We also find it helpful to apply Richard Schechner’s definition of the verb ‘to perform’ to self-situated performance research. He explains performance in terms of a four-part spectrum. The first part is ‘being’, which refers to existence. The second is ‘doing’, which is any activity. The third, ‘showing doing’, refers to performance: the activity of ‘pointing to, underlining, and displaying doing’ [45, p. 28]. In other words, while a person in everyday life might eat an apple with no effect beyond becoming less hungry, a person eating an apple on stage invites the audience to pay attention to the eating of that apple and speculate on its significance in the context of the overall performance. Attention and sense-making are both ‘heightened’ [52] when ‘doing’ is transformed into



Fig.1 (a) Guy Schofield and Robyn Taylor in humanaquarium (b) Brendan Walker as the Thrill Engineer (c) Bettina Nissen making data-things with participants (d) One of Jocelyn Spence's participants in The Rough Mile

'showing doing'. The fourth part, 'explaining showing doing', is defined as 'a reflexive effort to comprehend the world of performance and the world as performance' [45, p. 28]: the work of performance studies as a discipline.

When the performer/researcher conducts research in public, she is both 'doing' her research (gathering data in various ways) and 'showing doing' the act of that research (drawing attention to her research activities in a context that invites a tightly contextualised sense-making process). In the following case studies we will unpick this 'oscillation' between the concurrent activities of 'doing' research and 'showing' the 'doing' of that research to reveal specific mechanisms that can be useful to HCI research.

PERFORMING RESEARCH IN HCI: CASE STUDIES

To examine how self-situated performance practice can be used to conduct experience design research, we turn to four case studies drawn from our own portfolios which are familiar and relevant to the CHI community (see Figure 1). Reflecting upon work this paper's authors have been involved with firsthand, we attempt to illuminate nuances of how and why research is 'performed' in each of our diverse practices.

'Designing from within' through Musical Performance

We take as our first case study Taylor et al.'s humanaquarium. Humanaquarium is an interactive musical performance that emerged as part of a program of design research exploring how audiences could be motivated to collaboratively music-make using ambiguous technologies in public spaces (described in [55] [57], [58] and [59], see also [37]). To create and perform humanaquarium, Robyn Taylor worked closely with fellow performer/researchers Guy Schofield, and John Shearer, along with other colleagues at Newcastle University. Taylor, Schofield and Shearer had extensive musical skill and experience, Taylor a classically-trained singer with a keen interest in collaborative music-making; Schofield an electronic musician, visual artist and composer; and Shearer a pianist with strong improvisational and compositional abilities. Humanaquarium's music, costume, and means of interaction reflected the personalities of the performers in an act of autobiographical self-making [50] as they drew on

their lived experience as musicians and their own aesthetic sensibilities (elements of steampunk, gothic imagery, and nature-based abstractions). The means of interaction also signposted that they wished their actions to be interpreted as works of aesthetic performance—humanaquarium would be viewed differently had the performers been dressed in street clothes and the cube enclosure not been artfully crafted. The researchers made frequent technical and content revisions and refinements in response to live performance encounters, resulting in an ever-evolving interactive experience of practice-based research. The year-long humanaquarium project had over 50 performances, and included a tour of Europe and North America.

During live presentations of the work, Taylor and Schofield would perform improvisational music from inside the 'humanaquarium' cube—a 1.5 metre acrylic-fronted box, outfitted with FTIR touch-screen technology. Structuring participation in a configuration akin to Sheridan et al.'s tripartite interaction [50], Taylor and Schofield served as 'performers', making eye contact with and beckoning to 'observers', encouraging them to become 'participants' in the performance by placing their hands upon the touch-responsive glass surface of the cube. The participants' touches modified the sonic properties of the live music-making, co-creating an improvisational performance, the aesthetics of which were dependent upon the musical dialogue that developed. These interactions exemplify the 'situatedness' of live performance, where the researchers foregrounded the present moment of interaction with each unique audience, including the chance that audiences might fail to participate as the researchers hoped.

The *performance frame* [4, 25] of the work encompassed the interactions that took place while Taylor and Schofield sang and played inside the box, engaging with audiences through the interactive surface of the box's transparent front face. This performance frame set the interaction between performers and spectators apart from ordinary social interactions and placed willing participants into the position of actively contributing to the emerging performance and research activity that took place. As well as research opportunities, this project was a prime illustration of the 'aesthetics of the event' in performance theory. It created a

space of opportunity for audiences to experience at least a temporary experience of ‘liminality’—a state of being suspended between two ways of moving forward, one belonging to everyday life and one belonging to the world as imagined through performance. Liminality can be provoked through either ‘strong emotion’ or a sense of instability in terms of the roles, norms, and expectations placed upon them [19, p. 177]. *Humanaquarium* generated this instability by siting its performer/researchers in a socially peculiar configuration and challenging audience members to make eye contact and press hands with them through the glass. Improvising with participants, Taylor and Schofield’s performance was carefully crafted to ‘heighten’ the attention of passersby.

A particular nuance of the *humanaquarium* team’s research practice was that instead of investigating audience experience using techniques such as ethnographic studies, audience surveys, or participant interviews, the researchers were interested in a self-reflective, autoethnographic method of examining their own participation in shared encounters *from within* [57] the performance frame itself. Instead of requiring audience members to explicitly recount the experience in any sort of verbal or written debrief, the team interpreted the story of the shared encounter based upon the recollections of the performance team, who took detailed field notes upon the completion of each performance experience and later took part in a structured video analysis, viewing video footage to explore the performance from a variety of situated vantage points.

Investigating *humanaquarium* through the very act of performing *humanaquarium* meant that the performer/researchers had the ability to make sense of it through their own first-hand experience. In Schechner’s terms, the act of ‘showing doing’ or engaging in public performance gave them a unique and valuable vantage point for ‘doing’ their research into public interactions with technologies. The performances instantiated each experience that the team wanted to understand, allowing them to analyse the various interactions from a perspective integral to the interaction. The performer/researchers were in essence the subjects of their own research, spending the year-long study refining and evolving the *humanaquarium* artefact and their own performance practice so as to maximize the opportunity for meaningful encounters with the public who came forward to engage with the piece.

Creating a Character to Orchestrate Interaction

Since 2003, Brendan Walker has been performing as the “Thrill Engineer” in a series of mixed-media “Thrill Laboratory” events, inviting participants to join him in exploring the nature of thrill and extreme emotional intensity. Walker’s collaborations with UK theme parks and science museums attract attention both in the mainstream media and the academic worlds of design, HCI and art.

His Thrill Engineer is a colourful character, dressed in a red boiler suit, with stylish signature sideburns, and black-

framed ‘statement’ safety glasses, taking central stage during Fairground: Thrill Laboratory performance events (described in [6], [7], [48], [62] and [63]). During these events, his team of Thrill Technicians recruit members of the public to take part in a theatrical event centring around a medical data collection activity that captures, analyses and visualises riders’ physiological responses as they ride some of the UK’s most thrilling amusement park rides. For audience members not on-board the rides, the performance consists of live camera feeds that stream close-up imagery of the riders’ faces, as well as real-time representations of the riders’ medical data. The audience are afforded physical proximity to the operations of the imposing thrill rides, and in addition, the Thrill Engineer narrates and explains what the visibly broadcast biometric data reveals in terms of the riders’ emotional responses. The performances allow audiences an intimate understanding of the riders’ experiences, allowing them to vicariously imagine what it would be like to share the riders’ fear and excitement [62], and allow riders to compete with one another to see whose data reflects the biggest thrill-seeking tendencies.

Walker’s goal is not simply to collect biometric data reflecting the experience of riding white-knuckle thrill rides. If that were the extent of the project, it would be easy to have staff members disseminate waivers and questionnaires, connect biometric sensors and send riders on their way. Instead, a message Walker posted to coaster enthusiast forum TowersTimes reveals a broader, more creative goal for the Oblivion: Thrill Laboratory project he ran at Alton Towers in 2007. “We’re planning to turn you—Oblivion’s riders—into live performers,” Walker posted. “It’s amazing how different an experience can be when you know you’re performing to a crowd (who can see your most intimate heart-beats, facial expressions, and groans of horror...)” [60]. Participants in Oblivion: Thrill Laboratory (2007) queued for exclusive tickets to Walker’s event, willing to be strapped to intrusive, slightly embarrassing cameras and bio-sensors, in the hopes of discovering and showing off their own personal ‘Thrill Factor’: a measure of their thrill-seeking tendencies.

Interviewed in [6], Walker describes the Thrill Engineer character as the “showman” who compères the proceedings from the front of the house, interacts with the participants, and serves as an identifiable central figure responsible for the Thrill Laboratory event. His role “seems to help an audience make sense of the event as a whole, seeing that at the centre of all this content is one man, the Thrill Engineer, with his vision to pursue the perfect formula for thrill” [6, p. 180]. Using Schnädelbach et al.’s conception of three classes of roles in interactive performance [48], Walker’s Thrill Engineer can be seen as a front-of-house ‘orchestrator’ of the experience. While he is ‘performing’ his role, he is doing so in an orchestrational [6,34,48,59] capacity: guiding, sustaining, and shaping the public’s experience. Unlike *humanaquarium*’s Taylor and Schofield who, physically isolated within the glass-fronted box, could

communicate only via gesture and the formal musical tools of their craft, Walker's Thrill Engineer performs his role in a very different fashion, moving freely through the action of his event, 'heightening the attention' of fellow actors, the public, and other members of his Thrill Technician team.

In terms of 'self-making' in autobiographical performance, the Thrill Engineer persona raises the interesting question of the relationship between the person writing the performance based on his or her own life experiences, the person performing that version of his or her life experiences on a given day, and the person that the audience perceives. On a literal level, these are all the same person in autobiographical performance. However, it is easy to see that the person performing on a given day might have a very different attitude, mood, or perspective from the person who wrote the content of the performance some time ago. Also, the handful of life experiences that get performed will hardly represent the fullness of an individual's personality. 'Autobiographical performances strategically work with life experiences' [29, p. 9] and involve elements of fiction, including a 'persona' of some sort. In Walker's case, his professional interests motivated and shaped the development of the Thrill Engineer performances. His unique personality and mannerisms mark the Thrill Engineer persona indelibly. And when it comes to his in-the-moment orchestration of a given research event, no other person can represent in words the quality and detail of perception and tacit insight that Walker himself could gather while physically engaging with his audiences in the persona of the Thrill Engineer. In other words, while someone else could perform as 'a' Thrill Engineer, no one else would be 'The' Thrill Engineer as lived by Walker. His active engagement also illustrates the 'situatedness' of his performance, emphasising his personal contributions to the project through in-the-moment engagement with audiences.

The Thrill Engineer's performed reactions to the riders' video and data streams are what help to draw out the rich qualitative nuances in the data. Walker's goal in performance is to "relay ideas of emotional intensity, but without being too objective about the data" [62]. He uses a deliberately analogue format of data transmission to stream riders' medical data and live video image, which often patches in and out as the rides reach their maximum velocity. Walker describes this as an aesthetic benefit: "Was the subject still alive? Were they dead?—the data wasn't of a high fidelity, but in performance terms, that was a real treat to be able to work with an audience" [62]. This combination of strong emotion and social instability provides Walker's way into the 'aesthetics of the event' and gives him the freedom to use his performance to orchestrate and shape the audience's interpretations of the data as the experiences unfold [62].

In Schechner's terms, the Thrill Engineer engages in 'showing doing' [45] on multiple levels, all of which are necessary for the complete experience being studied. In

addition to explaining elements of the research project that might be unclear to a lay audience, such as readouts of biometric data, his 'showing doing' creates a set of expectations that prompt his participants to become performers themselves. In turn, they are not just 'doing' their own private thrill, but 'showing' it to onlookers—and it is precisely this complex set of emotional and physical interactions that Walker and his team study in the 'doing' of their research. What is more, the Thrill Engineer's performance offers participants an opportunity for liminal understanding, giving them a lens through which they can re-assess their own relationship to pleasure and thrill.

Performing as Maker to Stimulate Meaning Making

Making has oftentimes been seen as a form of educational outreach. Initiatives such as community-sponsored Maker Spaces, in which practitioners are invited to conduct technical work in sociable, visible, public settings, are growing in popularity in urban centres. Where making can be considered to take on more of a performative role, however, is through the practice of public making—described by Shaw and Bowers as "a strategy of conducting a creative process while working in and with the public to build artistic work." [49, p1.]

To illustrate how public making shares the characteristics of performance, our third case study examines the practice of Bettina Nissen. Nissen actively involves audiences in processes of physical data translation in public facing situations beyond simply conducting her work inside a specialised Maker Space. Combining design and computing science, Nissen's practice engages the public in participatory fabrication activities that algorithmically translate participants' data into *data-things* [41]: small, digitally generated items imbued with personal meaning.

Following from Ingold's discernment between mere ready-made 'objects' and meaningfully crafted 'things' [41], Bettina Nissen et al. [41, 42] suggest that making visible the lived practices of 'makers' allows the public a greater appreciation and understanding of, and an invested value in, the 'things' that are made (this concept is similarly explored through the works of Shaw and Bowers [14,49]).

Using technologies such as 3D printing or laser cutting, Nissen creates *data-things* relatively quickly and inexpensively, so that participants in her projects are able to leave their shared encounter with a physical representation or 'souvenir' [42] of their experience. She has worked in many different public contexts, making *data-things* to represent a variety of personal data such as participants' responses to an art exhibit [42], live-tweets during a design conference [41], or the physical rhythms of crocheting [41]. She involves participants in the digital making process to varying degrees, ranging from encouraging them to explore the processes of fabrication to engaging them in the actual making and assembly of the *data-things* themselves. Nissen elicits personal details and experiences to help participants make their own connections between the data and the lived

experiences represented in each unique data-thing. In Ingoldian terms, to make a thing is "to be invited in to the gathering" [33, p.85] which is what Nissen achieves in her work by performing making as a way to extend an invitation to her public/participants.

Intentionally working not only in view of but also in dialogue with her public (using portable technologies for on-site fabrication), a key part of Nissen's practice is that she performs the act of making alongside the participants, explaining, encouraging, demonstrating, and 'heightening their attention' to the algorithms and technologies she has created that translate data into artefacts. It is important to distinguish that she is not merely engaging in the task of explaining how she works with fabrication technologies; rather, by structuring these events on her personal approach to these technologies, Nissen engages both in 'self-making' before her audiences and in Schechner's 'showing doing' the process of data translation, helping participants understand how their lived experiences are manifest in the data-things' physical forms.

Nissen identifies the need for her performance-as-maker to structure the engagement for members of the public, to encourage and facilitate participation, and to inspire conversation and experience-sharing. While Taylor and Schofield perform through the medium of music, and Walker's Thrill Engineer is highly stylised, Nissen's is a performance of one version of her everyday self [29, p. 161] and a 'showing doing' of her practice. At the same time, like the Thrill Engineer, Nissen's 'showing doing' functions as a 'doing' that forms a connection based on the 'situatedness' between herself and the public. She is not adopting an overtly different persona or engaging in a structured musical performance, but her responsibilities as a performer for orchestrating the participant experience [6, 48], while maintaining a coherent aesthetic sensibility for the shared interaction, are comparable. In fact, Nissen et al. explicitly take the viewpoint that in her public fabrication activities, Nissen, the facilitator and practitioner, is acting as a performer [41]. She describes considering the 3D printing experience itself in terms of a performance, the timing and duration of which she must carefully plan to manage the heightening of her participants' attention.

While Nissen's participants may or may not experience strong emotions during these sessions, being face-to-face with a technologist who encourages them to create alongside her contributes to this unique 'aesthetics of the event' in which visitors experience "a strong sense of affective connection" through the process of digital making [42, p.833]. Through making her designerly choices and creative judgements visible to the public, Nissen's performative role as maker helps imbue personal meaning into the finished digital artefact she creates with each participant [41]. While fabrication tools are dazzling in their technical capacity, the 3D printer does not 'make' the data-things; Nissen and her participants together do.

Performing the Descent into Fiction

The Rough Mile was a two-part digital music gifting experience created by Jocelyn Spence, Adrian Hazzard, Sean McGrath, Chris Greenhalgh, and Steve Benford at the Mixed Reality Lab at the University of Nottingham. The first part was an audio walk that pairs of friends listened to while walking a set route through central Nottingham. The audio walk was a complex layering of recorded narrative, music, and ambient sound elements combined in a native Android application known as the daoPlayer, resulting in a continuous and responsive locative audio experience. Sound was delivered via bone-conducting headphones that left participants fully able to hear their surroundings, and the design capitalised on this affordance by incorporating engagements with the outside world, including two live performers that participants encountered en route. Aside from being an aesthetic event in its own right, in the tradition of audio walks by Janet Cardiff [28] and others, the first part of the experience solicited suggestions of music that participants would like their friend to listen to (cf. [20]). In Part 2 of the experience, the pairs of friends returned to re-walk the same route, this time listening to the songs their friend had chosen for them.

This project aimed to create a rich context that participants would become deeply and emotionally engaged in, thereby facilitating the selection of songs to give to each other. This experience would be compromised if presented purely as a research project with interviewers brusquely collecting data about something as personal and emotion-laden as music one might give to a friend who was feeling depressed. Therefore, the team chose to interact with their participants via a crafted performance design that respected both the research and the aesthetic contexts of their project.

The performer/researcher in this project was Spence, who wrote and voiced the narrative in the audio walk. She wanted to capitalise on the potential sense of intimacy that could come from participants hearing her voice seemingly from inside their own heads. Therefore, she ensured that she herself met each participant early in the process so that when the audio began, they would connect the 'researcher' they had just met with the 'voice performer' who was narrating their audio walk. She shaped this connection by personally guiding them downstairs, one at a time, in a 'descent into fiction' where she explained 'what we're really trying to do here'. Her explanation, given from the point of view of the narrator they were about to 'meet', implied a sense of reality to the content of that narration, emphasised by the intimacy of the sound provided by the bone-conducting headphones. During the audio walk, the two live performers presented themselves 'in character' as the ex-girlfriend and old friend of the narrative's protagonist, and they were careful not to be seen in the room where research activities such as consent and interviewing were conducted. At all times during the audio walk, participants were treated as a stranger kindly trying to help their efforts to make their friend happy.

Spence's artistic and research interests drove the entire project *and* shaped participants' perceptions of the event through personal interactions. This is another example of the 'self-making' of autobiographical performance. Participants were always clear that they were taking part in a research project, but the deliberate blurring of fact and fiction—Spence as researcher and Spence as performed persona—influenced their perception of their experience. In later interviews, some spoke about the story as if it were Spence's own and the situations described in the narration were real. The 'descent into fiction' also contributed to an 'absorbing', 'dreamy' experience that led most participants to surprise themselves and each other with a deeply 'personal' exchange of ephemeral gift experiences (all descriptive quotes taken from participant interviews).

Like Walker's Thrill Engineer, Spence drew on the 'situatedness' of guiding her participants to maximise mental and emotional involvement, both in person and through her recorded voice that seemed to exist inside their own heads. In other words, she took specific steps to transform the simple 'doing' of walking to a piece of audio into a 'showing doing' in which the audio pointed to, underlined, and displayed [45, p. 28] the participants' own actions, thoughts, and feelings in relation to the audio walk. This caused participants to pay unusually close attention to the details of their surroundings and of their own memories and emotions. Spence did not create a named and costumed persona to do this; instead, like Nissen, she presented only everyday elements of her own personality and situation, then extended these in the fictional world of the narrative as it combined with Hazzard's adaptive music and ambient sound. Like Taylor and Schofield, Spence was vividly present throughout the experience itself—not physically, but audibly and tactually. In part because of the complex mix of real-world action and fictional audio facilitated by Spence's role as performer/researcher, many participants experienced notable moments of 'liminality': they reported 'thinking differently', planning new strategies for regulating their emotions, vowing to listen better to their partners, and even reconsidering their partner's role in their lives (all statements from participant interviews).

WHAT DOES 'PERFORMING RESEARCH' LET US DO?

Each public intervention described in our case studies is simultaneously a 'showing doing' of performance as well as the 'doing' of live HCI research in the wild [44]. Obviously conducting research in such a fashion presents a number of challenges—not only the complexities facing any research project situated in a public environment rather than a laboratory setting [44], but also intricacies stemming from the need to present the public intervention as an aesthetically cohesive performance [5,8,55] in order to best engage participants in the creative experience. Through numerous discussions and communications about our experiences as performer/researchers intimately involved in the case studies explored in this article, we have identified the following four opportunities for exploration that are

made particularly accessible when HCI research is conducted through self-situated performance.

Develop intimacy through situatedness and trust

Engaging in performance provides an opportunity for an intimacy between performer/researcher and participant that may not be easily obtained in other contexts. The very liveness of the performance scenario brings an "intimacy and immediacy" [1, p. 36] to an encounter where performer/researcher and participant meet one another in a unique and unusual shared experience. The performer/researcher can intensify the mutually heightened attention and awareness of the live performance encounter by manipulating how he or she shares energy and space with the participant. It is no coincidence that Nissen physically bridges the human and machine by personally retrieving the crafted data-thing from the 3D printer and directly handing it to her participant—the physical gesture of giving and receiving helps her build intimacy in her dialogue with participants. Similarly, Taylor and Schofield valued the opportunity to make and hold direct eye contact as participants approached the transparent frontage of the humanaquarium, as well as a near-physical connection, pressing hands with visitors through the glass. Touching, making eye contact, and entering into close proximity with someone who is most likely a stranger is a vulnerable situation for both participant and performer/researcher, which accelerates the intimacy of the research encounter. In order to mediate the potentially intimidating effects of this, Taylor and Schofield deliberately assumed a submissive posture in the encounter, inviting standing participants to approach them as they sat on the floor, in the hopes that their willingness to assume a submissive vantage point would encourage participants to enter into unusually intimate proximity in public space. The willingness to engage in touch and other intimacies within the context of digitally mediated performative encounters is a subject of interest in HCI research (e.g. [30, 39, 46]), and as noted by Benford et al.'s exploration of uncomfortable interactions [9], performance is particularly able to push boundaries and facilitate unusual or embodied [16] social exchange.

Even in cases wherein the performer/researcher is not co-located alongside participants throughout the entire performance, such as The Rough Mile or the Thrill Laboratory, performance still hinges upon all parties' willingness to engage in intimacy and trust for the duration of the interaction. In our examples, these intimacies take the form of body-based connections—Spence's voice is transmitted into the very bones of her participants, who know that she is waiting for them nearby, while Walker's participants consent to make transparent to him a moment-by-moment real-time transmission of their bodily signals and processes. These connections have an undeniable intimacy that can be interpreted as a non-physical, affective form of situatedness: the technological mediations emphasise the physical and emotional connection between that particular participant and an identifiable, individual

performer/researcher. Thus the technology that allows the performer/researcher to operate from a distance acknowledges the mutual situatedness of performer/researchers and their participants—which is actually situated *within* the participants' own bodies. The context of live performance transforms a participant's data stream or song suggestions into an intimate encounter.

The intimacy gained from engaging in performance with participants provides a basis from which performer/researchers can build a strong rapport with participants in order to explore a variety of personal subjects. Examples of such subjects addressed by our case study performances include creative risk-taking in social scenarios (humanaquarium), personal reflection about and actual changes to intimate relationships (The Rough Mile), examination of one's thrill-seeking tendencies (Thrill Laboratory), or crafting a physical representation of life stories and personal data (Nissen's public making practice). We suggest that the intimacy of the shared performance encounter provides a platform for liminal experiences and empathetic connections [65], providing the researcher with opportunity to glimpse a participant's felt life [38].

Make sense of an encounter from within arts practice

Engaging in research via the medium of performance enables the performer/researcher to augment any traditional form of user study (i.e.: external observation, interviews or questionnaires) with reflective, autoethnographic understandings obtained first-hand during the performance scenario. Perhaps most interestingly, however, is the fact that not only can performer/researchers directly reflect upon their own participation in the research, but there is a differentiating factor at play: performer/researchers can access additional knowledge afforded by their creative practice to make sense of the performance event. This is consistent with Kuutti et al., who suggest that “there are design cases where performance can produce different knowledge” [35, p. 95] due to the ability to access a creative and involved way of knowing.

To use the humanaquarium case study as an example, performers Taylor and Schofield not only experienced a humanaquarium performance from their perspective as HCI researchers, but in addition, they each had at their disposal over twenty years of experience as musical performers. Engaging with the public through the medium of their established arts practice allowed them to improvise alongside participants, anticipate potential outcomes of creative interventions, and make sense of the musical dialogue that emerged and unfolded while ‘jamming’ with members of the public. Skills obtained through their lived experience as working musicians gave them the ability to maintain the expressivity of live performance while monitoring and managing the practical tasks of improvising a collaborative musical encounter [55, 57]. In addition to allowing them to ‘oscillate’ [19] between attending to the demands of live music-making and the practicalities of

operating the technologies supporting the performance interface, their experienced musicianship enabled them to access an extra layer of attentiveness and intuition honed through practice to augment their understanding of the social experience under investigation. Taylor recalls her fondest memories of humanaquarium as being those occasions in which she was able to “fully actualize” her engagement with participants during a performance [55, p.85], creating a dialogue encompassing her offered vocal improvisations and the participants' responses via the humanaquarium interface. Relying upon her skills of musicianship, Taylor would make tiny manipulations to the shape of her vocal tract in order to control the timbral and melodic character of her improvised contributions, resulting in a vocal utterance embodying her creative intent and suggesting a nuance of offering-and-response. She could withdraw or accentuate her efforts as she observed the subtleties of her participant's response, learning through practice how she could encourage a shared sense of agency and dialogue in the encounter. Thecla Schiphorst describes this body-based way of understanding the abilities of one's physicality and craft as a *somatic connoisseurship* enabled as a practitioner develops experiential acuity and understanding through years of experience and immersion in practice [46]. In a discussion highlighted in Bardzell and Bardzell's exploration of humanistic HCI [2], Kia Höök suggests that knowledge learned through the physical enactment of practice can be distilled to contribute a uniquely somatic perspective to experience design [31].

In [65], Jayne Wallace reports insight to be found through the tacit understandings that inspire her creativity in craft practice [61] as she gives ideas physical form. Nissen similarly found that working within her practice and crafting physical representations of participants' data helped her build relationships with participants and elicit richer, more personal stories from them while engaging in her research. Making data-things to explore participants' experiences running the Great North Run half-marathon [26], she gained a clear sense of understanding that particular recollections of different phases of the race (ie: nuances of the starting kilometres, or a tricky piece of uphill terrain) bore far greater subjective meaning than the minute-by-minute data. However, as part of the shared conversations, Nissen also recognised the importance of participants' taking personal ownership of their data in artefact form through this meaning-making practice. Through working as a creative practitioner to craft the representative data-thing, meaningful aspects of each person's individual story became apparent, leading to a better output in terms of the finished data-thing as well as a better understanding of the research in terms of eliciting each participant's personal story. Consistent with Binder et al., who suggest performance “imposes the primacy of sensory experience” [10, p. 129], and can contribute to a characterization of design that is “interventionist, participative, and experiential” [10, p. 129], these examples

of learning through the actual ‘doing’ of performance illustrate its usefulness as a way to make sense of a shared encounter, augmenting the objective with the lived, practice-honed intuitive.

Shape the spectator’s relationship to research

The institutional or contextual framing of an experience can radically alter how a person perceives and evaluates it. A century ago, Marcel Duchamp transformed a urinal into a work of art called ‘Fountain’ simply by signing it and installing it in an art gallery [27]. Encountering an interaction primarily as a work of research or primarily as an aesthetic encounter can shape the spectator’s perception of that project and therefore his or her understanding and valuing of the experience. In our case studies, the researchers shaped how their participants related to their projects in ways that we unpick here using Schechner’s categories of ‘doing’ and ‘showing doing’ alongside Spence’s four qualities of autobiographical performance.

For example, the Thrill Engineer creatively ‘heightens the attention’ (and anticipation) of his audiences in part by ‘showing doing’ the experimental procedure of his research process. While participants are caught up in the suspense, anticipation, excitement, and eventual bodily experience of the thrill ride for its own sake, Walker and his team theatrically explain the technological experimentations participants will undergo during the experience, while forcing them to wait their turn to understand firsthand what their experience will be like. The setup, gathering, and the display of participant biodata are explained and celebrated, creating desire on the part of many onlookers to take part as well. Research expertise is central to Walker’s ‘Engineer’ persona and to the framing of his entire body of work. By ‘showing doing’ his research (portrayed as the ‘doing’ of science) in a way that makes the spectator’s encounter seem exciting and important, he can amplify the spectator’s excitement and therefore the ‘doing’ of his research. In other words, his practice is enhanced by deliberately encouraging participants to make sense of their aesthetically crafted experience as research.

The Rough Mile, on the other hand, functions via locative audio technology that operates invisibly behind the scenes. The story told through the audio walk is much more prominent than the mechanics of its workings. Spence and her fellow researchers could not avoid activities such as gaining informed consent, so they conducted these activities in a separate space and physically moved participants to a new location to begin the audio walk. The research context became nearly invisible via the ‘descent into fiction’, where Spence used her skills as a performer (physically and vocally) to shift participants’ attention towards the fictional and immersive content of the interactive encounter. Similarly, the researchers captured audio data using live performers taking on roles within the fictional world, keeping participants engaged in the content of the project and obscuring the data capture process. In Schechner’s and

Spence’s terms, The Rough Mile ‘heightened’ participants’ attention to their own ‘doing’ of their activity—participating in an aesthetic event through a complex locative audio walk—while downplaying or blurring the ‘showing doing’ of both the performance event (only brief encounters with live performers) and the research event. Again, the ‘situatedness’ of Spence and her participants was prominent, though her ‘self-making’ was critical to the process of downplaying the ‘showing doing’ of the research, leading some participants to liminal experiences (the ‘aesthetics of the event’) in which some rethought their relationships and re-experienced their hometown.

The performer/researchers in the other case studies similarly ‘orchestrate’ [48] their performances to shape how the audience makes sense of the experience. In humanaquarium, for instance, what was actually being studied and documented was the performer/researchers’ personal experience and understanding of the unfolding shared performance encounter. As such, the ‘doing’ of the research activity could be relatively backgrounded—the audience members were primarily invited to make sense of the experience as a participatory performance event. Nissen takes the opposite approach in her work, performing and making visible (ie: ‘showing doing’) her research process by openly presenting herself as both a maker and research practitioner while discussing and engaging with the public. We suggest that considering the ‘doing’ and ‘showing doing’ of the research aspects of performative HCI research, along with attention to self-making, situatedness, heightened attention, and liminality in the research event, offers an explicit and informed approach to spectator and participant engagement.

Continually ‘devise’ and co-create via live improvisation

The need to respond to the inevitable unpredictability of live performance has been addressed in HCI literature (e.g.: [6,43,52]). Live performers are often enlisted to scaffold [56] or orchestrate [6,34,48,59] performance encounters. Specifically of interest to us, however, is the additional opportunity for HCI exploration afforded by self-situated performance research. As stated earlier, the autobiographical performer is necessarily also the ‘deviser’ of the performance content [29]. During the encounters described in our case studies, the performer/researchers are simultaneously performing, researching, orchestrating and improvising reactions to audiences based on their devising processes. Their responsibility for the project impacts not only upon the performative experience but also the research outcomes. Performing research readily enables *reflection-in-action* [47] during live encounters, although we acknowledge that care must be taken to preserve the ability to pursue post-event *reflection-on-action* [47] (e.g. through documentation and review as described in [5,8,55]).

The role of performer/researcher enables the devising process to extend into the run-time of the performances. Choices made by the performer/researcher during the

course of orchestrating live performance can be used to steer not only the flow of each performance, but also the unfolding research investigation. Self-situated improvisational performance enables performer/researchers to follow avenues of creative expression as well as research enquiries that become apparent on the fly. Described in Taylor et al.'s 'design from within' methodology [57], the presence of the performer/researcher within the performance frame allows the research practice to be immediately responsive to interesting stimuli that occur 'in the wild'. Taylor et al. describe how they considered humanaquarium to be "simultaneously finished and unfinished" [57, p.1861], leaving room for participant interaction and performer/researcher intervention to determine what would take place (and to some extent, what would be investigated) during each live performance. If audience members were particularly responsive, the team could focus their attentions on developing elaborate improvisational dialogues with particular participants during the encounter. Conversely, if the audiences were less ready to participate, the team could experiment with strategies for increasing people's confidence and willingness to take part [55]. Walker also describes responding to the inevitable unpredictability of live participatory performance, considering unforeseen incidents such as technological glitches and variable system response times as creative opportunities to improvise and stimulate his audiences in new ways [62]. Similarly, as performer/researchers, Spence and Nissen continue their devising process throughout, collaborating with participants to co-create not only the encounter, but also a research artefact (the data-thing and the audio gift).

While the performative research projects we have described are meticulously planned for and rehearsed in advance, the nature of these events are such that the enactment of each performance is actualised through the mutual and intersubjective presence of the performer/researchers and live participants during the performance event [18]. From a design research perspective, this enables a relational and dialogical approach [38, 65], as the performer/researcher and participants negotiate the performative research together during the shared encounter.

DISCUSSION AND CONCLUSION

The performer/researcher has the ability and responsibility to tell a unique and truthful story that can only be known from the perspective of one who was there, within the encounter, as s/he makes sense of his/her own lived experience. The insights contained in this paper have come from practitioners speaking of their own practice.

Bardzell and Bardzell call for the voice of the researcher—the 'expert subject'—in humanistic writing [2,3]. Similarly, Zhang and Wakkary support the use of designers' personal experiences to augment understanding [67]. However, the intuitive, pragmatic ways in which performer/researchers work often challenge mainstream academic convention.

What can we learn about the real world by making art? And how can the work of performer/researchers be used within conventional academic research teams?

We believe we can approach an answer to the first question by championing small-scale and unrepeatable events. At the outset of this article, we positioned the practice of performing research within the context of other current design practice valuing felt experience [38], situatedness [53], and the impact of artistry [32] and aesthetics [65] on personal experience. Research practices aiming to make sense of the ineffable [12] nuances of lived experience need not be, and in fact possibly *should* not be [18], uniformly scalable, generalizable, or extendable in order to be deemed capable of generating a deep understanding of personal experience. Smaller interventions on the scale made possible by the practice of performing research may in fact be preferable in terms of eliciting intimate, multifaceted understandings of shared experience.

An answer to the second question is made possible by demystifying the creative process and recognising that there are many ways of integrating artists into collaborative research practice. Consigning arts practitioners into an 'art-making' silo risks overlooking the fact that practitioners of technologically mediated performance have a perspective that bridges the concerns of interaction design, technology, experience research, data capture, and ethnography, in addition to art production. Conversely, many researchers who do not identify as artists may have performance skills that would support their own self-situated performance research. The great strength of the performer/researcher is that his/her 'artistic artillery' comprises both creative processes and an informed sensitivity to current HCI research concerns, the combination of which allows access to new ways of knowing. As such, self-situated performance research need by no means be restricted to 'artists', whether institutionally recognised or self-defined.

We have looked to examples of performer/researchers who produce work within the CHI community to identify four ways in which we suggest self-situated performance practice is particularly well placed to illuminate the nuances of shared social encounters mediated by technology. It is our hope that by making visible the tacit understandings that emerge through creative practice, we have provided insight into how performing research helps to make sense of human-computer interaction.

ACKNOWLEDGEMENTS

The authors thank the numerous colleagues who contributed to the case studies in this article. This work was funded by the AHRC Creative Exchange Knowledge Exchange Hub (AH/J005150/1) and the Fusing Semantic and Audio Technologies for Intelligent Music Production and Consumption (FAST) EPSRC Programme Grant, EP/L019981/1. Photography provided by Cassim Ladha, Brendan Walker, Sharon Bailey (ISIS Arts), and Jocelyn Spence. No new data were created during this study.

REFERENCES

1. Philip Auslander. *Liveness: Performance in a mediatized culture*. (1999) Abingdon: Routledge.
2. Jeffrey Bardzell and Shaowen Bardzell. *Humanistic HCI. Synthesis Lectures on Human-Centered Informatics*. Morgan & Claypool, 2015.
3. Jeffrey Bardzell and Shaowen Bardzell. 2016. Humanistic HCI. *interactions* 23, 2 (February 2016), 20-29.
4. Steve Benford, Andy Crabtree, Stuart Reeves, Jennifer Sheridan, Alan Dix, Martin Flintham, and Adam Drozd. 2006. The Frame of the Game: Blurring the Boundary between Fiction and Reality in Mobile Experiences. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '06), ACM, New York, NY, USA, 427-436.
5. Steve Benford, Mike Fraser, Gail Reynard, Boriana Koleva, and Adam Drozd. 2002. Staging and evaluating public performances as an approach to CVE research. In *Proceedings of the 4th international conference on Collaborative virtual environments* (CVE '02). ACM, New York, NY, USA, 80-87.
6. Steve Benford and Gabriella Giannachi. *Performing mixed reality*. The MIT Press, Cambridge. 2011.
7. Steve Benford, Gabriella Giannachi, Boriana Koleva, and Tom Rodden. 2009. From interaction to trajectories: designing coherent journeys through user experiences. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '09). ACM, New York, NY, USA, 709-718.
8. Steve Benford, Chris Greenhalgh, Andy Crabtree, Martin Flintham, Brendan Walker, Joe Marshall, Boriana Koleva, Stefan Rennick Egglestone, Gabriella Giannachi, Matt Adams, Nick Tandavanitj, and Ju Row Farr. 2013. Performance-Led Research in the Wild. *ACM Trans. Comput.-Hum. Interact.* 20, 3, Article 14 (July 2013), 22 pages.
9. Steve Benford, Chris Greenhalgh, Gabriella Giannachi, Brendan Walker, Joe Marshall, and Tom Rodden. 2012. Uncomfortable interactions. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '12). ACM, New York, NY, USA, 2005-2014.
10. Thomas Binder, Giorgio De Michelis, Pelle Ehn, Giulio Jacucci, Per Linde and Ina Wagner. 2011. *Design Things*. The MIT Press.
11. Suzanne Bødker. When second wave HCI meets third wave challenges. In *Proc. NordiCHI '06*, ACM Press (2006), 1-8.
12. Kirsten Boehner, Phoebe Sengers, and Simeon Warner. 2008. Interfaces with the ineffable: Meeting aesthetic experience on its own terms. *ACM Trans. Comput.-Hum. Interact.* 15, 3, Article 12 (December 2008), 29 pages.
13. John Bowers. The logic of annotated portfolios: communicating the value of 'research through design'. In *DIS '12*. ACM, New York, NY, USA, 68-77.
14. John Bowers and Timothy Shaw. *Reappropriating Museum Collections: Performing Geology Specimens and Meteorology Data as New Instruments for Musical Expression*, Proceedings of NIME 2014 p. 175-178.
15. Peter Dalsgaard and Lone Koefoed Hansen. 2008. Performing perception—staging aesthetics of interaction. *ACM Trans. Comput.-Hum. Interact.* 15, 3, Article 13 (December 2008), 33 pages.
16. Paul Dourish. *Where the action is: the foundations of embodied interaction*. MIT Press, 2006.
17. Carolyn Ellis, Tony E. Adams, Arthur P. Bochner. *Autoethnography: An Overview*. Qualitative Social Research, [S.l.], v. 12, n. 1, nov. 2010. ISSN 1438-5627
18. Daniel Fällman & Eric Stolterman. 2010. Establishing criteria of rigour and relevance in interaction design research. *Digital Creativity*, 21(4), pp. 265-72
19. Erika Fischer-Lichte. *The transformative power of performance: A new aesthetics*. Routledge, London, 2008.
20. David S. Kirk, Abigail Durrant, Gavin Wood, Tuck Wah Leong, & Peter Wright. 2016. Understanding the Sociality of Experience in Mobile Music Listening with Pocketsong. In: *Proceedings of the 2016 ACM Conference on Designing Interactive Systems*. pp. 50-61
21. William Gaver. Making Spaces: how design workbooks work. In: *Proc CHI '11*. New York, NY: ACM.
22. William Gaver, Jacob Beaver, and Steve Benford. 2003. Ambiguity as a resource for design. *CHI'03*, 233-240.
23. William Gaver, Mark Blythe, Andy Boucher, Nadine Jarvis, John Bowers, and Peter Wright. 2010. The prayer companion: openness and specificity, materiality and spirituality. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '10).
24. William W. Gaver, John Bowers, Andrew Boucher, Hans Gellerson, Sarah Pennington, Albrecht Schmidt, Anthony Steed, Nicholas Villars, and Brendan Walker. 2004. The drift table: designing for ludic engagement. In *CHI '04 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '04). ACM, New York, NY, USA, 885-900.
25. Erving Goffman, 1974. *Frame analysis: An essay on the organization of experience*. Cambridge, MA: Harvard University Press
26. Great North Fabrications | Data Things: 2015. <https://makingdatathings.wordpress.com/2015/08/18/great-north-fabrications/> Accessed on: Sept 14, 2016.
27. RoseLee Goldberg. 1988. *Performance art: from futurism to the present*. New York: H.N. Abrams.

28. Jen Harvie, 2004. Being her: Presence, absence and performance in the art of Janet Cardiff and Tracey Emin. In: B.B. Gale & V. Gardner (eds.), *Auto/Biography and Identity: Women, Theatre and Performance*. Manchester; New York: Manchester University Press, pp. 194-216
29. Deirdre Heddon. *Autobiography and performance*. Palgrave Macmillan, Basingstoke, 2008.
30. Mads Hoby. 2012. Touchbox: intriguing touch between strangers. In *CHI '12 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '12). ACM, New York, NY, USA, 1023-1026.
31. Kristina Höök. 2010. Transferring qualities from horseback riding to design. In *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries* (NordCHI '10). ACM, New York, NY, USA, 226-235.
32. Kristina Höök, Phoebe Sengers, and Gerd Andersson. 2003. Sense and sensibility: evaluation and interactive art. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '03). ACM, New York, NY, USA, 241-248.
33. Tim Ingold. *Making: Anthropology, Archaeology, Art and Architecture*. Routledge, London, 2013.
34. Borianna Koleva, Ian Taylor, Steve Benford, Mike Fraser, Chris Greenhalgh, Holger Schnädelbach, Dirk vom Lehn, Christian Heath, Ju Row-Farr, and Matt Adams. 2001. Orchestrating a mixed reality performance. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '01). ACM, New York, NY, USA, 38-45.
35. Kari Kuutti, Giulio Iacucci, and Carlo Iacucci. 2002. Acting to know: improving creativity in the design of mobile services by using performances. In *Proceedings of the 4th conference on Creativity & cognition (C&C '02)*. ACM, New York, NY, USA, 95-102.
36. Celine Latulipe, David Wilson, Sybil Huskey, Melissa Word, Arthur Carroll, Erin Carroll, Berto Gonzalez, Vikash Singh, Mike Wirth, and Danielle Lottridge. 2010. Exploring the design space in technology-augmented dance. In *CHI '10 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '10). ACM, New York, NY, USA, 2995-3000.
37. John McCarthy and Peter Wright. 2015. *Taking [A]Part: The Politics and Aesthetics of Participation in Experience-Centered Design*. The MIT Press.
38. John McCarthy and Peter Wright. 2004. *Technology as Experience*. The MIT Press.
39. Alexander Müller, Jochen Fuchs, and Konrad Röpke. 2010. Skintimacy: exploring interpersonal boundaries through musical interactions. In *Proceedings of the fifth international conference on Tangible, embedded, and embodied interaction* (TEI '11).
40. Carman Neustaedter and Phoebe Sengers. 2012. Autobiographical design in HCI research: designing and learning through use-it-yourself. In *Proceedings of the Designing Interactive Systems Conference (DIS '12)*. ACM, New York, NY, USA, 514-523.
41. Bettina Nissen and John Bowers. Data-Things: Digital Fabrication Situated within Participatory Data Translation Activities. In *Proc. CHI'2015*, ACM (2015)
42. Bettina Nissen, John Bowers, Peter Wright, Jonathan Hook, and Chris Newell. Vovelles, domes and wristbands: embedding digital fabrication within a visitor's trajectory of engagement. In *Proceedings of the 2014 conference on Designing interactive systems* (DIS '14). ACM, New York, NY, USA, 825-834.
43. Stuart Reeves, Steve Benford, Claire O'Malley, and Mike Fraser. 2005. Designing the spectator experience. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '05). ACM, New York, NY, USA, 741-750.
44. Yvonne Rogers. 2011. Interaction design gone wild: striving for wild theory. *interactions* 18, 4 (July 2011), 58-62.
45. Richard Schechner. *Performance studies: An introduction*. 2nd ed. Routledge, New York, 2006.
46. Thecla Schiphorst. 2011. Self-evidence: applying somatic connoisseurship to experience design. In *CHI '11 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '11). ACM, New York, NY, USA, 145-160.
47. Donald A. Schön, (1983). *The reflective practitioner: how professionals think in action*. New York: Basic Books.
48. Holger Schnädelbach, Stefan Rennick Egglestone, Stuart Reeves, Steve Benford, Brendan Walker, and Michael Wright. 2008. Performing thrill: designing telemetry systems and spectator interfaces for amusement rides. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '08). ACM, New York, NY, USA, 1167-1176.
49. Tim Shaw and John Bowers. *Public Making: Artistic Strategies for Working with Collections, Technologies and Publics* – Proceedings of ISEA (International Symposium of Electronic Art) 2015
50. Jennifer Sheridan, Alan Dix, Simon Lock, and Alice Bayliss. Understanding interaction in ubiquitous guerrilla performances in playful arenas. In *Proc. HCI 2004*, Springer-Verlag (2004), 3--17.
51. Jennifer G. Sheridan, Nick Bryan-Kinns, and Alice Bayliss. 2007. Encouraging witting participation and performance in digital live art. In *Proceedings of the 21st British HCI Group Annual Conference on People and Computers: HCI...but not as we know it - Volume 1* (BCS-HCI '07), Vol. 1. British Computer Society, Swinton, UK, 13-23.

52. Jocelyn Spence. 2016. *Performative Experience Design* (1st ed.). Springer Publishing Company, Incorporated.
53. Lucy A. Suchman. 2006. *Human-Machine Reconfigurations: Plans and Situated Actions*. Cambridge University Press, New York, NY, USA.
54. Atau Tanaka and R. Benjamin Knapp. 2002. Multimodal interaction in music using the Electromyogram and relative position sensing. In *Proceedings of the 2002 conference on New interfaces for musical expression* (NIME '02), Eoin Brazil (Ed.). National University of Singapore, Singapore, Singapore, 1-6.
55. Robyn Taylor. 2012. *Designing from Within: Exploring Experience Through Interactive Performance*. Ph.D. Dissertation. University of Alberta, Edmonton, Canada.
56. Robyn Taylor, John Bowers, Bettina Nissen, Gavin Wood, Qasim Chaudhry, Peter Wright, Lindsey Bruce, Sarah Glynn, Helen Mallinson, and Roy Bearpark. 2015. Making Magic: Designing for Open Interactions in Museum Settings. In *Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition* (C&C '15). ACM, New York, NY, USA, 313-322.
57. Robyn Taylor, Guy Schofield, John Shearer, Jayne Wallace, Peter Wright, Pierre Boulanger, and Patrick Olivier. Designing from within: humanaquarium. In *Proc. CHI '11*, ACM Press (2011), 1855-1864.
58. Robyn Taylor, Guy Schofield, John Shearer, Jayne Wallace, Peter Wright, Pierre Boulanger, and Patrick Olivier. Composing for the Interactive Medium. *International Journal of Design and Innovation Research*, Vol.6 - n°1, 2011.
59. Robyn Taylor, Guy Schofield, John Shearer, Peter Wright, Pierre Boulanger, and Patrick Olivier. 2014. Nightingallery: theatrical framing and orchestration in participatory performance. *Personal and Ubiquitous Computing*. 18, 7 (October 2014), 1583-1600.
60. Thrill Laboratory at Alton Towers: 2007. <http://forum.towerstimes.co.uk/viewtopic.php?t=16318&p=295185> Accessed on: Sept. 14, 2016.
61. Jayne Wallace, Mike Press. All this useless beauty. *The Design Journal* Volume 7 Issue 2
62. Brendan Walker. 'Punters: auto-portraits of fairground thrill' Panel 2: Digital Brutalism On the Verge of Photography: Imaging, Mobile Art, Humans & Computers 24th -- 25th May 2013, Birmingham School of Art
63. Brendan Walker, Holger Schnädelbach, Stefan Rennick Egglestone, Angus Clark, Tuvi Orbach, Michael Wright, Kher Hui Ng, Andrew French, Tom Rodden, and Steve Benford. 2007. Augmenting amusement rides with telemetry. In *Proceedings of the international conference on Advances in computer entertainment technology* (ACE '07). ACM, New York, NY, USA, 115-122.
64. Julie R. Williamson, Lone Koefoed Hansen, Giulio Jacucci, Ann Light, and Stuart Reeves. 2014. Understanding performative interactions in public settings. *Personal Ubiquitous Comput.* 18, 7 (October 2014), 1545-1549.
65. Peter Wright, Jayne Wallace, and John McCarthy. 2008. Aesthetics and experience-centered design. *ACM Trans. Comput.-Hum. Interact.* 15, 4, Article 18 (December 2008), 21 pages.
66. Mick Wallis, Sita Papat, Joslin McKinney, John Bryden & David C. Hogg, 2010. Embodied conversations: Performance and the design of a robotic dancing partner. *Design Studies*, 31(2), pp. 99-117.
67. Xiao Zhang and Ron Wakkary. 2014. Understanding the role of designers' personal experiences in interaction design practice. In *Proceedings of the 2014 conference on Designing interactive systems* (DIS '14). ACM, New York, NY, USA, 895-904.