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Dogs Produce Distinctive Play Pants: Confirming Simonet et al. (2001)

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Identifying meaningful vocalizations in nonhuman animals can help explain the evolution of human communications. However, non-speech-like sounds, including laughter equivalents, are not well studied, although they may be meaningful. In this pilot study, we investigate whether dogs perform a domain-specific pant during play by capturing vocalizations and behaviors during three interactions: training, play, and rest. Sixteen human and dog dyads participated in a session that included all three interactions in the same order: training, play, and rest. During these sessions, each partner wore wireless microphones that transmitted to a receiver and digital recorder, while a standalone digital camera captured video of the interactions. A one-way ANOVA demonstrated that dogs performed a domain-specific "play pant," which was almost completely absent during training and rest. These vocalizations mostly co-occurred with play behaviors (e.g., play bow) or tickling and cuddling. These preliminary findings suggest that a laugh-like play pant is used by dogs during play; future research should explore other interspecific acoustic signals as derived from conspecific signals and having communicative function.

Keywords: bioacoustics, dog communication, human-dog interactions, play behavior, play pant

Identifying meaningful vocalizations in nonhuman animals, particularly those that are communicative in nature, may help to explain the evolution of our own communications. Harmonic calls like birdsong notes are frequently investigated as analogous to human speech (Sainburg et al., 2019); however, non-speech-like sounds, including laughter equivalents, are less well-studied. One under-studied vocalization is the "play pant" – described as ranging from small, breathy panting to throaty grunts in chimpanzees (Matsusaka, 2004) to high-pitched chirps in rats (Panksepp & Burgdorf, 2003). These vocalizations co-occur with play in chimpanzees and rats and have been described as “laughs” or “laugh-like” sounds.

Winkler and Bryant's (2021) review of play vocalizations argues that play pants across species likely began as auditory byproducts of labored breathing during play, eventually becoming a sophisticated signal that may affirm affiliation and social cohesion. Similar to human laughter, play pants in nonhuman animals can signal harmless intent (Wood & Niedenthal, 2018) or encourage the continuation of current interactions (e.g., tickling, chase; Matsusaka, 2004). In this way, play pants and laugh-like vocalizations may function as affiliative and cooperative cues to conspecifics (Briefer, 2018). Relatedly, Rooney et al. (2001) found that humans often whispered at a high pitch when encouraging their dogs to play, though dogs only responded playfully about half of the time. Despite this, the antics of dogs in the home are often a source of human laughter (Valeri, 2006), and, anecdotally, some guardians report that their dogs understand and respond to human laughter.

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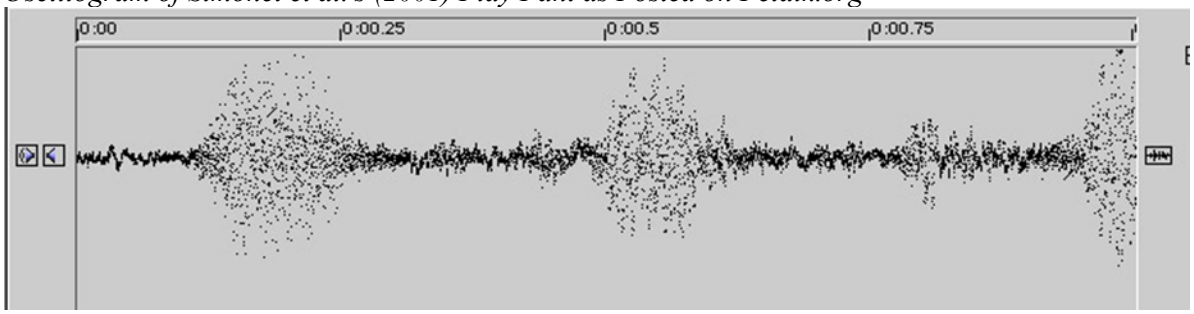
In 2001, Simonet et al. presented the first study of a domain-specific, canine play pant during intraspecific play interactions at the Animal Behavior Society Conference. During this presentation, Simonet et al. specified that this conspecific signal—which she later called "the dog laugh" during media interviews (e.g., "Dogs Laugh When They Play," 2001, August 7)—occurred exclusively during play. In 2005, Simonet et al. presented further data, using recordings from the initial study to assess the effect of playback on ambient noise at a shelter. They found that playback led to a 24dB decrease in peak noise level. Despite widespread media attention in following years (see Coren, 2009, for an example), Simonet and colleagues' evidence for the canine play pant was neither published nor replicated.

The purpose of this pilot study is to determine whether dogs perform a domain-specific pant during play, as proposed by Simonet et al. (2001). We recruited guardians and their dogs and sought to capture vocalizations from each across three interactions: training, play, and rest. We chose dog-human interactions to compare different states of focus (e.g., training vs. play); in addition, a final "rest" period provided an opportunity to capture the pattern of a post-exertion pant. We hypothesized that the target vocalization would be significantly more common during play than when engaged in training or shared rest with the guardian. We also hypothesized that if the pant is specifically indicative of a playful state, then it should co-occur with other play behaviors such as play bows, play slaps, loose bodies, and play faces. These and other behaviors have been documented in dog-dog play (Bekoff, 1974, 2015; Byosiere et al., 2016, 2018; Horowitz, 2009; Horowitz & Hecht, 2016) and dog-human play such as playing tug-of-war, chasing, or tickling (Horowitz & Hecht, 2016; Rooney et al., 2001). While research on more audible vocalizations such as play growling (e.g., Faragó et al., 2010) and play barking (e.g., Yin & McCowan, 2004) has been published, we are unaware of any work on a domain-specific play pant in dogs since Simonet et al.'s work in the early 2000s.

To identify vocalizations that may be a play pant, we used Simonet et al.'s (2005) description of the vocalization as a "pronounced breathy forced exhalation" (p. 1) and analyzed samples of her original audio recordings from a website she maintained (Petalk.org) with permission of her widower (R. Brost, personal communication, August 12, 2022). In the waveforms of the sample recordings on the website (Figure 1a), the play pant is identifiable by irregular bursts of amplitude. These are contrasted with a typical, rhythmic pant following exertion (Figure 1b) which does not contain the irregular bursts. We generated a spectrogram of each sample recording (see Figures 2a, 2b) to refine our definition of the target vocalization. Ultimately, we operationalized the target vocalization as including frequencies between 0 to 4 kHz; lengths between 0.1 and 0.3 s; large, irregular oscillating waveforms and high amplitudes; and the absence of harmonic bands (indicative of speech and tonal vocalizations, such as birdsong or wolf howls).

Figure 1a

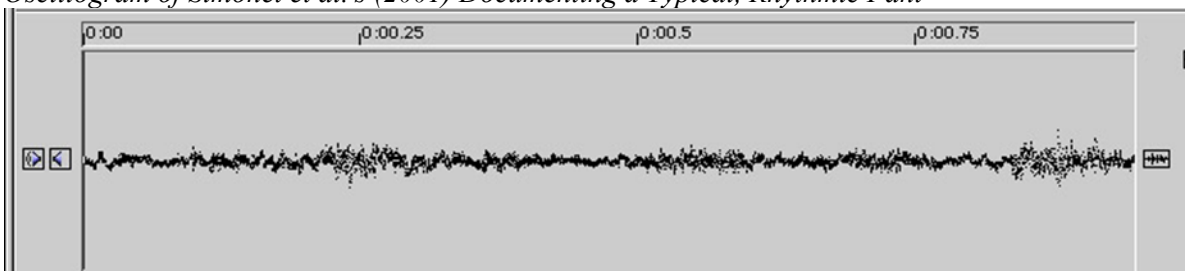
Oscillogram of Simonet et al.'s (2001) Play Pant as Posted on Petalk.org



Note. The irregular bursts demonstrate the presence of what Simonet labeled the "play pant."

Figure 1b

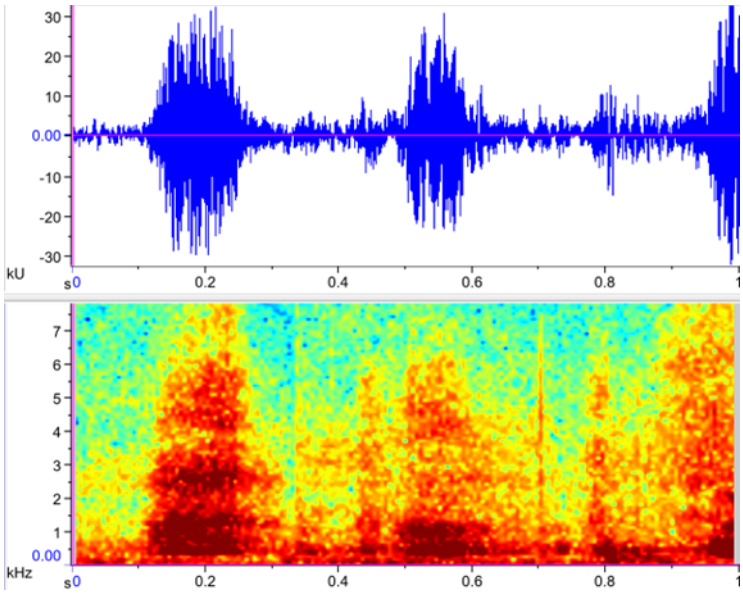
Oscillogram of Simonet et al.'s (2001) Documenting a Typical, Rhythmic Pant



Note. Waveforms and data from Simonet et al. (2001) are used with permission.

Figure 2a

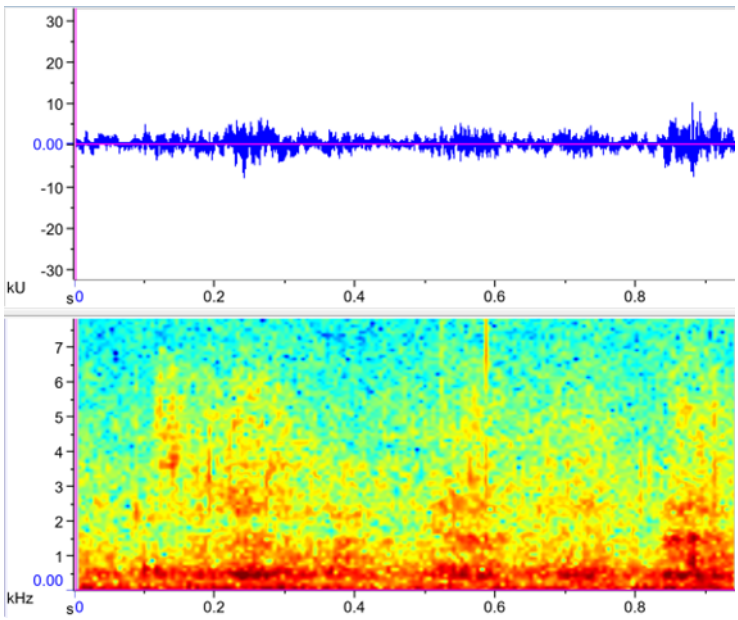
Spectrogram Generated from Simonet et al.'s (2001) Play Pant as Published on Petalk.org



Note. Notice the dark, undefined areas which align with the scattered bursts of the oscillogram and the presence of a forced, breathy exhalation, enabling identification of play pants in our sample.

Figure 2b

The Spectrogram was generated from Simonet et al.'s (2001) Typical Rhythmic Pant as Published on Petalk.org



Note. Notice the significantly fewer dark areas, marking the lack of forced, breathy exhalations Waveforms and data from Simonet et al. (2001) are used with permission.

Method

Ethical Note

This study was designed in accordance with the ARRIVE guidelines (Kilkenny et al., 2010) and reviewed by both the Institutional Review Board (protocol # 041-SB21-071) and the Institutional Animal Care and Use Committee (protocol # AC21-006) at Boise State University. All dogs were owned companion animals under private care, and all human subjects signed an informed consent and dog assent form acknowledging permission to audio and video record sessions. Consent was also obtained to use said recordings in dissemination of the research findings. The research team was trained in Fear Free handling techniques ("What Is Fear Free & Why Is It Important?", 2022) when working with the dogs directly. Guardians were also informed they could stop the session at any time if they felt their dog became stressed or dissented. Table 1 provides additional details regarding participant welfare and ethics approval.

Table 1

Study Data Regarding Participant Welfare and Ethics Approval

Variable type	Variable	This Study
Demographic data	1. Species – common name	dog; domestic dog
	2. Species – Latin name	*Canis familiaris*
	3. Sample size	15 assents; 1 dissent
	4. Sex of individuals	Male and female; neutered/spayed and intact; no females in estrous
	5. Age (mean + *SD*)	*M* = 6.97 years, *SD* = 4.07
	6. Names or identifying labels (where applicable)	See Table 2 for a complete list of participants
	7. Weight (where applicable)	N/A
	8. Inclusion / exclusion criteria	friendly to strangers; over 6 months old; not in estrous; basic manners training
Husbandry	9. Source of animals	owned dogs; living in human homes
	10. Housing for animal	dogs remained in their homes; no lab housing
	11. Enrichment provided	N/A
	12. Endpoint for animal	N/A
Experimental details	13. Experimental outcome measures	audio and video recordings & analysis
	14. Procedure / experiment type	• human consent obtained • human assent for dog obtained • dogs and humans fit with wireless mic pack • audio and video recording starts

Variable type	Variable	This Study
		• human "trains" dog (1-2 min) • human and dog change to play (5-7 min) • human and dog share rest (5 min, timed) • end recording, remove mic packs • human debriefed; dog petted and thanked • follow up email and cert. of completion sent
	15. Justification for protocol	Simonet et al.(2001) are frequently cited in the literature as demonstrating canine play pant ("laugh"). Evidence of the play pant has not been published or undergone peer-review, but it continues to be cited. The purpose of this protocol is to pilot methods to 1) validate or dismiss the original findings and 2) begin the process of further investigating the development, evolution, and function of the canine play pant.
	16. Welfare monitoring scheme (with / without citation)	No formal monitoring but dogs that were ill/ had no appetite were temporarily withdrawn from experiments and treated.
Participation criteria	17. Termination criteria for trial	Dog refusing food or being dull and unresponsive; dog falling asleep in stand
	18. Termination criteria for participation in study / Exit point	dog dissents by either displaying stress behaviors (lip licking, hiding, refusing food/play) or leaving the study area (often the backyard of the participant's home)
	19. Criteria for animal's assent or dissent to participate	Voluntary engagement in training, play, and shared rest with human
Administrative	20. Ethics approval reference	IACUC #AC21-006 IRB #041-SB21-071
	21. Data access	by approved request only at this time
	22. Funders	N/A
	23. Notes	N/A

Subjects and Housing

A total of 16 dogs participated in our study: six males (neutered $n = 5$, intact $n = 1$) and nine females (spayed $n = 9$, intact $n = 1$), ranging in age from 11 months to 14 years (Table 2). This study was carried out in either the participant's home or at local parks in Ada County, Idaho during the spring and summer of 2021. Though the dogs were not housed on campus (they remained in/returned to their homes), the dog assent form included referrals to local veterinary offices and basic care instructions should a dog present with injury during or after their data collection session. A prescreening questionnaire confirmed that all dogs met the inclusion criteria (over 6 months of age, not in estrous, friendly to strangers, with basic manners training). One dog, Tilly, did not engage in play. We documented this as dissent and did not include her data in the final analysis. Additionally, the audio for one session was corrupted, leaving us with $N = 14$ viable recordings. See Table 2 for a list of the dogs who participated in our study and their demographic details.

Table 2

Participating Dog Demographic Details

Name	Age	Sex	Breed	Favorite Play
Cardi B	3 years	F/S	Doodle	Fetch or Tug
Phoebe	9 years	F/S	Doodle	Disc (Fetch)
Tula	4 years	F/S	Pit Mix	Tug
Hepp	11 years	M/N	Border Collie	Fetch
Winnie	9 years	F/S	Corgi	Fetch
Tilly*	4 years	F/S	Lab Mix	Fetch
Piper	3 years	F/S	Golden Retriever	Tug
Pepper	11 years	F/S	Welsh Terrier	Fetch
Luke	11 years	M/N	German Shorthaired Pointer	Fetch
Taylor	11 years	F/S	German Shorthaired Pointer	Fetch or Tug
Jack	5 years	M/I	German Shepherd	Fetch or Tug
Nemesis	9 years	F/I	German Shepherd	Tug or Training
Toldi	3 years	M/N	Doodle	Stomp Feet
Thunder	14 years	M/N	German Shepherd Mix	Fetch (tennis ball)
River	11 months	F/S	Weimaraner	Tug
Sonny	1 years 3 mos	M/N	Pit Mix	Keep Away

Note. All information is based on guardian-provided data. Sex: "M/N = neutered male," "M/I = intact male," "F/S = spayed female," or "F/I = intact female." Breed and Favorite Play were provided by guardians. *Tilly ultimately dissented to participation

Experimental Design

Recruitment took place via Twitter, word of mouth, and postcards left with local businesses, directing interested persons to a brief, prescreen survey on Qualtrics (Provo, UT), which allowed us to capture basic demographic information about the guardian, the dog, the dog's training history, and contact information for participants who met inclusion criteria. Sessions were then scheduled via email correspondence.

This preliminary study occurred during the height of the COVID-19 pandemic. As such, researchers and participants observed public health recommendations including wearing masks, meeting participants in their backyard rather than walking through homes, and having minimal prolonged, close contact. Likewise, all equipment was disinfected between participants to reduce the probability of spreading pathogens across sessions.

Each participant session consisted of three interactions: training, play, and shared rest. The sessions were performed in this same order for every participant so the dogs would still be aroused from physical play during the shared rest. Sessions included capturing audio and video recordings of both play partners (guardian and dog) to identify any non-verbal vocalizations during inter-specific play. We used a Movo 48-channel UHF dual wireless lav mic system (WMX-20-DUO), which includes two wireless microphone packs and a wireless receiver. Human participants wore one wireless microphone on the collar of their shirt with the transmitter attached to their pants or in a pocket. We fitted dogs with the second wireless microphone pack using equipment familiar to the dogs (e.g., the dog's usual harness, ThunderShirt©/wrap), as selected by the dog's guardian. Once each dog was fitted with a microphone, they were watched for signs of stress or discomfort before and during the session (e.g., yawning, scratching at equipment). The stereo wireless receiver was connected to a Zoom H1n4 digital recorder. We captured video on a Nikon D40 digital camera secured to a tripod at one side of the play area.

Guardians and dogs performed three separate interactions: practicing known training cues (on average, 2 min), play until the human or dog disengaged (approximately 5-10 min), and a timed, 5-min shared rest. The training allowed for dogs and humans to focus on each other and provided data on vocalizations common to the dogs when attentive; the play allowed for domain specific data collection; and the 5 min shared rest allowed for capturing of a post-exertion, resting pant. All participants completed the three interactions in the same order (training, play, and rest) to mimic a typical, routine interaction between guardian and dog. During the training, guardians were instructed to walk their dog through known training cues such as *sit*, *down*, *wait*, and *heel*. Human participants were allowed to use treats, clickers, or other equipment during the training interaction.

The type of play interactions varied, as we encouraged guardians to play with their dog as they normally would (Horowitz & Hecht, 2016). Most participants engaged in combinations of tug-of-war with a rope or flexible frisbee, fetch or other ball play (e.g., kicking the ball for dog to chase), played chase or teasing games, mimicked their dog's play behaviors (e.g., play bow, play slap), or tickled and ruffled their dog's coat (mostly on their rear). For the "rest" interaction, participants were instructed to sit, lie, or stand near their dog and cease play. Though not specified in the instructions, many humans made gentle contact or laid in the same space on the grass. It is notable that some dogs continued to mouth their human's limbs or roll on their back while resting.

Data Analysis

The principal investigator (PI) and one undergraduate research assistant (URA) independently analyzed all the audio recordings of the dogs using RavenLite 2.0.1 and video recordings using Windows Media Player. We recorded any events meeting the following criteria: (a) having frequencies between 0 to 4 kHz; (b) of length between 0.1 and 0.3 seconds; (c) featuring large, irregular oscillations, and high amplitudes; and (d) absence of harmonic bands (indicative of speech and other more defined vocalizations). Coders listened to the playback again after initially identifying the event to confirm we did not document play growls or barks, which share some characteristics. The timestamp of the audio event was then matched to the time stamp of the video; the video was then coded for play behaviors using an ethogram derived from Horowitz and Hecht (2016; see Table 3). Upon completion of the independent analyses, we used an intraclass correlation coefficient (ICC; Cronbach's alpha) to determine interrater reliability and an ANOVA to determine whether distinctive vocalizations that may be describable as a play pant occurred (a) with common play behaviors and/or (b) more frequently during play than during the other two interactions.

Table 3

Ethogram Used in Coding Video

Behavior	Description
Walk	Toward (T) or Away (A)
Run	Toward (T) or Away (A)
Parallel Walk/Run	H and D moving in the same direction without direct interaction occurring
Sit	H or D places rear on ground or nearby seat
Lie	Passive state prostrate on ground or floor
Freeze	Notable pause / lack of motion
Chase	D and H move fast in same direction "run after another within 5 s of departure"
Chase-me	Withdraw with looks back; reduced pace; may include verbal encouragement from H
Play bow	H emulates dog play bow with either hands on ground or hands on thighs, bent forward. D places front limbs on ground with rear in the air.
Bipedal play slap	Quick movement performed by H while standing to initiate play. May be done with hands or feet.
Play slap	Like a play bow but punctuated by a slapping of front paws on ground/object. May also be reduced in length compared to play bow.
Lunge	Make sudden quick movement.
Shuffle feet	H rapidly moves feet whilst in a standing or sitting posture.
Stamp feet	H places feet heavily and audibly on the ground.
Attention tap	H taps body or ground with an overt intention to gain D's attention; may be repeated; may or may not include vocalization toward D.
Paw	D raises paw toward person or object; may establish contact.
Body push	H or D uses body to knock into other party; may include D "jumping up" onto H.
Tug-of-war	H and D each pulling on an end of an object; may overlap with/include other behaviors.
Hide and seek	H hides toy/self and D attends to toy's lack of presence or possible location.
Fetch	H tosses a toy away from self and D retrieves item.
Keep away	D or H makes body movements or vocalizations to withhold object or item from other party
Toy tease	H or D maintains possession of toy and moves it around within reach of the other party.
Hand creep (hand spider)	H moves hand(s) or fingers simulating movement of an insect or other creature.
Nuzzle	One individual's head makes contact with other's body in driving motion.
Mouth	D keeps object in mouth while chewing or moving the object around; does not result in destruction of object.
Tickle	H applies light touch to D's body, similar to human tickling.
Ruffle	H uses hands or objects to disorder or "mess" D's coat.
Wrestle	Back and forth with mirroring of body parts.
Kiss	H to D
Lick	D to H
Hug/Embrace	Wrap forelimbs/arms/neck around neck/shoulders (for D) or any part of D (for H)
Clap	Strike palms of hands audibly together
Point	H signals a direction with hands/fingers

Note. All behaviors were coded for either human (H) or dog (D) and were recorded as an annotation with the corresponding, time stamped audio event.

We imported the audio recordings of 14 sessions to RavenLite as a 2-channel file and deselected the channel that recorded the human participant to focus on the dog's audio. We then set the Fast Fourier Transform (FFT) to 512, the brightness and contrast to 50, and the color map to "Jet Black" to provide the clearest delineation between low amplitudes (blue) and high amplitudes (dark red). We set the visible frequency range to 0–8 kHz, and time increments of 0.1 s. Because we were working in RavenLite, we had less control to configure advanced settings.

Results

Interrater Reliability

An intraclass correlation coefficient (ICC) was used to determine interrater reliability on the number of vocalizations and associated play behaviors recorded for each participating dog. Estimates and their 95% confidence intervals were calculated in SPSS using a 2-way, single measures mixed-effect model. Reliability between the raters was achieved in documenting target vocalizations ($\alpha = 0.967$) with a 95% confidence interval from 0.938–0.982 (F [41, 41] = 30.021, $p < .001$), as well as on ethogram codes ($\alpha = 0.969$) with a 95% confidence interval from 0.942–0.983 (F [41, 41] = 32.029, $p < .001$). Greater than 0.8 agreement is considered "excellent" agreement (Bland & Altman, 1997).

Quantifying Target Vocalizations

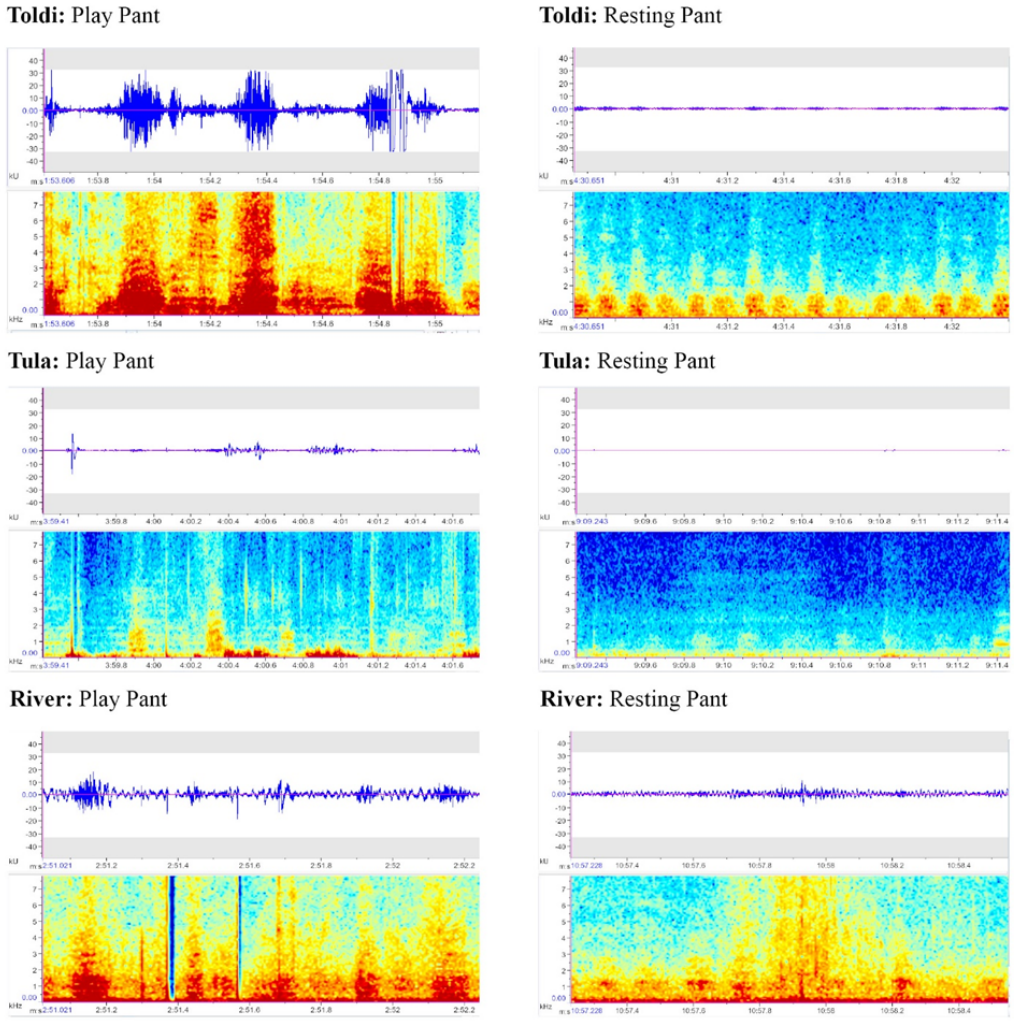
Rater 1 (R1) documented 378 target vocalizations, and 365 of those co-occurred with a play behavior or activity (96.6%). Rater 2 (R2) documented 327 target vocalizations, and 295 of those co-occurred with a play behavior or activity (90.2%). After averaging R1's and R2's counts, a total of 353 target vocalizations were recorded, and an average of 330 of those co-occurred with a play behavior or activity. A one-way ANOVA resulted in statistically significant differences in the presence of these vocalizations during the three interactions, $F(2, 39) = 5.897$, $p = .006$. A Tukey post hoc test revealed that significantly fewer "play pants" occurred during training ($p = .018$, 95% C.I. = [2.903, 36.597) and shared rest ($p = .013$, 95% C.I. = [3.623, 35.913]) when compared to the play interaction. There was no statistically significant difference in vocalization rates between the training interaction or shared rest, $p = .999$.

Individuality in Play Pants

While play pants were identifiable and distinguishable from panting in other contexts, individual variation was also present within the vocalization events captured in our data. Figure 3 provides comparisons of the play pant and the resting pant for three dogs (Toldi, Tula, and River). Toldi is an example of a particularly loud, noisy player. His play pants were interspersed with low growls and deep barks. During the time stamp captured, he was play slapping and biting at his person's feet as she stomped the ground between his forepaws with her feet and tapped his shoulders with her hands. She also regularly whispered to him, a sound we did not hear during the session, but which was identified during audio analysis. This was followed by audible play pants during the session at distances of 15 ft or more. Tula was a quieter player overall but exhibited the play pant as she chewed on and shook a new toy. The captured time stamp occurred while she was pushing her nose into the toy and chewing on it. River's play pant occurred while River was being chased by her human, immediately followed by role reversal in the chase game. Her pant is not as quiet as Tula's nor is it as loud and boisterous as Toldi's. Her play pant is marked by the bursts of exhalation that occur in rhythm with her pant, but are louder, more pronounced punctuation.

Figure 3

Comparing Play Pants and Resting Pants of Three Participating Dogs



Note. All resting pants were captured immediately after play sessions to provide a comparative vocalization. Notice the dark red bursts that occur more irregularly in the play pant, while in the resting pant, nearly every pant is at the same frequency and time interval. There are artifacts in the recording due to ambient noise and the use of omnidirectional microphones. Future research should seek to use unidirectional microphones to reduce this ambient interference.

Comparatively, in all three subjects' captured resting pants, a steady, respiratory rhythm is identifiable. Additionally, the amplitude is less than that heard in the play pant and lacks bursts of undefined "breathy forced exhalation" (Simonet et al., 2005, p. 1). In all three subjects, rest-panting corresponded to time spent lying on the ground next to their guardians immediately following the exertion of play.

Correlating Target Vocalizations and Play Behavior

A two-tailed Pearson's correlation determined a strong correlation between average number of target vocalizations and average number of play behaviors recorded, $r_s(42) = 0.998$, $p < .001$. Of the average 353 target vocalizations recorded, only 23 occurred outside the play phase and only three were not associated with a play behavior, play activities, or direct human-to-dog contact (e.g., tickling). Most of the vocalizations occurring outside the play interaction occurred during playful training (e.g., giving a high five or getting a ball as a reward) or when being tickled or cuddled during rest. Notable exemplars were Jack and Nemesis (Schutzhund trained German Shepherds, the only dogs with training beyond pet manners) who were exceptionally motivated to train and work in anticipation of receiving a tug toy as a reward. As such, there was less distinction between their training and play interactions and pairing the presence of the target vocalization with the ethograms was key in analyzing their data. Also, Tula and Piper sought petting and Toldi cuddled on the grass with his guardian during the shared rest, which resulted in muzzle-to-human chin nuzzling and the humans tickling the dogs' bellies and flanks.

Discussion

Our study is the first to confirm and contextualize the presence of a canine play pant, a domain-specific vocalization that occurs almost exclusively in the context of play. The presence of a "pronounced breathy forced exhalation" (Simonet et al., 2005, p. 1) occurred significantly more often during the play interaction as compared to in training or during shared rest. The play pant correlated significantly with play behaviors or activities (e.g., play bow, chase, tug, tickling, and play slap). To our knowledge, this is the first work since Simonet et al.'s findings (2001, 2005) to validate and replicate the presence of a canine play pant as a domain-specific vocalization. Additionally, it is the first to capture the canine play pant during interspecific exchanges.

We can now define the canine play pant as including frequencies between 0-4 kHz; of length between 0.1 and 0.3 s; featuring large, irregular oscillating waveforms and high amplitudes; absent of harmonic bands; and occurring almost exclusively with play behaviors or interactions. Nearly all of the captured play pants occurred in conjunction with other canine play signals, confirming that this is a domain-specific expression aligned with play behaviors and activities such as the play bow, play slap, chase, fetch, and play face as previously defined (Bekoff, 1974, 2015; Byosiere et al., 2016, 2018; Horowitz, 2009; Horowitz & Hecht, 2016; Rooney et al., 2001). These vocalizations are also distinct from play growling (e.g., Faragó et al., 2010) and play barking (e.g., Horowitz & Hecht, 2016; Yin & McCowan, 2004), in that there is no discernable tone to them; rather, they are characterized by a "huhf" sound produced almost solely of exhaled breath. We suggest these criteria be used in future work on the canine play pant as a starting point for investigating the play pant vocalization in dog-dog and human-dog play.

Our research also identifies individual variation in the canid play pant, as documented in other species (e.g., Barbary macaques (*Macaca sylvanus*) and chimpanzees (*Pan troglodytes*), Vettin & Todt, 2005) and as heard in other vocalizations (e.g., barks, Molnár et al., 2009). This is likely due to differences in personality, age, preferred form of play, and play style of individual subjects. While we had also wondered about the potential influence of each dog's or human's sex, we could not draw conclusions given the small sample size of 16 dogs and the fact that only three of the human participants were male. Future research may address potential human and dog sex differences.

Other variables that may influence variation in the canine play pant include differences in the guardian-companion dog relationship and the prior training history for each. We suspect learning histories may play a role in shaping the amplitude and abundance of play pants an individual dog may perform. For example, dogs who are more frequently hushed or told to "be quiet" may be less vocal during play. With this in mind, the effects of relationship, play style, and personality could be further investigated in future studies. It is also possible that whether a dog is intact vs. altered may impact the findings, and future studies should collect these data to consider whether reproductive status impacts play. We are unable to address this with the current data given the small sample size and single intact female.

Wood and Niedenthal (2018) suggest that human laughter serves three primary functions: rewarding the behavior of others, easing social tensions, and navigating social hierarchies in a nonconfrontational way. Likewise, Winkler and Bryant (2021) argue that play pants across species often become sophisticated signals of affiliation and prosocial intention. Both sets of authors identify human and nonhuman play vocalizations as honest signals of nonviolent intentions. Future research could expand upon if and how ontogenetic influences and adaptive explanations can provide nuance to the sophisticated functions in nonverbal exchanges during human-dog play. Assuming the canine play pant originated as a conspecific signal, research might ask when and how the signal became co-opted for interspecific exchange. There is prior evidence to suggest that cooperation between wolves and humans served as the basis for domestication (Range & Virányi, 2014). Perhaps interspecific play signals are a byproduct of this process, resulting from changes in the dog's social cognition.

As is the nature of pilot studies and research in general, we must acknowledge the limitation of our small sample size. Additionally, as this study also served as a training opportunity for undergraduate research assistants, we acknowledge that our choice to average the two raters' data rather than redo the analysis may have influenced the results. However, since the more experienced rater documented more, not fewer, events, we suspect an experienced second rater would only strengthen the findings. Given the significance of our findings (i.e., *p*-values below .001), our results are indicative of an important phenomenon that is worth further exploration. As mentioned in our introduction, previous research had not been replicated until now. Our study is the first to empirically validate the existence of a domain-specific play pant in dogs and operationalize the target vocalization for future investigation.

Conclusion

This work is the first known study to confirm Simonet et al.'s (2001) findings of a domain-specific play pant in dogs. In the process, we provide bioacoustics and behavioral criteria on which future work can build. Research regarding vocal communication between humans and their dogs has increased in recent years; however, the emphasis on more distinct signals (e.g., barking, growling, and whining) has overlooked pant-based signals. Here we find that a laugh-like play pant is used by dogs in the specific context of dyadic play with their persons. The science of human-canine coevolution is still relatively young, particularly as it pertains to nonverbal vocalizations, and we hope that this study unlocks a new line of inquiry into the nonverbal exchange existing between them.

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Author Contributions

S.V., A.H., and H.R.G. conceived of the present idea. S.V. and H.R.G. developed the methodology for capturing data. S.V., C.B., H.G., and M.K. carried out data collection and participant sessions. S.V., C.B., and H.G. analyzed audio and video recordings, and S.V. completed statistical analysis. All authors contributed to discussions of the results and creation of the manuscript.

Data Availability

Data are available on request from the corresponding author.

Ethical Review

This study was designed in accordance with the ARRIVE guidelines (Kilkenny et al., 2010) and reviewed by both the Institutional Review Board (protocol # 041-SB21-071) and the Institutional Animal Care and Use Committee (protocol # AC21-006) at Boise State University.

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