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Entangled Technique

Material indeterminacy and embodied knowledge in experimental music performance

MIRA BENJAMIN, ZUBIN KANGA AND SCOTT MCLAUGHLIN

INTRODUCTION

This article explores a meeting of 'embodied technique' (Spatz 2015: 60) and 'material agency' (Pickering 1995: xi) in experimental music performance, where two musicians are materially entangled with each other through a single sounding instrument. Drawing on collaborative practice research (2019 – present)[1] emphasizing the 'material indeterminacy' (McLaughlin 2022, after Pickering) inherent in performing with musical instruments, we ask how a contingent and coalitional technique may be developed, utilized, adapted and mutually experienced in practice. Specifically, we argue that 'coalition' – an under-used term in music performance discourse – is a productive description for intersubjective negotiation in performance, highlighted in this context of entangled human and non-human agencies, and in the political context of the 'diagonality' (Citton 2016: 170) of improvisation as reformulation of the control/freedom binary.

Our discussion concerns *we are environments for each other [trio]* (2024) – an experimental 'performance ecosystem' (Waters 2007) in which playing techniques of Mira (violinist) and Zubin (pianist) become enmeshed (see 'meshwork' in Ingold 2010: 19) through a bespoke electric-violin-resonator-piano-feedback-system and conceptual framework developed collaboratively with Scott (composer). This project has grown out of two previous collaborations (see McLaughlin *et al.* 2021) that laid foundational work for the instrument- and performer-specific techniques, as well as the hardware for the resonator system. While approaching these projects from initial roles of 'performers' and 'composer', the experimental techniques and infrastructures of *we are environments for each other [trio]* – developed across six years of workshops, recordings and performances – have pushed us ever farther outside these roles, resulting in the eventual performance piece discussed here. This developmental work is drawn on throughout this article in the form of annotated audiovisual documentation that can be viewed in tandem with, or independently from, the writing below. Readers who wish first to encounter the performance piece in its entirety may access video documentation of a complete live performance.[2]

The following sections outline the move from the collaborative development of the piece to the 'coalitional entanglement' of its performance. For our proposition on coalitions to be clear, it is necessary first to outline some key terms ('technique' and 'material indeterminacy') before briefly describing the feedback system itself and its performance conditions. We then establish the basis of the piece's 'material-epistemic coalition' – a growing-together of embodied technique (knowledge-in-formation) and material indeterminacy. In the final section we turn our focus to the structures of technique that are both the site of this coalition and its main organizing principle. The tenor of our conversation will shift as we employ video annotation and 'phenomenotechnical' writing (Spatz 2020: 97, after Rheinberger 2005) – a mode of reflection that communicates not only an experiential account of practice, but more importantly the embodied knowledge structures that have formed the key insights of the project. Finally, we return to reflect on the implications of this practice within the wider context of experimental music performance.

[1] This research was undertaken as part of *Cyborg Soloists*, supported by a UKRI Future Leaders Fellowship and Royal Holloway, University of London [grant number UKRI1065]. Data supporting this study is not publicly available, as participants have not consented to public sharing of these materials. Selected documentation materials cited in this article are available on request to researchers. Please contact the project Research Lead, Zubin Kanga, via the Royal Holloway research portal: https://bit.ly/3RfSx3k.

[2] Documentation of a complete live performance of *we are environments for each other [trio]* at City St George's, University of London's 'Summer Sounds' concert series (23 May 2025) can be accessed at McLaughlin *et al*. (2025) or streamed at Kanga (2025).

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AT THE INTERSECTION OF TECHNIQUE AND MATERIAL INDETERMINACY

Before getting into details, it is important to emphasize the experimental nature of the performance system itself and the way it enables the specific embodied techniques of this practice to form.[3] On a purely mechanical level, the system comprises a microphone and an electric violin,[4] both inputting to a mixer that outputs one signal into an electromagnetic resonator, which activates the piano strings. The microphone is attached to the resonator, so it receives the resonating piano string and creates a feedback loop. Zubin operates the resonator on the piano strings, while Mira plays the electric violin whose signal then interferes with the piano string vibration. Scott's role is to propose interactive frameworks through which the players incite the system to sound, and act as an outside ear as the players attune to each performance space. (Further details of the feedback system are discussed below.)

This project is positioned at the intersection of two investigative territories within experimental music practice, which engage in various ways with questions of performer agency and relationality. The first of these territories is 'feedback musicianship', which explores 'the recurrent circulation of signals as a core of musical agency' (Kiefer *et al.* 2025: 1). A key feature of these projects is that 'the dynamical autonomy of feedback instruments demands a shift in mode of interaction … that itself takes on a form of autonomy and couples, or entangles the player and instrument' (23). A second territory is that of 'embodied research' (Spatz 2017), which has its methodological basis in theatre and physical performance, but that affords a useful framework in music for the interrogation of 'relational performance practices' (Førsidal 2024) such as ours, where 'multiple performers cooperate to make sounds on a single sound source', resulting in 'the entanglement of performers and technology as performative networks' (ibid.).[5]

We are environments for each other [trio] was developed out of a curiosity about the intersection of these two fields: how might the introduction of relational (multi-performer) elements into feedback musicking compound the displacement of agency noted by so many performers engaging with both disciplines? Paul Stapleton notes that hybrid practices orientate performers to 'momentum and external influences alongside human technique' (Stapleton cited in Kiefer *et al.* 2025: 12) and thus 'mastery and therefore instruction takes a different form than that associated with more traditional instrumental practice' (13). For Mira and Zubin, an uncanny uncertainty arises around our instruments, as actions by either player affect the system and its affordances for all the players. Sounds do not map directly on to actions, and a replicated action may result in different sonorities from one playing to the next. The proposition of 'learning' this piece thus presents a paradigm shift on a level of embodied technique, which resists sedimentation through repetition in the way we are accustomed to when performing with our primary instruments (violin and piano).

Anders Førsidal (2024) observes 'the alienating effects of not being able to grasp the result of [one's] efforts' in such practices where performers are rendered 'wholly interdependent, their subjective agencies literally in the hands of others and mediated by precarious technologies'. What Førsidal characterizes as 'precarity' is nonetheless experienced by Zubin and Mira as a creative affordance – a 'threshold' (Spatz 2020)[6] across which lies a different way of arriving at 'technique' within the indeterminacy of the system. This is not simply a matter of indeterminate or improvised musical structure, but a radical reorientation towards embodied responses, which, to borrow from Karin Knorr Cetina's description of experimental practice, are 'always in the process of being materially defined' and thus must 'continually acquire new properties and change the ones they have' (2001: 181). Knorr Cetina here is addressing the epistemic nature of practices that are 'creative and constructive' (175), suggesting a relational underpinning 'that by the nature of its dynamic transforms itself and the entities formed by the relationship' (185). Correspondingly, Mira and Zubin's task is not to establish technical proficiency within the system by mapping sounds to techniques, but to develop a coalitional listening strategy – an 'entangled

[3] Equally, it's important to surface music's disciplinary nuances here, as some of our assumptions may not be obvious to readers from other disciplines – without getting into the complex history of notation/scores and sound. While the authors here are all from notation/score-based musical backgrounds, the piece under discussion here does not have a score and is closer to a devising process found commonly in theatre. However, this is devising without a fixed object at the end of the process: a devising of relations. For readers from a theatre discipline, Duška Radosavljević's writings on aural/oral dramaturgies may provide a useful bridge, as it argues for similar 'relational dramaturgies' and 'decentring of the written word in theatre, within the wider context of decolonisation' (2023: 4).

[4] We use a Yamaha YEV105 5-string electric violin.

[5] Both of these communities of practice form parts of a larger discourse around 'cyborg' musicianship, which engages with onto-epistemic critique of 'technological-performer entanglement' (Dyer and Kanga 2023, after Haraway 2006). See also Kanga *et al.* (2024a, 2024b).

[6] Spatz uses the term 'threshold' to describe a point along a trajectory of practice where a 'crossing over into formations of new knowledge' occurs (2020: xii).

technique' negotiated around the fulcrum of material indeterminacy.

TECHNIQUE

Our use of the term 'technique' here is quite specific, and draws on the perspective of theatre practitioner and theorist Ben Spatz, who defines technique as 'embodied knowledge that structures practice' (2015: 1). Spatz presents a view of technique that is orthogonal to many of music's historical and disciplinary discourses (Benjamin and Furniss 2020), however it uniquely invites an attentiveness to embodiment within the context of cyborg musical practice. For Spatz, a positioning of embodiment as 'first affordance' (2020: 70) implies that 'technology can be defined as its effect upon embodied technique' (12). Expanding upon this framework, we have previously proposed that

> technique here implies not only the skilled processes and knowledges inherent to instrumental performance or composition, but also to the collection of embodied and performative adaptations to what McLaughlin refers to as the 'material indeterminacy' of strings that have emerged from this project. (McLaughlin *et al.* 2021)

This extension of Spatz's framework motivates us to consider our embodied negotiation with the feedback system outside paradigms of control that typify musical discourse around performance technique, and to enter willingly and with curiosity into an entangled 'dance' of human and material agencies (Pickering 1995: 21).

MATERIAL INDETERMINACY

'Material Indeterminacy' is a specific case of the indeterminacy first proposed in music by John Cage in 1961, through his use of 'chance operations' (2012 [1961]: 35) that reduced his agency in the compositional process; indeterminacy went on to be a key part of the tradition of Experimental Music that followed Cage. The materialist strand of this tradition emerged from composers such as Alvin Lucier and David Tudor who designed musical performances to unfold according to the specific resonance of given objects: for example, in Lucier's 'Nothing is Real' (1990) for piano amplified through a teapot, swapping out one teapot for another of a different make would change the pitches of the whole piece. 'Material Indeterminacy' is useful as an

> umbrella-term [to refer to] the contingent sounding of physical things, and also the compositional strategy grounded in the productive tensions of this contingency. Composing with material indeterminacy channels the performative response to an instrument's materiality in repetitive structures that expose its multiplicity. (McLaughlin 2022: 218)[7]

In this research, the materiality of the piano and violin strings, entangled through an amplifying resonator, creates an indeterminacy that is dependent on the specific resonances of those strings in any given moment, contingent on the emergent topology of moment-to-moment alliances and rejections between resonant 'things' (Bennett 2010). The indeterminacy of the system is not random; rather it reveals a (material) agency in the complex interaction of preferred resonances, which makes its presence known to the musicians through singing and ringing tones of agreement, or unresponsive refusals of unresonant strings.

THE FEEDBACK SYSTEM

The characteristics of the feedback system itself represent a parallel strand of this research and lie outside the scope of this article – however readers wishing to engage with the technical details may access an annotated video of the system in use.[8] For our purposes here, the system can be understood as a black-box where both Mira and Zubin can input sound/energy to the piano strings (via the resonator) but the strings themselves respond in such a complex manner to these inputs that the individual agency of the musicians is obscured and the piano strings emerge as a third (non-human) agent. The result is that the players operate without fully understanding how their actions are affecting the overall sound; their playing techniques become situated and relational, relying on listening and responsiveness. For Zubin and Mira these events intensify both the sense of estrangement from our established technical groundings and the creative and constructive embodiments that form the 'epistemic objects' of the practice (Knorr

[7] Scott's application of these ideas focuses on the instability of musical instruments, on the indeterminacy of instrument materiality in (so-called) 'extended techniques' where the instrument's material agency is foregrounded and the player switches agential role from controlling the instrument to supporting it – by providing the energy for the instrument to vibrate, and in the virtuosity of touch that allows delicate states to be sustained and allowed to bloom. For a more complete overview of material indeterminacy, see McLaughlin (2022).

[8] The video *We are environments for each other [trio]*, resonator-feedback system overview can be accessed at (McLaughlin 2026).

Cetina 2001: 176). For Scott's established compositional practice, the system is no less evasive: Scott initially presented notations that were intended as the basis of a score (fig. 1), but even the most abstract of these had the effect of obstructing the responsiveness of the players to the system. Instead, the notations became more like 'training modules', which we now use to calibrate our listening to new performance spaces (and pianos), and thus form the basis of techniques specific to this piece and its interactions. The notations prime the players, attuning them to forces and seeking entanglements, and afford the threshold for a material–epistemic coalition to emerge. This coalitional position, outlined below, will be further unpacked in the following section with a more detailed explanation of the specific embodied techniques that structure this practice.

COALITION AND COLLABORATION

Part of our proposal here is that what we are calling 'entangled technique' in this piece, while developed in collaboration, is itself coalitional rather than collaborative.[9] As Gloria Anzaldúa suggests, 'coalition work attempts to balance power relations' (Anzaldúa cited in Fowlkes 1997: 108) and because the feedback system at the centre of this piece resists the sedimentation of its playing techniques, it creates a power structure wherein the work of performance is the work of just such a coalitional balancing act – both in the moment of performance and across the unfolding emergent structure. The piece is called a 'trio' because the two humans and the one feedback-system are theoretical equals in performance, but the unfolding of performance is never equal – it shifts constantly and unevenly as the players commit to the radical entanglement of the dance. Through both the

[9] Of course coalition is a subset or type of collaboration but with specific power relations: coalition is always collaboration, but not all collaboration is coalition, and the nuancing of this difference is fruitful in discussing performance.

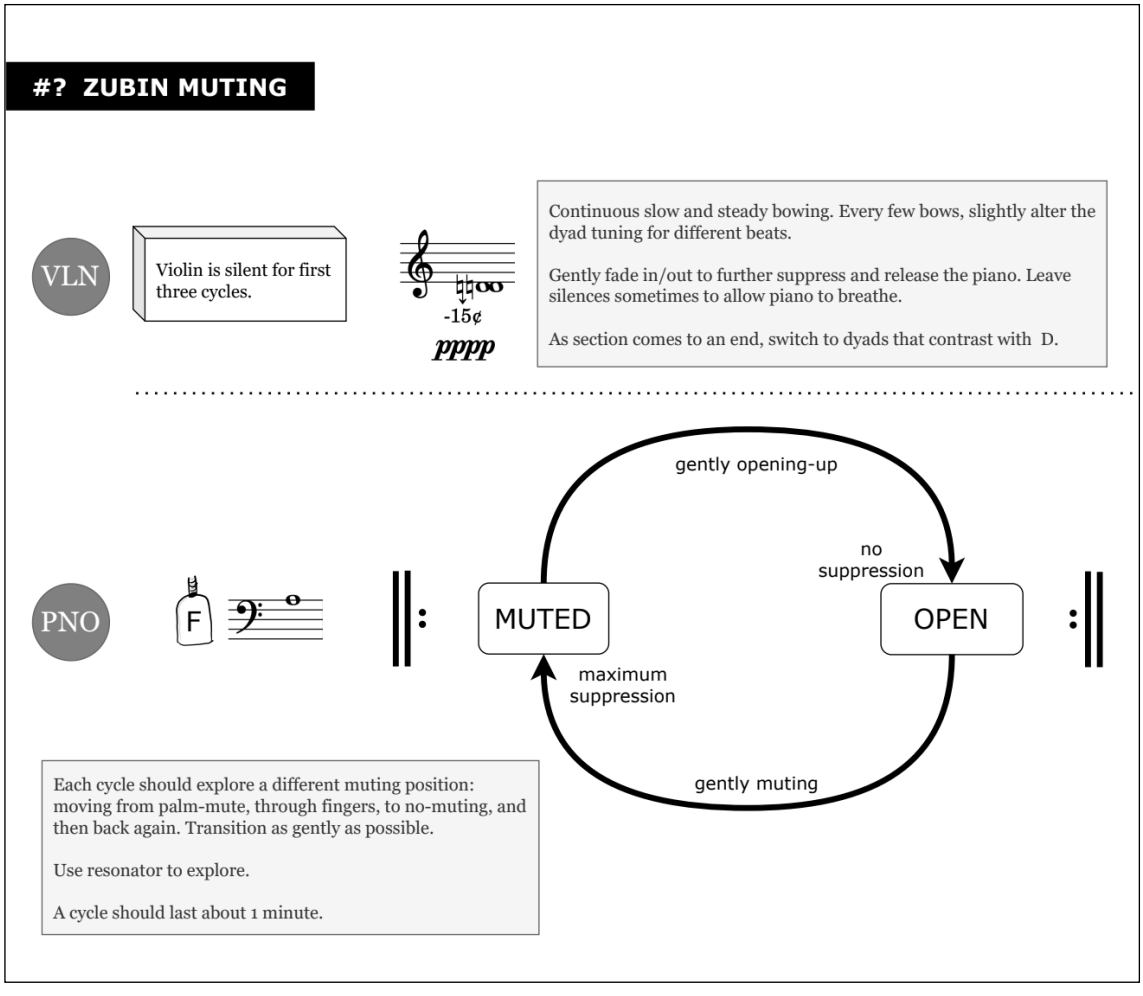


Figure 1. Early score fragment, which later became a more abstract 'training module' for rehearsals.

embodied techniques of the players and the continuous flow of electricity in the feedback-system, the three agents are in constant negotiation to maintain an 'intersubjectivity' (Fowlkes 1997: 108, after Anzaldúa) that 'undermines and subverts' the cartesian binaries (Anzaldúa cited in Fowlkes 1997: 108) of player-instrument, action-reaction, and the subordination of material agency to human agency. This is the coalitional 'growing together of parts' (*Etymonline* n.d.) through what Rosi Braidotti describes as an [inter]subjectivity 'both materialist and relational, "nature-cultural" and self-organizing' (2013: 52). The piece enacts the unfolding of such an embodied subjectivity as an 'epistemic thing' (Rheinberger 1997: 1) in composition and performance, but also to 'elaborate critical tools suited to the complexity and contradictions of our times' (Braidotti 2013: 52).

The discourse of critical improvisation studies is generative here as a frame. The nature of performance in this piece is fundamentally improvisational, though constrained by the common agreement about what 'the piece' is and is not. While improvisation discourse often frames performance in terms of collaboration, even when the players are deliberately oppositional on stage, we would argue that 'coalition' may well be a more fruitful term for discussing such performance practices where negotiation and power imbalances play themselves out onstage. While there is insufficient scope in this article to make this argument comprehensively, we hope that our example of emergent and materially contingent performance may provide a compelling model.

Psychologist and improvisation scholar R. Keith Sawyer describes improvisation as collaborative 'because no single person controls or directs a conversation; instead, the direction of its flow is collectively determined, by all of the participants' contributions' (1999: 192). Sawyer's emphasis on collaboration and collective decision-making aligns with improvisation discourse (Caines and Heble 2015: 2) across music, theatre, comedy and even law (Ramshaw and Stapleton 2018). Such 'collective determin[ation]' is a commonly acknowledged feature of improvisation, and will involve negotiation of some sort whether on- or off-stage, tacit or explicit. We suggest that a coalitional perspective can usefully foreground the nature of the agential positions in these performance situations.

Improvised performance is by its nature a political act. As Ramshaw and Stapleton describe, 'improvisation self-consciously engages with tradition and convention, at its best enabling resistance to past oppression and injustice and opening up possibilities for new ways of being together in society, both locally and at the global level' (Ramshaw and Stapleton 2018: 1). Deborah Wong, in her work on the racial politics of Black and Asian improvising musicians in the United States, suggests that 'many agree … that musical collaboration enacts political coalition' (2004: 174). She argues for 'free improvisation as coalition politics' (276), drawing on both the nature of the performance itself – the 'points of ideological contact (indeed, indebtedness) in a mindful, performative manner enacted through music' (306) – and the politics of its musicians, saying that

> this music always emerges relationally – either between musicians in performance, or in terms of ethnic and racial bridge building, i.e., the histories behind the bodies that produce it. Moreover, it is not so much that bridges are built but that coalitions form. Bridges and coalitions are not at all synonymous. (Wong 2004: 277)

Free jazz artist Muhal Richard Abrams describes improvisation as 'a human response to necessity', a perspective taken up in the contemporary field of critical improvisation studies to create 'an agenda in which the arts become part of a larger network tracing the entire human condition of improvisation' (Lewis and Piekut 2016: 2). Readers will find a broad range of discourse in that field that draws out improvisation in music as just one example of a larger world of relation, response, and political action at all scales, but here we wish to draw specifically on Yves Citton's reference to the 'diagonality' of improvisation, both in music and in direct political action: Citton exemplifies this through analysis of the 2010–11 demonstrations in Tahrir Square, Egypt. For Citton,

> [I]mprovisation draws a diagonal in the traditional opposition between vertical (hierarchic) structures

> of command and horizontal (egalitarian) structures of (free) interaction [… as a] (fundamentally political) challenge to devise collective forms of agency that articulate the outstanding power of the participating singularities with the principle of equal respect necessary to find non-oppressive strength in numbers. (Citton 2016: 171)

The diagonal offers possibilities for action, and new realities.

While we position our work in the domain of experimental music, rather than improvisation, we use the same techniques of contingent responsiveness that are central to improvised performance to create our own diagonal within the traditional hierarchies of notated concert music and technology. It is in this embodied domain that our coalition arises through the bridge-building offered by the sounding affordances of the instrument, and the intersubjective (mindful) position taken by the musicians that makes them open to such negotiation. Coalition-forming-as-process is primarily a matter of positions and negotiation (The National Democratic Institute (NDI) and the Oslo Centre for Peace and Human Rights 2015: 45): arguably, the centrality of negotiation is the vital distinction between coalition and collaboration writ-large.

In *we are environments for each other [trio]*, the negotiation is towards 'finding a way',[10] something that cannot be fully mapped-out because the materials and techniques only emerge during performance as opportunities presented by the contingencies of the feedback system. The players begin the piece with no musical materials, no melodies or harmonies, only nascent diagonals in the form of strategies for engagement. The coalition is agreed in advance as a principle of performance, but only formed through negotiation during the moment of performance. Even though the seeds of wayfinding have been sown in the development of technique across previous instances of practice, the specific actions needed to satisfy the coalitional goals can only emerge in the moment of performance and are negotiated through the performers' choices in response to contingency of the feedback system.

FROM COLLABORATION TO ENTANGLEMENT (COALITION)

Embodied technique has thus far been signposted as both an epistemic region and a coalitional principle. We now turn our attention to the specific configurations of this embodied knowledge, tracing the thresholds across which the practice developed, from initial experiments to an instance of live performance. During early workshopping of this project in 2019, Zubin and Mira approached the feedback system as collaborators – turn-taking, responding to perceived actions by one another, but acting from the discrete technical positions of experienced performers. Much of this approach was grounded in workshop frameworks proposed by Scott – in the form of verbal notations[11] (see fig. 1) that specified patterns of interaction, and in techniques developed and sedimented in earlier collaborative work (McLaughlin *et al.* 2021). What became clear in the process of building the system and its associated techniques was clarity that the emergence of coalitions in a live and responsive setting of material engagement is a far more interesting proposition for performance.

To reflect holistically on the structure of these entanglements, it is helpful to consider the various patterns along which players of musical instruments form technique. In the first instance, 'violin' or 'piano' technique is easily observed in certain postures and physicalities – the position of an arm as it draws a bow, or the suspension of hands across a keyboard – technique that is clearly mappable onto the constructed instrument.[12] Of equal significance to this practice are activities of listening and the aural imagination – perhaps only variably observable to spectators (or the video camera)[13] but that nonetheless form crucial lines along which technique can develop and become entangled. We will note three distinct 'patterns of technique':[14] (1) manual-somatic, referring to received and trained postures and movements that are mapped in the muscular-skeletal body, and the extensions of these physicalities that arise in experimental practice; (2) aural-attentive, referring to listening as a discrete mode of embodiment (after Oliveros 2005; LaBelle 2025); and (3) reflective-conceptual,

[10] See Tim Ingold on 'wayfaring' (Ingold 2008: 15).

[11] 'Verbal notation' is 'an approach to scoring that uses the written word, as opposed to symbols, to convey information' (Lely and Saunders 2012: xix).

[12] 'Constructed' in the sense of organology, the material-mechanical rather than the instrument as a cultural object.

[13] The 'invisibility' of sound presents challenges to the discussion embodied technique in sonic practices, which extend beyond music into other areas of performance-making – for example, Radosavljević (2023) notes efforts to 'locate the specific materiality of sound' within dramaturgical practices, implying a shift towards considering sonic agency as a means of 'switching on and off receptors in the human body', facilitating interaction (Eckersall *et al.* cited in Radosavljević 2023: 14).

[14] Also see Benjamin (2019).

referring to the naming and modelling of musical materials and the body schemas that are activated by these conceptual mappings. In any instance of live practice, these three patterns of technique are themselves entangled and co-constitutive, however, by alighting on each, we explore how they might become entangled between performers and through the material indeterminacy of the feedback system.

[Quotations and time indices within the following text refer to the video *Annotated Rehearsal Documentation 1*.][15]

Initial experiments presented several significant thresholds across which the development and articulation of an 'entangled technique' unfolded. One such approach was to notice how 'two techniques' [1:44] – one enacted by each player – could affect the feedback system in similar ways. Experiments in dialoguing with these similar techniques (passing them between the players) nonetheless presented high degrees of material indeterminacy in the system. An effect produced in one instance might not be replicable in another; actions were difficult to reliably map onto outcomes, and thus we found that individual performance techniques did not sediment, as they might have been expected to in other collaborative situations. Rather this creates a 'temporary inequality' (Citton 2016: 170) in the power relationship between musicians and technology/instruments that opens a diagonal.

THRESHOLD 1: LISTENING HAS BECOME ENTANGLED

> *MB: 'The sounds that you make cause me to choose different pitches… we sort of search on each other's listening'* [5:52]

A first technical entanglement could be characterized as a shift from 'listening-to' to 'listening-through' one another's aural attention. A relinquishing of discrete listening roles in favour of a mutually reinforcing approach had the unanticipated result of activating the system in livelier ways, which Scott remarked created 'something that sings' [3:17]. We came to refer to these events as 'blooms' in the activity of the system.

THRESHOLD 2: THE TRACEABILITY OF TECHNIQUE HAS BECOME ENTANGLED

> *SML: 'So I can't tell now if that's what Mira's doing or what [Zubin] is doing with the left hand'* [8:35]

In performance, there is ambiguity between cause and effect. When the resonance in a string shifts to bloom into a new harmonic, neither performer can be certain how they caused this, who was more responsible, or if change has resulted from a particular characteristic of the system on that particular day. What is certain is that both players are pushing the system to points of instability, laden with potential energy that then is released in points of bloom, although the direction and type of release cannot be anticipated or directed, only diagonally followed.

THRESHOLD 3: HAPTICS HAVE BECOME ENTANGLED

> *ZK: 'Strangely, I can feel [the string activate] in my hand before I can hear it.'*
>
> *MB: 'Which is really what bowing a string instrument feels like… it's a tension.'*
>
> *ZK: 'Yeah, it's like the string is catching.'* [9:00]

An entanglement of aural-attentive technique in turn gave rise to a surprisingly mutual manual-somatic approach – an orientation towards a particular 'catch-and-hold' of resonance by the magnet and bow, which we later identified as the focal technique of the practice. Building on Scott's provocation of 'working "with" the string, its material predilections' (McLaughlin 2017), we have prioritized this haptic togetherness that seems to activate still stronger agencies from the system – reflecting Pickering's description of human and material agencies as 'mutually and emergently productive of one another' (1995: 56).

PHENOMENOTECHNIQUES OF ENTANGLED PERFORMANCE

Returning to questions posed at the outset, this final section examines the coalitional formation of technique in a live performance, adopting Gaston Bachelard's notion of 'phenomenotechnique' (Rheinberger 2005) via Spatz's (2020) writings on embodied

[15] The video *Annotated rehearsal documentation 1* can be accessed at Benjamin (2026b).

theatre practice. Bachelard's framework aimed to acknowledge the 'epistemic function' of technical objects in the everyday activity of laboratory researchers (Rheinberger 2005: 315), where he argued epistemic phenomena are not merely found, but 'materially instructed' (Bell 2021: 536). Bachelard highlights the relationality that is elicited between method and phenomenon: 'one must know the *method of knowing* in order to grasp the *object to be known*' (cited in Rheinberger, 2005: 321). Turning towards embodied research, Spatz (2020) draws an analogy between Bachelard's 'technical objects' and a performer's embodied technique – an interpretive leap that is enabled by the position that technique represents 'transmissible and repeatable knowledge of relatively reliable possibilities afforded by human embodiment' (Spatz 2015: 16). It is this 'relative reliability' and therefore 'transmissibility' (ibid.) of technique that is core to Spatz's application of phenomenotechnique.

Given that the relative *un*-reliability of our entangled technique has been suggested as the threshold for our material–epistemic coalition, we are motivated to question on what grounds (if any) our coalitional negotiations might form the basis of a claim on 'consensual reality' (Spatz 2020: 113, after Middleton and Chamberlain). Førsidal (2024) notes the difficulty of circumscribing limits where performance is organized around 'shared negotiation within the network [rather] than the precise rendition of carefully sculpted musical events in time' – suggesting instead a relational approach that accommodates variability, which Knorr Cetina identifies as a core feature of 'epistemic practice' in which objects of knowledge 'have the capacity to unfold indefinitely' (2001: 181). The aim of our phenomenotechnical account, then, is not to enable a given instance of practice to be replicated (or imitated), but to communicate the foundational patterns of technique by which the necessary intersubjectivity may be variably instantiated – 'a continuous movement of differential reproduction rather than a movement toward a preconceived end' (Bachelard cited in Rheinberger 2005: 323).

Phenomenotechnical writing, in conjunction with 'illuminated' video (Spatz 2021), affords some significant openings through which to articulate patterns of entanglement in *we are environments for each other [trio]*. First, it allows us to articulate detailed technical responses without codifying them; in other words, we can discuss techniques that resist sedimentation by highlighting flows of engagement and relationality, while leaving the phenomenology of the performance – its specific sonorities, temporalities, and aesthetic references – open to instantiation.[16] Second, the phenomenotechnical mode allows us to articulate certain patterns of technique that are deeply embodied – that is to say, difficult to observe for spectators or video cameras. Consequently, we tend towards metaphorical and analogical descriptors, which often characterize the language of musical technique, appearing in specialist pedagogical treatises aimed at advanced students and professional musicians.[17] Three phenomenotechnical articulations follow, corresponding to the three patterns of technique proposed above. Each also refers to a section of the video, 'three phenomenotechnical illuminations',[18] which offers intersecting perspectives on a single excerpt of live performance.

[16] We take inspiration from the tenor of Spatz's own phenomenotechnical writing (see Spatz 2020: 105).

[17] For example, Heinrich Neuhaus' influential *The Art of Piano Playing* draws on a vast range of metaphors to describe piano technique, from motors, to acting on stage, to petrification, to comparisons to the periodic table (1973: 114–15).

[18] The video *three phenomenotechnical illuminations: we are environments for each other [trio]* can be accessed at Benjamin (2026a).

PHENOMENOTECHNIQUE 1: MANUAL-SOMATIC

The fulcrum of this technique is the 'catch-and-hold'. Magnet catches string, bow catches string – the hands gather the sound and attempt to sustain it: frictious, resistant, pulling, suspended; a rolling object to be maintained but never interfered with; an ember to be stoked. Tips of fingers, palms, forearm tendons hold, coax and grasp at edges.

Pianist: the pianist holds the head of the magnetic resonator with one hand, allowing the other to either mute strings or control the levels at the mixing desk. Hand and magnet hold a tenuous balance – a threshold of tolerance between losing the 'catch' and colliding with the string. The appearance of (near) stillness masks an intensity of holding – a narrow oscillation of forces. Either the movement of the resonator or the amplitude generated by the violin can allow

a new sound to catch. This new sound is felt in the fingers grasping the resonator before it is heard. When muting the string, the resonator's power – fed by its own feedback loop and by the violin – is resisted by the pianist's direct bodily contact. The vibrations through the finger allow an even more precise tactile perception of the system: when the sound is firmly sitting, and when it wants to move.

Violinist: the violinist stands in the 'bow' (the curved side) of the piano, to allow for maximal visual and aural contact with the piano and pianist. Bow catches the resonance, spins a narrow oscillation – exploring string circumference, angling, maintaining a balance of aggregates. A counter-intuitive responsiveness inverts the long-trained relationship between effort and effect: a surface contact of the bow on the string activates a richness of tonal colour; a depth of contact seems to suffocate the system.

A tenuous resonance instructs a tenuous embodiment. The system is encountered as an enormous object, shielded from view. Its shapes (directionalities, agencies) can be apprehended only as if by grappling across a dynamic surface – sensing (moving with, being moved by) its movements. The 'catch' is a threshold: we can initiate resonance, but doing so reveals a coming tide that sweeps us along. Our bodies must remain receptive – holding and sustaining, giving way – if a 'bloom' is to emerge. The entangled negotiation is embodied, the connection felt/heard and surfed.

PHENOMENOTECHNIQUE 2: AURAL-ATTENTIVE

Can the source of a sound be traced? Is there a pattern of sounds and actions? *Can I hear what you're doing?* Is there a potential for a bloom? Listening scans across layers, identifying footholds, grappling points, cessations. A selective and impressionable attention – honing in on objects of momentary concreteness. This is listening that seeks relationality, joins in another's listening, steers action. We are also listening to one another's strategies: tuning in, scanning, matching, relating, deviating, resting. There are moments when we've both understood what we're looking for – understanding what potential is there within a single string, and examining it from multiple perspectives until we've exhausted that potential. We hear the string reach a point of stability, a valley that requires energy to climb out of, or a point of instability, the top of the mountain where the slightest variation will push it in new directions. A violin pattern that searches through pitches, or repeats a specific harmonic encourages the pianist to wait and see how the system responds. A more static pattern on the violin encourages the pianist to search out the harmonics themselves, or to change strings, creating change and difference through a more foreign relationship between the chosen string and the violin pitch. Out of this dance of pulling towards and away from the system, emerges a larger structure.

PHENOMENOTECHNIQUE 3: REFLECTIVE-CONCEPTUAL

A, 3:2, third partial, minor third, 11º, tuneable interval, difference tone, harmonic. Names like these excite the aural imagination and activate body schemas. A familiarity with the harmonic series underpins this technique. Equal divisions of vibrating lengths manifest materially in our instruments and afford frameworks for the imagination to construct pitch spaces. Hinging on these devices we can lead one another into new territories, constructing a local and temporary map of the unfolding terrain – of the system's behaviour and our preferences of the day.

Pillars of sound emerge that delineate an hour or more of music. An archive of violin techniques is developed within the performance, which will likely need to be re-developed for every subsequent performance. The geography of the piano's resonances must be learned anew, and each piano reacts to the system in new and unanticipated ways. The playing is an act of exploration of this new geography – using some of the same tools but resulting in a journey that can never be planned.[19] A growing bloom invites us to set aside mapping, to work 'continuously and responsively as co-producers' (McLaughlin 2022: 217).

[19] Kiefer *et al.* (2025: 12) describe 'playing methods [that] can be compared with sailing a ship' – a metaphor that we have frequently drawn on as we grapple with co-navigation across the fluid and dynamic 'sea' of the feedback system.

WHAT WE CARRY FORWARD

Six years into our practice of *we are environments for each other [trio]*, the system continues to evade sedimentation in the conventional sense, but an approach has been established. We arrive in the performance space, 'meet' the piano, put in place the hardware and set out to attune ourselves to the system using Scott's score-fragment training modules. In the moment of performance Zubin and Mira approach the entangled practice with fresh ears, few expectations, and the agreement to engage with technique-in-formation. The specific technique that we carry forward from this practice is that ability to enter into an intersubjective negotiation that is the basis for coalition-forming. By reflecting on the structure of this knowledge in the phenomenotechnical mode, we suggest some intersecting frameworks through which performers might foreground those embodied responses that are 'invisible' to spectators or the video camera, but that nonetheless form crucial structures within the practice. The coalitional approach that has arisen through this practice proposes a model for performers to engage with embodiment as an epistemic object of relational music, and indeed wider performance practices in music and sound.

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