How Musical Is Dog? - An Interspecies Improvised Musical Collaboration

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ABSTRACT

This paper outlines an interspecies improvised musical collaboration with Razzly the dog that utilises a pre-existing gestural DMI, the AirSticks, inside a fetch ball. The evolution of the collaboration across three significantly different performances over a year and across two cities is described, along with an outline of the mappings created. Through the lens of my experience as an improviser, instrument designer and dog guardian, and drawing from research into dog cognition, animal liberation, human-animal interaction, animal-computer interaction, zoömusicology and posthumanism, I explore the phenomena that is dog-human play, and draw comparisons between it and collaborative musical improvisation. Through the act of turning play into a musical performance, I discuss creativity, agency and consent, focusing on the social, collaborative and physical aspects of musicking, as opposed to the sound making itself, in an attempt to understand the way dogs (starting with this particular dog) might use play, ritual and perhaps even music-making, to navigate the world and connect with humans.

Author Keywords

animal-human interaction, interspecies improvisation, gestural DMIs

CCS Concepts

•**Applied computing → Sound and music computing;** Performing arts; •**Human-centered computing → Gestural input;**

1. INTRODUCTION

As I sit down to write this paper, I notice Razzly, my almost 4 year-old Koolpoodle,[1] looking at me from his curled up position in the corner of the room post-walk. I feel he is often confused by what I'm doing on the laptop. What a strange posture, hunched over this perfectly sleek 'non-biteable' object, moving my fingers on it's flat hard surface,

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[1]quarter Australian Kelpie, quarter Koolie and half Poodle

making clicks and taps and the occasional sigh of frustration at not finding the right words. Upon hearing a sigh, Raz, as he is often referred to, or Razzle, Razzle Dazzle, Razzamatazz (he responds to all) would walk over, sit leaning against my leg and comfort me, noticing some sort of distress, and suggest, "wanna have a play?"

In this paper I will discuss the interspecies improvised musical collaboration with Raz that developed through our plays. The evolution of the collaboration, across three significantly different performances over a year and across two cities will be described, along with the mapping decisions made in utilising a pre-existing gestural DMI inside a fetch ball. Through the lens of my experience as an improviser and instrument designer, and drawing from research into dog cognition, animal liberation, human-animal interaction, animal-computer interaction, zoömusicology and posthumanism, I wish to explore the phenomena that is dog-human play, and draw comparisons between it and collaborative musical improvisation. In the spirit of John Blacking's 1973 *How Musical Is Man?*, this is not a scholarly study of canine musicality, so much as an attempt to reconcile my experiences of interspecies improvisation [4].
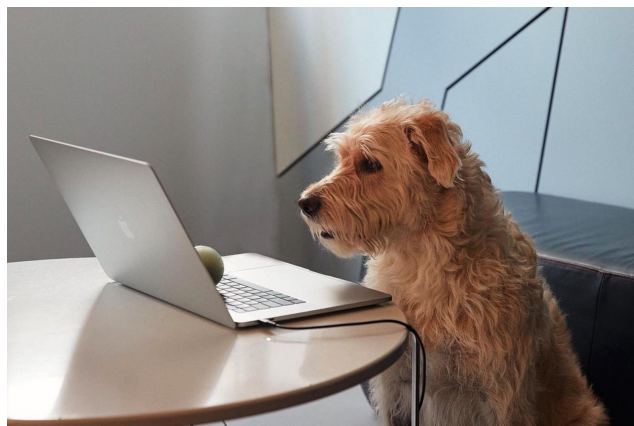

Figure 1: Promo Shot of Razzly for Our Premiere Performance.

As leading zoömusicologist and composer Hollis Taylor suggests, in this field of research, where science meets the arts, we must "deal with generalities and replication... and incline towards particularities and one-offs" [29]. With this in mind, I will reference previous research on dog cognition, musicality and play, but focus on describing in words (and short videos) the unique experience of working towards and playing these particular gigs, with this particular instrument, with this particular dog we call Razzly.

Dog cognition researcher and author Alexandra Horowitz suggests that "naming makes something someone: it personalizes them" [16]. "To give an animal a name highlights

the differences between subjects (individuals) being considered only as members of a group (species)" [17]. Horowitz emphasises that dogs are individuals, each with different talents, but all with incredible facility for cooperative communication, reading intention and solving the types of problems that involve humans [15]. She urges more dog guardians (my preferred word to masters, owners or parents) to let dogs be dogs and for researchers to investigate their own dog's behaviour at home [17], where play can be studied in a safe yet varied and cognitively challenging environment [28].

I take this as permission to lean into my experience of collaborating with Razzly, and describe him as a collaborator in detail, as I would any human collaborator. This personalisation (or 'caninalisation[2]') may help us gain a better understanding of dog's relationship with music, play and cognition (or "dognition" [14]), and of our human selves, as "our understanding of the human depends on our conceptions of [nonhuman] animals" [23].

But my drive to share this story of our creative collaboration goes far beyond simply gathering more knowledge about ourselves as humans. Dogs and humans are, as pioneering ecofeminist and posthumanist Donna Haraway states in her second posthumanist Manifesto,[3] "constitutively, companion species" [13]. "Her [Haraway's] investigations around interspecies communication and collaboration are realized specifically through terms of performance as she and her dog, Cayenne Pepper, work together to produce a successful event" [6], in her case, dog agility shows. Haraway states in her *Companion Species Manifesto* that the book "is a personal document, a scholarly foray into too many half known territories, a political act of hope in a world on the edge of global war, and a work permanently in progress, in principle" [13]. In the spirit of her work, and perhaps as a political act, I have included Razzly as a co-author here.

2. BACKGROUND

2.1 Interspecies Musical Improvisation

Interspecies musical collaborators Hollis Taylor [29] and David Rothenberg [24] have improvised and composed highly evocative and complex music with birds[4] and whales[5] respectively for decades, mimicking and reacting to their non-human collaborators in inspired powerful interspecific performances. Rothenberg compares cross-cultural improvisation—where collaborators may not speak the same language—with interspecies improvisation, where "spontaneous creativity in music can dare to make the leap between one animal and another" [24]. Furthermore, he remarks that "interspecies improvisation may be a promising way to communicate with creatures with whom we cannot speak" [24]. Rothenberg's focus, like most "interspecies musicians," is on sonic "intra-actions" or a "dynamism of forces" [2] with non-human animals, whose natural song has inspired composers and philosophers for millennia [10].

Though 'singing' dogs are not usually considered in this category of animal 'muses,' studies show that dogs are highly-developed in discriminating between different pitches [1], with there being no shortage of videos on YouTube of dogs holding notes.[6] Furthermore, the effect of listening to mu-

sic on dogs is "quite mixed" [27]. In this paper, it is not Razzly's listening or vocal talents that I am interested in sharing, but his passion for and creativity during play.

2.2 Dog Play as a Dance

Dogs, indeed, are a unique species through which to examine play [28]. And furthermore, dog play can easily be viewed through the creative practice lens of dance [16, 20]. Indeed researchers such as Shapiro, in studying the physical behaviour of their own dogs, note that "for [his dog] Sabaka, meaning consists of and is known through bodily experience. To understand the complex, intimate, and wonderful *choreographies*[7] of that [dog] world, it is helpful for an investigator to assume a posture of bodily sensitivity to it—to kinesthetically empathize" [25]. Considering dogs are clearly more wired for physical play or 'dancing' than utilising their vocal chords and lips, many researchers focus on bodily communication as an inspiration for interspecies collaboration [7]. Building on Shapiro's "kinesthetic empathy" [25], Warkentin developed a "praxis of attentiveness" [32] in connecting physically with animals. "The kind of attentiveness we are concerned with here involves one's whole bodily comportment and a recognition that embodiment is always in relation to social others, both animal and human" [32]. In playing with Raz, this attention to my body 'language,' along with an acute attention to the space around us, is key to our collaborative play—"the task is to create the space within which a response can emerge or an exchange co-evolve" [5]. This nonhuman turn—allowing animals to 'have their say'—is a practice that has recently been increasingly adopted in human-animal interaction design, as participatory design practices are more regularly deployed in the field [8].

In the field of creative improvisation, whether music or dance, these concepts of turn taking, attentiveness and providing space are key in any truly successful collaboration. Noticing that these and other elements of musical improvisation were inherent in my plays with Raz, and having a pre-existing gestural DMI, the AirSticks, lying around the house, was always going to lead to some play-turn-dance-turn-sonic intra-actions.

2.3 The AirSticks

The AirSticks have been documented in previous NIME Proceedings [30], so I will keep a technical description to a minimum here. The version of the device used with Raz is what we refer to as the AirSticks Box—a wireless device the size of fun-size Mars bar that can be worn or placed in objects, like a fetch toy.[8] The device connects via Bluetooth to a laptop running our receiver app, which translates the gestural data, in the form of linear acceleration and absolute orientation, into useful OSC and MIDI information. For our performances, I created mappings in Ableton Live[9] which I will elaborate on later in the paper.

2.4 Animal Computer Interaction

Since interaction designer Clara Mancini wrote her *Animal-Computer Interaction Manifesto* in 2011, calling for the fostering of the "relationship between humans and animals by enabling communication and promoting understanding between them [through] technology that allows companion animals to play entertaining games with their guardians or

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[2]my made up term in the spirit of many new dog specific terms in the field

[3]her two manifestos are 'A Cyborg Manifesto' (1985) and 'The Companion Species Manifesto' (2003)

[4]https://youtu.be/BE53KQSEiIw

[5]https://youtu.be/807LSbW28Po

[6]https://youtu.be/3SZCMDlmO0c

[7]my emphasis

[8]In our case the Chuckit! Ball Max Glow

[9]https://www.ableton.com/en/live/

enables guardians to understand and respond to the emotions of their companion animals"[19], very little work has been done in the field of creative or musical animal computer interaction. Exceptions to this may be the design of digital musical instruments for grey parrots [11], or some dogs hijacking iPad games.[10] [11]

The Global Pet Toys Market, of which dogs make up almost half, reached eight billion US dollars in 2022, and is expected to hit thirteen billion US dollars by 2030,[12] with a growing number of tech toys hitting the market, some utilising cameras or other sensors to maintain attention during self-play.[13]

Figure 2: The AirSticks Box.

3. AN INTERSPECIES COLLABORATION

3.1 Who Is Raz The Dog?

I'll try to keep this short, but like most dog guardians, I could write for days about this special little guy, particularly as he entered my life as a puppy in the height of lockdown in Melbourne, Australia. I never had a dog growing up. This gave me a child-like fascination with this tiny creature. Also, being a single non-parent musician, with no tours for the foreseeable future, it gave me a type of responsibility I had never encountered before, and someone to focus on, someone who could give me structure. Someone to try to understand. Most of that understanding has come out of play and long off-leash walks.

On these walks, Raz balances seeking guidance with exploring his spatial freedom with aplomb. He has a keen road sense, so feels comfortable walking well ahead, turning back to me within each block to make sure he is leading us in the right direction. On bush walks, he identifies the most unclear of paths. On slow walks he rarely heals, but on bike rides, he runs alongside like a champion, excited that I've finally picked up the pace to his liking.

When we wrestle at home he vocalises, and play bites with confidence and gentleness. If he wants to play rougher, he goes grabs his rope, which is as old as he is, showing his dedication and care to the game of tug and the tools we use

[10] https://youtube.com/shorts/9RQi-Xc7yvc?si=H_HfxHLi-yZCx-eq
[11] https://www.youtube.com/shorts/F8H5NlxipT0
[12] https://www.datamintelligence.com/research-report/pet-toys-market
[13] http://www.startplaydate.com/

in play. He's hard to beat, but doesn't matter how razzed up he gets with his head banging and paw stomping he is lighting fast to let go of the rope on the slightest utterance of 'out!'

He loves to fetch. The rope, a ball, a frisbee, a big stick. If we are near water, he beckons for it to be thrown in, and then cautiously navigates his way in if he hasn't been in before. But once the depth has been assessed, months later he will remember the best way in. He loves the rock pools, and the sand, and has developed a game of self-fetch, dropping the ball and watching the tide take it back out, or digging a hole from which to launch the ball backwards between his legs.

And he loves to catch. A ball, a frisbee, and treats. The tiniest treats from metres away. Once the ball is in his mouth he chews gently, drops it, and catches it again off the first bounce. But of most interest is where he drops it. Playing a game of fetch with Raz often feels like I might be the one doing the fetching. Sure with some command like 'closer?' he may bring it to me, but he navigates spaces and social relations through where and when he drops the ball. In certain moods he insists on dropping the ball to other dog lovers at the park, kids in particular. At the times where his focus is on us really playing the game, his choice for dropping the ball can communicate joy, fatigue or humour.

He can also chill though, laying his head against the sound board of an upright piano when Chopin is being played or just hanging under the table at the bar when a band is on, waiting for some food to drop. His relaxed and curious demeanor around all people — and cats, and *most* dogs — and his appetite for play, inspired us to combine his love for fetch, with my love for improvised music.

3.2 A New Instrument?

During the development of the latest AirSticks, the team at SensiLab began gravitating towards making mappings that centred around the absolute linear acceleration of the device, creating instruments I've affectionately started referring to as 'glorified shakers.' The 'Energy' parameter (as the team refers to it) can be adjusted to bring immediate sonic response, with the dynamics also controlled by this parameter. It can also be quantised to a pulse. The absolute orientation can then be mapped to change filters, pitch and effects.

While exploring an FM synthesis mapping in my living room during lockdown, wearing the AirSticks on my wrists, Raz came over to me with his old rope for a play.

'Rope Play'
https://youtu.be/9vpwE587ziI

As enjoyable as it was to sonify or 'musify' [18, 33] this play, half considering what sounds I could make and half focusing on playing tug, it didn't really feel like Raz had much control or agency over the sound, with the devices strapped on me and not him.

For the next sonic play, leading up to an upcoming performance I had committed us to do in SensiLab post-lockdown, I decided that perhaps Raz should wear the device. After trying his tail and collar, I settled on strapping the device to his front leg.

'AirStick on Front Leg Play'
https://youtube.com/shorts/y7DguEzh88Y

This brought up some concerns about consent, with Raz not being able to stop making sounds unless he stopped

moving. Though I was reluctant to put our 3D printed custom-electronics device in a dog toy and have people throw it around a room and Raz chew on it, not a single device has been harmed since squeezing one into a dog fetch ball almost 2 years ago. This new design gave Raz more agency over how long to engage with what we may call a new instrument, perhaps?

'AirStick in Ball Play'
https://www.youtube.com/shorts/dF-CiZBwZWI

With this set up I felt ready to properly collaborate with Raz on our first upcoming performance at our lab's open day.

Figure 3: Ending of Our Premiere Performance.

3.3 The Gigs

3.3.1 The Lab

I took months to prepare for this first gig, feeling concerned that the performance would appear like a gimmick or worse, dog exploitation. I wanted people to get an idea of who Raz was, for Raz to feel like we were working together on something special, and to feel like Raz was contributing, or more so, just being himself, with me avoiding the use of vocal commands.

'Except From The Lab Show'
https://youtu.be/-zP8t-Kj0a8

I decided to film all our 'rehearsals' and to present them as a rolling 'triptych' before, during and after the performance (see *The Lab Show* link above). These rehearsals included walks, plays, wrestles, car drives, naps and a groom (Raz got one of his full back mohawk haircuts for the gig). Feeding the audio from the film into the AirSticks, I decided to start the piece by manipulating the audio through the ball's movement, while enticing Raz to play a gentle tug game with it. I automated Ableton to cross-fade different sounds and parameters within the 12min play—basically changing the way the ball would react to movements over the course of the piece. In the performance, as I began hearing less of the film audio manipulation and started hearing that the ball was now activating a marimba sound, I finally threw the ball to Raz, allowing him to take charge of the instrument. The game in the piece for me was to then pull out two other AirSticks balls with different sounds and give Raz a choice of which one to play, based on its sound, or probably more so its 'feel.' All three balls, of different sizes, shapes and materials, were automated to change the way they reacted over the course of the piece, but always worked with the other sounds—one percussive, one melodic and one playing lower registers. As the crowd began to film the performance for social media, Raz began to invite others in the semicircle which had formed around us to get involved in the game, gesturing for audience members to throw the ball as he dropped it at their feet. Compositionally building to a drum'n'bass chaotic section and then cross-fading back to the audio from the film still playing behind us, I gestured for Raz to join me back on the couch to finish the piece.

Figure 4: Raz at the Melbourne gig

3.3.2 The Improvised Music Night in Melbourne

For the next show I wanted to play drums, for Raz to move more freely around the space, and for the sounds to be purely made up of live real-time sampling, looping and manipulation of the acoustic kit. Having played at this particular improvised music night many times before, I knew the audience would be open-minded and that the space would allow Raz to interact more easily with the audience, particularly with me being 'stuck' behind the drum-kit. What worked further in our favour was the audience's natural inclination to sit on the floor in a semi-circle around the drums (see *The Improvised Gig in Melbourne* link below). The piece began by inviting Raz to sit next to the drum-kit by squeezing a 'acoustic' squeaky dog toy and luring him to play tug with it, while improvising with the other hand and feet. After sampling the squeak, we then moved onto playing with the AirSticks ball. As soon as Raz had full control of this new ball in his mouth, he was off into the crowd which freed me up to improvise on the drums, occa-

sionally resampling new percussive activity through loops and granular synthesis controlled via hotkeys in Ableton.

'Excerpts from The Improvised Gig in Melbourne '
https://youtu.be/JZWxVud4l8A

Raz seemed to love this set up, strutting proudly around the room, choosing different people to drop the ball to, most of who got a chance to improvise a phrase or two with the ball in hand before throwing it back towards Raz. As we started looking for a way to end the piece, I noticed an audience member winding up for a high throw. As Raz leapt up I decided it would a fitting ending, marking the catch with a bass drum hit and muting Ableton.

3.3.3 The Improvised Music Night in Sydney

For the last show I'll outline here, I wanted to play a 35min drum composition while wearing AirSticks (under gloves on the back of the hand so that all wrist movement was tracked), for Raz to play a 'melodic' part freely in the audience and for me to interact with his sonic part, not his physical self. Like the previous gig, I knew I would have an open-minded audience, with the organisers personally inviting me to perform with Raz.

'Excerpts from The Improvised Gig in Sydney'
https://youtu.be/G5k9P4mPluc

Figure 5: Raz at the Sydney gig

The space was much bigger than any we'd played in before, with the audience seated in chairs and comfortable couches (see *The Improvised Gig In Sydney* link above). The piece began with a standing AirSticks solo beside the kit, rolling Raz's AirStick toy ball with my feet. I had pro-

grammed the sound of the worn AirSticks to cross-fade with AirStick ball, as if the sound was being transferred from me to him. As soon as the cross-fade was complete, I kicked the ball and Raz went into the audience among the chairs, activating sounds that would change and 'work' with whatever I was doing with the worn AirSticks and drums. For one section, I programmed howling sounds to activate if the ball was left alone for more then 10 secs, for another, samples I had recorded of Raz barking and vocalising while playing layered with orchestral percussion hits, and for another, bass-lines synchronised to the tempo of my worn AirSticks. I basically didn't see Raz for most of the piece, just hearing the intensity with which he was playing amongst the audience. I mapped out the ending in a way that would allow me to play the AirSticks for the last few minutes without drums, giving me a way to get off the kit and go summon Raz back to near the drums for the ending.

4. DISCUSSION

The interspecies musical collaboration laid out in this paper clearly sits apart from those created by other 'acoustic' interspecies musicians mentioned earlier [29, 24]. Raz's involvement in this more-than-human sonic collaboration, "as the anthropocentric 'othering' of non-humans gives way to a concept of a more-than-human sociality of sound" [31], is not sonic itself, but instead his 'natural' play is merely sonified (through the use of motion sensing technology). "Bodies are at the core of our experience, we live our lives as embodied creatures—feeling, sensing, thinking, and acting through the body—and our relationship to space, place, landscape and others is inescapably shaped by the kinds of bodies we have" [9]. Raz uses fetch toys to navigate space and relations with others. He uses these 'toys,' like we use musical instruments, to express himself in everyday life (and now in concerts), making choices based on his mood and preferences. The latest ball found at the park is often the go to, but he returns to certain ones that lie around the house at his discretion.[14] It was truly fascinating to see him often beckoning for the AirSticks ball at home, which I would place up high to avoid being played with outside our rehearsals, in an attempt to reduce the risk of it being damaged. Occasionally he would take it out of my bag if I was too complacent in hiding it and invite play. There was a ritualistic association with the AirSticks ball that usurped the sound it could make—sound coming out of speakers spatially displaced from the physical action. Indeed many humans would pick up the AirSticks in workshops or demonstrations and struggle with this disembodied sound phenomenon, so it would be tough to expect a dog to understand the connection between their movement and the music coming out of the speakers. But the ritual, the ceremony, the social gathering, the attention, the focus given to this particular object in a place where people congregated is something he definitely seemed to understand, perhaps? And as Haraway reflects on her adventures with her dog, Cayenne Pepper, "we are training each other in acts of communication we barely understand" [13].

Outside of better understanding one another, "play can improve welfare through self-reward, positive experiences, or social bonding... as evidence from interspecific interactions with humans suggests play increases familiarity, strengthens their relationship and may reduce agonistic interactions" [28]. Further, in a lab experiment, "when a dog and their handler were 'Playing' [sic] with a tug toy, cortisol [stress

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[14]Raz was actually given a found fetch ball by bar person after one of our gigs which became his favourite for the week.

levels] increased if this interaction was accompanied by commands, but decreased when play was more spontaneous" [28]. The choice to avoid using commands, particularly verbal ones that may influence the sonic output of the performance, seems to be supported by dog psychology research, but again, simply leans into the idea of letting dogs be dogs [17], or more generally, letting beings be beings.

These 'inclusive' and 'empathetic' decisions are easy to make within the context of musical improvisation, as the art-form is grounded in collaborative practices [3], with the principles in a true collaboration representing complementary domains of expertise [21]. The dog's expertise, in this case Raz's individual ability to catch, dance and interact with strangers in a ritualistic performance space, ought to be celebrated and foregrounded in human-animal interaction research [17]. Furthermore, as Haraway (2008) describes, only the physical act of play can "lure its apprentice stoics of both species back into the open of a vivid sensory present... so that both can learn the corporeal semiosis of cross-species trust and enter the open of risking something new" [12].

It is this trust and risk I wanted to share with others through performance. Playing is something Raz and I do most days, but the AirSticks ball and the sound it can generate turns our playing into an act of musicking [26], and an excuse to share it with an audience.

5. CONCLUSION

In this project, I used the AirSticks as a tool to bring the more-than-human into our sacred human performance spaces. In this paper, I used the project as a philosophical tool for exploring the notions of dog cognition, creativity, agency and consent. With humans causing more and more problems for ourselves, and worse, for non-humans and the entire planet we all share, this paper is an opportunity to celebrate a non-human animal, in this case Razzly the dog, and the phenomena that were his first three gigs on his AirSticks ball of many to come.

6. ACKNOWLEDGMENTS

7. ETHICAL STANDARDS

In line with the NIME's Principles and Code of Practice in Studies and Interfaces Involving Animals, this 'study' not only satisfied all the ethical requirements for the research, but in fact encouraged best practices in involving animals. I use 'study' in quotation marks as these performances were never considered as experiments or formalised research. The intention of these performances and the rehearsals and development leading up to them, were always treated as a form of bounding and an extension of our daily interaction in the form of walks, pats, wrestles and plays. As an improvising musician and instrument designer, our public performances grew out of our play sessions at home. As a practice-based researcher, the description and reflections on the development and realisation of these plays into musical performances is something that is hopefully of interest to the NIME community.

Having brought Raz into my life and home when he was 7-weeks old over three years ago, I have an "intimate knowledge of the specific animal to be included in the study" [22]. As the guardian, I have provided prior consent before pursuing this practice-based 'study' [22]. Moreover, not only have I avoided preventing Raz from expressing spontaneous behaviour, I've encouraged it throughout our rehearsals and performances, using only positive forms of interactions both in playing and performing with him, but also in our general day to day. Raz does not show any signs of distress in music venues and gravitates towards the acoustic piano or drums when I practice at home. Volume of sound at rehearsals and performances is kept to a minimum, with again, no sign of distress from Raz. On one occasion a decision was made to take Raz away from the venue for a support act that was louder than anticipated. I have continued to "promote good quality of life for the animal after the animal's involvement in the research" [22].

8. REFERENCES

[1] G. Anrep. Pitch discrimination in the dog. *The Journal of Physiology*, 53(6):367, 1920.

[2] K. Barad. *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning.* duke university Press, 2007.

[3] L. Bishop. Collaborative musical creativity: How ensembles coordinate spontaneity. *Frontiers in psychology*, 9:1285, 2018.

[4] J. Blacking. *How musical is man?* University of Washington Press, 1973.

[5] J. Cheney and A. Weston. Environmental ethics as environmental etiquette: Toward an ethics-based epistemology. *Environmental Ethics*, 21(2):115–134, 1999.

[6] L. Cull. From homo performans to interspecies collaboration: Expanding the concept of performance to include animals. In *Performing animality: Animals in performance practices*, pages 19–36. Springer, 2015.

[7] B. D'Aniello, A. Scandurra, A. Alterisio, P. Valsecchi, and E. Prato-Previde. The importance of gestural communication: a study of human–dog communication using incongruent information. *Animal cognition*, 19:1231–1235, 2016.

[8] F. Fava, C. M. Soares, and M. Carvalhais. Playful design, empathy and the nonhuman turn. *Technoetic Arts: A Journal of Speculative Research*, 17(1-2):141–154, 2019.

[9] R. Fox, N. Charles, H. Smith, and M. Miele. 'imagine you are a dog': embodied learning in multi-species research. *cultural geographies*, 30(3):429–452, 2023.

[10] T. Gracyk. *On music.* Routledge, 2013.

[11] R. Gupfinger and M. Kaltenbrunner. Animal-centred sonic interaction design: Musical instruments and interfaces for grey parrots. In *Proceedings of the Sixth International Conference on Animal-Computer Interaction*, pages 1–11, 2019.

[12] D. Haraway. When species meet (minnesota, university of minnesota press).. 2008.

[13] D. J. Haraway. *The companion species manifesto: Dogs, people, and significant otherness*, volume 1. Prickly Paradigm Press Chicago, 2003.

[14] B. Hare and V. Woods. *The genius of dogs: discovering the unique intelligence of man's best friend.* Simon and Schuster, 2013.

[15] A. Horowitz. *Inside of a dog: What dogs see, smell, and know.* Simon and Schuster, 2010.

[16] A. Horowitz. *Our Dogs, Ourselves: The Story of a Singular Bond*. Scribner, 2019.

[17] A. Horowitz. Considering the "dog" in dog–human interaction. *Frontiers in Veterinary Science*, 8:642821, 2021.

[18] S. Mainka, A. Schroll, E. Warmerdam, F. Gandor, W. Maetzler, and G. Ebersbach. The power of musification: Sensor-based music feedback improves arm swing in parkinson's disease. *Movement Disorders Clinical Practice*, 8(8):1240–1247, 2021.

[19] C. Mancini. Animal-computer interaction: a manifesto. *interactions*, 18(4):69–73, 2011.

[20] M. Merritt. Dances with dogs: interspecies play and a case for sympoietic enactivism. *Animal Cognition*, 24(2):353–369, 2021.

[21] M. Minnis, V. John-Steiner, and R. J. Weber. Collaborations: Values, roles, and working methods (research proposal). albuquerque, nm: National science foundation. *Ethics and Values Studies Program*, 1994.

[22] F. Morreale, N. Gold, C. Chevalier, and R. Masu. Nime principles & code of practice on ethical research. 2023.

[23] M. Puchner. Performing the open: actors, animals, philosophers. *The Drama Review*, 51(1):21–32, 2007.

[24] D. Rothenberg. Interspecies improvisation. 2013.

[25] K. J. Shapiro. Understanding dogs through kinesthetic empathy, social construction, and history. *Anthrozoös*, 3(3):184–195, 1990.

[26] C. Small. *Musicking: The meanings of performing and listening*. Wesleyan University Press, 1998.

[27] C. T. Snowdon. Animal signals, music and emotional well-being. *Animals*, 11(9):2670, 2021.

[28] R. Sommerville, E. A. O'Connor, and L. Asher. Why do dogs play? Function and welfare implications of play in the domestic dog. *Applied Animal Behaviour Science*, 197:1–8, 2017.

[29] H. Taylor. How musical are animals?: Taking stock of zoömusicology's prospects. *Music Research Annual: a multidisciplinary journal of key issues in music studies*, 1:1–35, 2020.

[30] S. Trolland, A. Ilsar, C. Frame, J. McCormack, and E. Wilson. Airsticks 2.0: Instrument design for expressive gestural interaction. In *NIME 2022*. PubPub, 2022.

[31] M. Ullrich and S. Trump. Sonic collaborations between humans, non-human animals and artificial intelligences: Contemporary and future aesthetics in more-than-human worlds. *Organised Sound*, 28(1):35–42, 2023.

[32] T. Warkentin. Interspecies etiquette: An ethics of paying attention to animals. *Ethics & the Environment*, 15(1):101–121, 2010.

[33] D. A. H. Williams. Utility versus creativity in biomedical musification. *Journal of Creative Music Systems*, 2016.