



RESEARCH



The open palm gesture in human–dog communication: An exploratory synthesis

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Abstract

Background: Gestures are widely used in everyday human–dog interactions and are often understood in terms of directing behaviour towards tasks or outcomes. However, less attention has been given to how such gestures may function outside task-oriented or trained behavioural contexts. This article examines the open palm prone gesture (OPPG) as it occurs in everyday interactions, with a focus on its potential role beyond directive use and its implications for how interspecies communication is conceptualised. **Methods:** This article draws on qualitative analysis of naturalistic video observations of everyday human–dog encounters, including interactions involving both companion and free-living dogs across a few different cultural contexts. The analysis is informed by and interpreted through existing research on animal behaviour and cognition, human gesture use, and human–dog relationships. Selected interactional sequences are presented within the manuscript, alongside detailed observational descriptions in supplementary material, to enable close examination of gesture use, timing, and contextual dynamics. This approach is intentionally designed to foreground analytic transparency by presenting interactional material in a form that invites direct engagement, enabling readers to examine how interpretations dynamically arise from context and history. **Results:** The analysis identifies a range of interactional factors that appear to shape how this gesture is taken up in context, including multimodal coordination, relational history, situational dynamics, shared attention, and the dog's internal state. Rather than establishing a fixed function, the article catalogues these factors and situates the observed interactions in relation to existing knowledge, positioning this mode of gesture use as a candidate for further systematic examination. **Conclusions:** The study argues that gestures in interspecies communication may warrant examination beyond task-oriented and directive frameworks to include the possibility of affect-modulatory roles. By outlining key factors for consideration, it provides a foundation for future enquiry into how such gestures may function in context-dependent and relationally situated ways. More broadly, it highlights the potential significance of such forms of communication in shaping longer-term human–dog relationships and supporting canine welfare, suggesting that gestures may influence not only immediate interactions but also the quality and stability of the dyad over time.

Keywords: human–dog interaction, gesture, affect regulation, multimodal communication, free-living dogs, canine cognition, interspecies communication, ethnographic observation, co-construction of meaning

Introduction

It is a typical Indian monsoon evening. A storm is raging, thunder rattling the windows. Cheeru, my dog, is trying to fall asleep, but each crash of thunder startles her awake. Her body tenses, she looks repeatedly at the window and then at me. I flick my wrist, showing her the open palm of my hand, my posture relaxed and my gaze soft. I glance briefly toward the window and then back at her before returning to my work, remaining within her line of sight. After a few moments, Cheeru exhales audibly, looks once more toward the window, and settles back into sleep.

Such moments are familiar to many people who live with dogs, yet they are rarely treated as sites of analytical interest. Everyday human–dog encounters are saturated with gestures of this kind. A substantial body of research has demonstrated dogs' responsiveness to gestures, particularly pointing (Miklósi *et al.*, 1998; Hare and Tomasello, 1999; Hare *et al.*, 2010; Espinosa *et al.*, 2023). Far less attention has been paid to gestures that do not function referentially.

This article examines such everyday interactions as a means of exploring human–dog communication—specifically, focusing on a

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particular human gesture corresponding to what Kendon (2004) describes as the *open palm/hand prone gesture* (hereafter OPPG). Focusing on the OPPG as it appears in moments of uncertainty, stress, or hesitation, I argue that this gesture functions as a relational practice of reassurance and affects regulation. It emerges through multimodal coordination, relational history, and shared context, with dogs participating actively in shaping the interaction. By attending to these mundane practices of co-presence and care, this article contributes to anthrozoological scholarship that foregrounds relational processes over instrumental models of communication.

This article does not suggest that dogs universally or innately interpret this gesture in a fixed way. Instead, the article proposes that dogs living in close social contact with humans may learn to associate the open palm prone gesture (OPPG) with safety, non-escalation, or social reassurance under particular relational and contextual conditions. To examine this possibility, the discussion first situates the OPPG within the longer evolutionary and social history of human–dog coexistence, then considers existing research on canine sensitivity to human social cues, before examining the use of such gestures in human communication more broadly. Drawing on naturalistic observations of dogs in both companion and free-living contexts, the article then explores how the gesture may function within multimodal interactions and considers its possible implications for canine welfare and future research in animal behaviour.

OBSERVATIONAL BASIS OF THE HYPOTHESIS

This present hypothesis emerged from repeated observations made during professional and everyday interactions with dogs across multiple settings. I work extensively with free-living dogs in India and companion dogs in other cultural contexts, mostly across North America and Europe. I teach humans how to attend to dogs' communicative signals and to use human facial expressions, tone and posture to communicate with dogs. Over time, I noticed that many people across cultures and without explicit instruction, use OPPGs in moments where they appear to be attempting to *calm*, *pause*, or *reassure* a dog. Dogs, in turn, often respond in ways that suggest reduced arousal. Drawing on these observations, I have been teaching people to attempt the same with their companion dogs, results of some of them have been presented as examples in this article.

These observations are used to examine what information, if any, is being communicated, what affect is expressed, and what nuances characterise this communication.

HUMAN–DOG COEVOLUTION AND THE CONDITIONS FOR GESTURAL MEANING

The possibility that the OPPG may function as a meaningful social signal must be considered within the longer evolutionary history of the human–dog relationship. Domestic dogs (*Canis familiaris*) have lived alongside humans for several thousand years, creating sustained opportunities for interspecific social learning. Although the precise timing of domestication remains debated (Vilà *et al.*, 1997; Germonpré *et al.*, 2009, 2012; Larson *et al.*, 2012; Freedman and Wayne, 2017; Cohn, 1997; Pennisi, 2002), growing evidence suggests that dogs emerged through a coevolutionary process shaped by shared ecological and social environments rather than through simple human-directed selection alone (Budiansky, 1992; Paxton, 2000; Clutton-Brock, 2016).

The human–dog relationship is considered a paradigmatic case of convergent evolution, in which cooperative demands on both species generated selective pressures for interspecific coordination (Reid, 2009). This collaborative context is argued to have led humans and dogs to evolve comparable socio-cognitive traits (Hare and Tomasello, 2005), reflected in human-like attachment and communicative capacities in dogs (Miklósi and Topál, 2013).

Dogs form attachment relationships with humans that resemble infant–caregiver bonds (Topál *et al.*, 1998; Nagasawa *et al.*, 2009; MacLean and Hare, 2015) and show heightened sensitivity to human communicative behaviour, as demonstrated by their strong responsiveness to human gaze and pointing (Kaminski *et al.*, 2012; Kikusui *et al.*, 2019).

It is within this evolutionary and relational context that interactions such as the one described with Cheeru become intelligible, and within which the conditions for the OPPG to function as a meaningful gesture emerge.

Dogs' sensitivity to human gaze and attention

Dogs are known to attend closely to human gaze and to show a refined sensitivity to human attention, perspective, and gestural direction. Both companion dogs raised in human homes and free-living dogs with extensive, but informal contact with humans appear to recognise gaze as a meaningful social cue (Miklósi *et al.*, 1998; Bhattacharjee *et al.*, 2017; Brubaker *et al.*, 2017). This capacity distinguishes dogs from many other species and places them closer to human toddlers in their responsiveness to referential cues (Miklósi *et al.*, 1998; Marshall-Pescini *et al.*, 2013; Gácsi *et al.*, 2009a).

Pointing gestures provide one of the clearest demonstrations of this sensitivity. Dogs respond flexibly to a wide range of human referential cues, including distal and proximal pointing, head turns, and glances (Miklósi *et al.*, 1998; Lakatos *et al.*, 2009). Importantly, specialised training does not substantially enhance this responsiveness (Gácsi *et al.*, 2009b), and other human-socialised species do not show comparable performance (Miklósi *et al.*, 2003; Hare *et al.*, 2010), suggesting a species-typical predisposition rather than just instrumental learning.

Dogs also appear sensitive to human visual perspective (Gácsi *et al.*, 2004; Virányi *et al.*, 2004). Studies indicate that they can respond differently depending on what a person can or cannot see (Kaminski *et al.*, 2009) and may actively attempt to recruit human attention towards objects of interest to them (Gaunet and Deputte, 2011). At the same time, this sensitivity remains shaped by experience (Hare *et al.*, 2002; Gácsi *et al.*, 2009b). Among free-living dogs, sensitivity to pointing includes developmental differences, with puppies showing a preference for proximal pointing and adults exhibiting greater responsiveness to distal cues, possibly due to learned caution towards humans (Bhattacharjee *et al.*, 2017), suggesting experiential modulation. Similar plasticity has been observed in shelter dogs and in companion dogs as they adapt their responses to pointing based on human reliability (Elgier *et al.*, 2009; Udell and Wynne, 2010).

Returning to the opening account, these findings situate Cheeru's observation of my gaze within established evolutionary and cognitive frameworks. We now turn to the functional significance of this exchange.

Social referencing and cooperative orientation

Dogs' sensitivity to human gaze and pointing is part of their cooperative orientation towards humans. When confronted with ambiguity, dogs often look towards humans and adjust their behaviour accordingly – a phenomenon described as social referencing (Merola *et al.*, 2012b; Duranton *et al.*, 2016). This form of social learning involves using emotional and behavioural information provided by others to guide future action, rather than relying solely on individual trial-and-error (Cooper *et al.*, 2003; Duranton and Gaunet, 2015).

Dogs also use gaze alternation to solicit human assistance during problem-solving (Topál *et al.*, 1997; Miklósi *et al.*, 2003; Pettersson *et al.*, 2011). Notably, when faced with difficult tasks, dogs often abandon independent problem-solving sooner than wolves and instead orient towards humans (Brubaker *et al.*, 2017; Marshall-Pescini *et al.*, 2017). This is not a cognitive limitation. Rather, it is

described as a social problem-solving strategy in which human input is incorporated into decision making (Szetei *et al.*, 2003; Erdőhegyi *et al.*, 2007; Marshall-Pescini *et al.*, 2013; Plourde and Fiset, 2013).

Comparative studies further suggest that dogs, unlike other species, perform better in cooperative communicative contexts as compared to competitive ones (Pettersson *et al.*, 2011; Range *et al.*, 2019), highlighting species-specific orientation of dogs towards social collaboration. MacLean and Hare (2015) identify this cooperative orientation as a defining feature of the human–dog relationship, while Topál *et al.* (1997) describe it as a tendency of dogs to treat humans as part of a shared social unit.

These findings invite the question of whether a dog, when faced with a challenge, gazes at humans in an attempt to recruit the human into relational meaning-making. Byrne *et al.* (2023) found that dogs preferentially re-engaged with human partners following joint activities, indicating that social interaction itself may hold significance and that the human–dog communication cannot be understood solely in terms of information transfer. Therefore, social engagement and relational alignment become the next stage of our inquiry.

Attachment and emotional attunement

Dogs do not attend equally to all humans; their responsiveness is shaped by relationship history. Dogs preferentially attend to and collaborate with humans with whom they share attachment bonds (Duranton and Gaunet, 2015), are more adept at reading their emotional cues (Merola *et al.*, 2014) and learn the significance of their gestures more rapidly (Elgier *et al.*, 2009).

Attachment, originally described in developmental psychology (Bowlby, 1982, 2018) as a bond that regulates safety and proximity, has also been documented in human–dog dyads (Topál *et al.*, 1998). Behavioural and neuroendocrine findings suggest that close social bonds between dogs and humans can influence how dogs interpret human presence under conditions of uncertainty (Nagasawa *et al.*, 2009; MacLean and Hare, 2015). In the presence of a familiar attachment figure, dogs often explore more confidently, tolerate novelty more effectively, and show greater willingness to engage with potentially stressful situations (Topál *et al.*, 1998; Gácsi *et al.*, 2001; Horn *et al.*, 2013).

Dogs are additionally sensitive to human emotional expressions, particularly those of attachment figures (Nagasawa *et al.*, 2011; Morisaki *et al.*, 2009). In ambiguous situations, they look towards such humans and adjust their responses based on perceived emotional cues (Merola *et al.*, 2012b). Dogs use human emotions as informational signals (Buttelmann and Tomasello, 2013; Turcsán *et al.*, 2015) and may show forms of emotional matching or contagion (Joly-Mascheroni *et al.*, 2008; Yong and Ruffman, 2014). Developmental evidence indicates that this sensitivity is shaped by ontogeny, with responsiveness evolving with age and experience (Deputte and Doll, 2011).

Although much of this literature focuses on companion dogs and their owners, similar processes may occur outside formal ownership relationships. Free-ranging dogs live within dense networks of interaction with humans and are capable of recognising and responding differently to familiar individuals, suggesting that residents, shopkeepers, and informal caretakers may become reliable social figures despite the absence of formal ownership (Sen Majumder *et al.*, 2016; Bhattacharjee and Bhadra, 2020; Nandi *et al.*, 2024; Sarkar *et al.*, 2024). Such relationships may provide the social conditions under which subtle gestures, including the OPPG, acquire communicative significance through repeated interaction.

GESTURE AND EMBODIED COMMUNICATION

Human interaction is saturated with hand movements that often occur outside conscious awareness (Lapaire, 2006; Givens, 2016; Harrison, 2018a; Harrison, 2018e; Kita, 2020). In everyday life, gestures are not only used to direct action or indicate objects; they

can also accompany reassurance, hesitation, caution, or social calm.

Open palm gestures (OPGs) are among the most common of these movements and frequently occur in situations involving attempts to regulate the emotional tone of an interaction (Calbris and Doyle, 1990d; Payrató, 1993; Kendon, 2004). Givens (2016) discusses the OPG as a communicative form widely regarded as among the most evolutionarily ancient human gestures. OPGs are also among the most recurrent and recognisable gestures across cultures. Research on primates documents the OPG as a gesture that functions less as an object-directed signal and more as a regulator of social relations (Givens, 2016). This relational quality may be that of salience in their apparent role in human–dog interactions.

Müller *et al.* (2014a) classify OPGs as recurrent gestures – frequent, multifunctional, and highly context-dependent in meaning – and distinguish between open-palm supine (palm-up) and open-palm prone (palm-down) forms. The open-palm prone gesture (OPPG) and its variation, the open-palm back gesture (OPBG) are the focus of this article.

The OPPG is extensively documented across diverse cultural contexts, spanning several continents, and its communicative function is strikingly consistent despite variation in orientation and spatial configuration. Cross-cultural analyses identify recurrent themes of negation, interruption, blocking, and calming. Such uses have been studied and documented in several cultural contexts, including Neapolitan (Kendon, 2004), French (Calbris and Doyle, 1990b), South African (Brookes, 2004), German (Müller *et al.*, 2014b), US English (Ferré and Mettouchi, 2020), Kabyle (Ferré and Mettouchi, 2020) and Savosavo speakers (Bressemer *et al.*, 2015). The embodied expression of negation is particularly salient in human–dog environments, as it occupies a central place in human intraspecies communication (Harrison, 2009).

Several authors describe extensions of this gesture into contexts of reassurance or calming, often conceptualised as a form of negation – specifically, negating the need for action, fear, or concern (Calbris and Doyle, 1990d; Payrató, 1993; Kendon, 2004). In such cases, negation extends beyond propositional content into affective and regulatory domains.

For dogs living in close social contact with humans, repeated exposure to such gestures creates ongoing opportunities for social learning. Dogs have a well-documented capacity to learn novel human gestures and to respond flexibly to repeated social cues (Miklósi *et al.*, 2004; Lakatos *et al.*, 2009). Because dogs are highly attentive to human posture, gaze, and movement, recurrent gestures may gradually acquire meaning through the accompanying emotional state of the human, the secure base effect and the body language in which the gesture is consistently and culturally embedded.

From this perspective, the gesture becomes relevant not because it has a fixed universal meaning, but because its recurring social function may be available to canine learning. This raises the question of whether the OPPG functions in some human–dog interactions as more than a simple hand movement? Could it serve as embodied communication that signals de-escalation and reassurance?

Beyond pointing

Research on human–dog communication has generated extensive knowledge about dogs' responses to referential cues such as pointing, gaze direction, and attentional signals. Recent work on canine perspective-taking suggests that dogs may be sensitive not only to human behaviour but also to cues related to human attention, knowledge and intention (Huber and Lonardo, 2023). However, less attention has been paid to gestures that may influence affective state, emotional regulation, or relational alignment, despite evidence that dogs use emotional information

in social learning and decision making. This raises the possibility that some communicative gestures may function not only to direct behaviour, but also to shape how situations are experienced. This article, therefore, seeks to expand the scope of human–dog communication studies to include gestures that go beyond directing a dog's behaviour and may also function through emotional regulation, social inhibition, or reassurance.

To examine such non-referential and non-instructive gestures, it is essential to recognise that human communication is profoundly multimodal. Gesture, gaze, posture, facial expression, and vocal tone often act together to shape social interaction, frequently without conscious intent. Dogs living in close proximity to humans are likely to encounter these interactional gestures more often than explicit instructional ones that involve formal training. Free-living dogs in India, for instance, routinely experience gestures conveying meanings such as “do not approach,” “calm down,” “it is safe,” or “go away,” often without accompanying speech or other directive cues. These behaviours influence dogs' movement, proximity, and arousal, yet are rarely examined as communicative acts.

The open-palm-prone gesture (OPPG) may belong within this under-examined category of communication. Unlike pointing, it does not necessarily direct a dog towards action but may instead function as part of a signal that reduces uncertainty or escalation. If so, gestures that convey non-threat or social reassurance could represent an important, but largely unrecognised, dimension of human–dog communication.

Methods

QUALITATIVE OBSERVATIONS

To consider the role the OPPG plays in human–dog interactions and relationships, this article draws on a series of video-recorded interactions involving both free-living dogs in India and companion dogs in India and Europe. These observations are not presented as controlled experimental evidence, but as naturalistic examples that allow closer examination of behavioural context, multimodal signalling, and the nature of and impact on relationships. Within a hypothesis-generating framework, such observations can help identify recurring interactional patterns that may warrant more systematic future investigation.

Observational approach

The analysis is based on a corpus of video recordings documenting the use of the OPPG across a range of interactional contexts. The material includes:

- (A) publicly circulated recordings of traffic police officers in India appearing to use the gesture towards free-living dogs.
- (B) preliminary observations conducted in Europe, in which canine heart rate was monitored in a staged setting where the OPPG is used as someone gets up and walks away from the dog.
- (C) household recordings provided by individuals familiar with the gesture who have documented its use during everyday interactions with their own dogs.

These videos are used as observational material through which the timing, form, and multimodal features of the interaction can be examined in detail. The analysis conducted was interpretive, not quantitative. The primary purpose of analysing these recordings is to identify recurring behavioural patterns and subtle communicative features that may inform future studies conducted under more controlled conditions. Therefore, observations were recorded descriptively rather than coded into predetermined categories, in order to preserve the contextual and multimodal nature of the interactions. Consequently, no formal coding manual, behavioural scoring system or inter-rater reliability assessment was employed.

Each recording was treated as a discrete observational unit and assigned a unique identifier for reference within the manuscript and Supplementary material (e.g., V1, V2, V3). A second-by-second analysis was conducted for each video. Each observable movement by either the human or the dog, together with any audible vocalisation or environmental sound, was recorded in sequence to produce a chronological account of the interaction. Where permission allowed, still frames capturing significant moments of posture, facial expression, or body orientation were extracted and included in the Supplementary material. Still frames were extracted from the highest available resolution of the original or publicly available files in order to document key moments in each interaction. Selected examples are presented in the main text, while additional stills and extended descriptions are provided in the Supplementary material. Links to the videos are provided in the Supplementary Material to facilitate reviewer and reader access, with due attention to ethical and legal considerations associated with the use of pre-existing video recordings of human–dog interactions. Consistent with the exploratory aims of this article, the videos are included as an invitation for readers to engage directly with the interactions themselves. The intent is to make the phenomenon available for scrutiny, allowing readers to use the observations and the interpretations offered here.

Results and Discussion

EXAMPLES OF EVERYDAY USE OF THE OPPG IN FREE-LIVING DOG INTERACTIONS IN INDIA

Two publicly circulated videos from India show traffic police officers using OPPGs while interacting with free-living dogs at road crossings. Although neither interaction was recorded for research purposes, both provide examples of how gestures commonly used in human social regulation may also appear in spontaneous human–dog encounters.

Example 1a: Traffic police

Video V1 shows a street dog positioned beside a police officer at a traffic junction. The dog intermittently looks at the police officer but stands motionless beside him. The officer repeatedly meets the dog's gaze and presents OPPGs or its variation with the palm oriented backwards (OPBG) before returning attention to traffic. The dog remains in place. Finally, the police officer stops the oncoming traffic, at which point the dog crosses the road.

As in several later examples, the palm-down form occasionally shifts into a backwards-facing open hand (open palm back gesture or OPBG) during the interaction. For the purposes of this article, these related forms are treated as part of the same gestural family because they appear to occur fluidly within the same behavioural sequence.

Example 1b: Traffic police

In video V2, a dog stands beside a police officer on a roadway. The officer intermittently looks towards the dog while extending his hand towards the dog. Although the precise details of palm orientation are less clear, given the relative heights of the two, physical contact appears unlikely. Unless his palm is in a fist, given the orientation of the arm, the gesture is plausibly an open palm directed towards the dog. Like the previous video, the officer alternates between directing traffic and lowering the hand towards the dog while intermittently looking at the dog. The interaction culminates with the officer stopping traffic and seemingly signalling to the dog. The dog crosses the roadway.

Discussion: These observations do not establish that the dogs understood the gestures in any fixed or deliberate way nor do they allow us to determine whether the OPPG functioned as a directive cue or an affective signal. The dogs in these examples are free-living and possess considerable agency to ignore or avoid interactions that do not align with their goals. This complicates interpretations based solely on conventional command–response frameworks.

However, these examples illustrate how OPPGs used in human social coordination may also appear in interactions with dogs during moments requiring stillness, timing, or behavioural restraint. At minimum, such examples illustrate how the human tendency to use the OPPG appears to spill over into interactions with dogs, where they could become relevant to dogs, through relational context, where human movement and canine movement become closely coordinated.

PHYSIOLOGICAL OBSERVATIONS

Example 2a: Preliminary observations from Norway

The following observational material suggests that OPPGs may, in some cases, be associated with measurable physiological changes. In a small exploratory series of recordings in Norway (video V3), dogs' heart rates were monitored during human departures from a resting context.

In the first observation, a dog resting near a seated human showed a baseline heart rate of 88 bpm. As the human stood and walked away, the dog's heart rate rose sharply to 152 bpm. When the procedure was repeated with the addition of an OPBG before the human departed, the dog's heart rate increased from 87 to 100 bpm.

In a second observation, a dog resting near three humans had a baseline heart rate of 60 bpm. A human departure was followed by an increase in the dog's heart rate to 79 bpm, and a subsequent departure preceded by an OPBG was followed by a decrease from 76 to 62 bpm.

Example 2b: Preliminary observations from France

Video V4 is of another preliminary observation by DogFieldStudy in France (Budzinski and Gomes-Budzinski, 2023). In this observation, a resting dog showed a baseline heart rate of 44 bpm, which increased to 139 bpm when a human stood up and walked away. When this was repeated, but this time one person presented the OPBG, while another departed, the dog's heart rate was observed to increase from 60 to 62 bpm. These differences in pulse variations are presented as a graph at the end of the video (Fig. 1).

Discussion: These observations are preliminary material. The small number of observations, absence of experimental controls, and possible influence of multiple contextual factors

require considerable caution in interpreting results. Nevertheless, the repeated appearance of reduced cardiovascular change across these examples raises the possibility that OPPGs could sometimes contribute to the modulation of canine arousal, including in situations where overt behavioural changes remain minimal.

REASSURANCE AS A POSSIBLE FUNCTION OF THE OPPG

Note that in the following examples, dog names are provided by the owner of the video and are used here for descriptive clarity.

Example 3a: Mutton

Video V5 opens with the dog called Mutton alerting towards a sound. A human seated nearby is extending the OPBG towards Mutton (Fig. 2A). Mutton watches for a few seconds and then puts her head down and seems to return to sleep (Fig. 2B).

Example 3b: Balt

Video V6 captures a seemingly unusual behaviour of a dog called Balt. According to the video description, Balt typically responds to the neighbour's dog's bark by vocalising, yet in this instance, he remains behaviourally calm throughout. The video begins with Balt walking briskly towards the barking dog, while the accompanying human extends an OPBG towards him. Balt halts, moves his head from side to side, and appears to sniff the air. He takes a few more steps forward before standing still, quietly observing. He remains still but not stiff, and since there are no vocalisations or frantic movements, this moment can be interpreted as indicating physiological calm.

Example 3c: Luna and Max

Video V7 opens with Max and Luna being woken by the sound of barking. The OPPG is offered to Max, but in this instance, it is held vertically with a slightly stiffer handshape (Fig. 3A). Max looks away.

Turning the head away is documented as a canine communicative signal indicating discomfort (Rugaas, 2005). The human's extension of the hand towards Max appears to have inadvertently stiffened the gesture—an orientation different from those seen in previous examples. The vertical configuration, according to Calbris

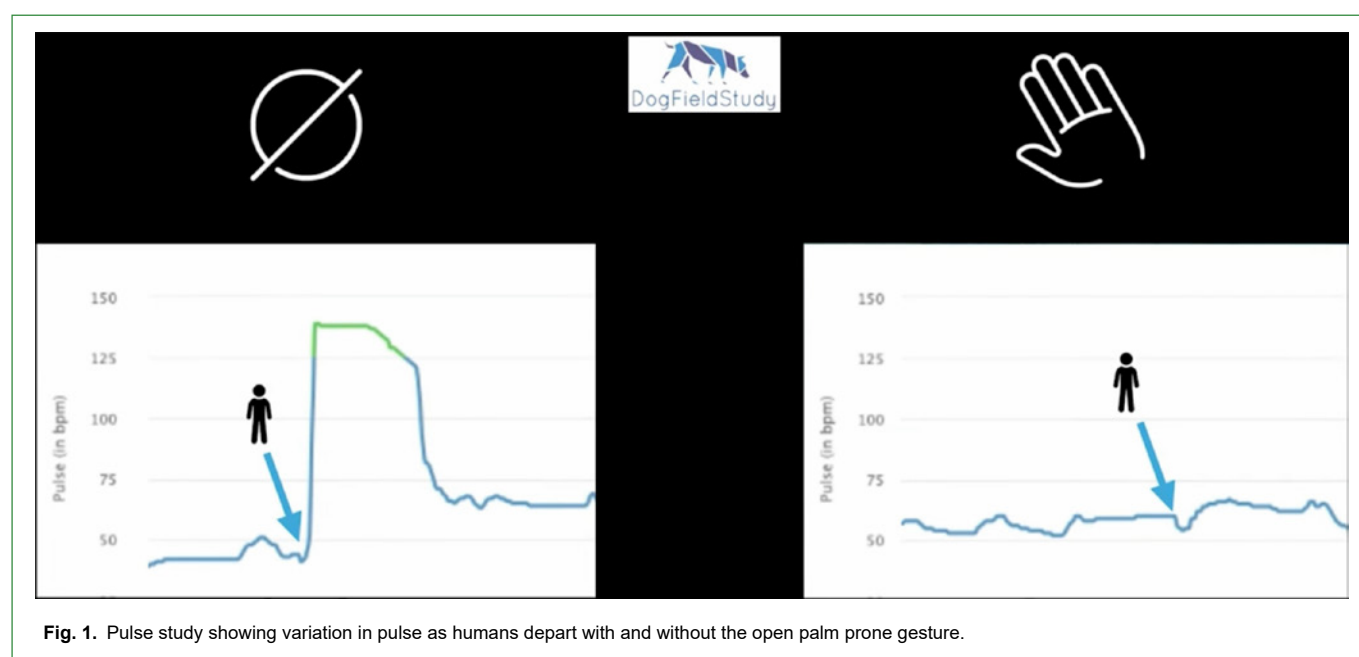


Fig. 1. Pulse study showing variation in pulse as humans depart with and without the open palm prone gesture.



Fig. 2. A human shows the open palm prone gesture to a dog called Mutton. (A) Mutton is alert. (B) Mutton rests.

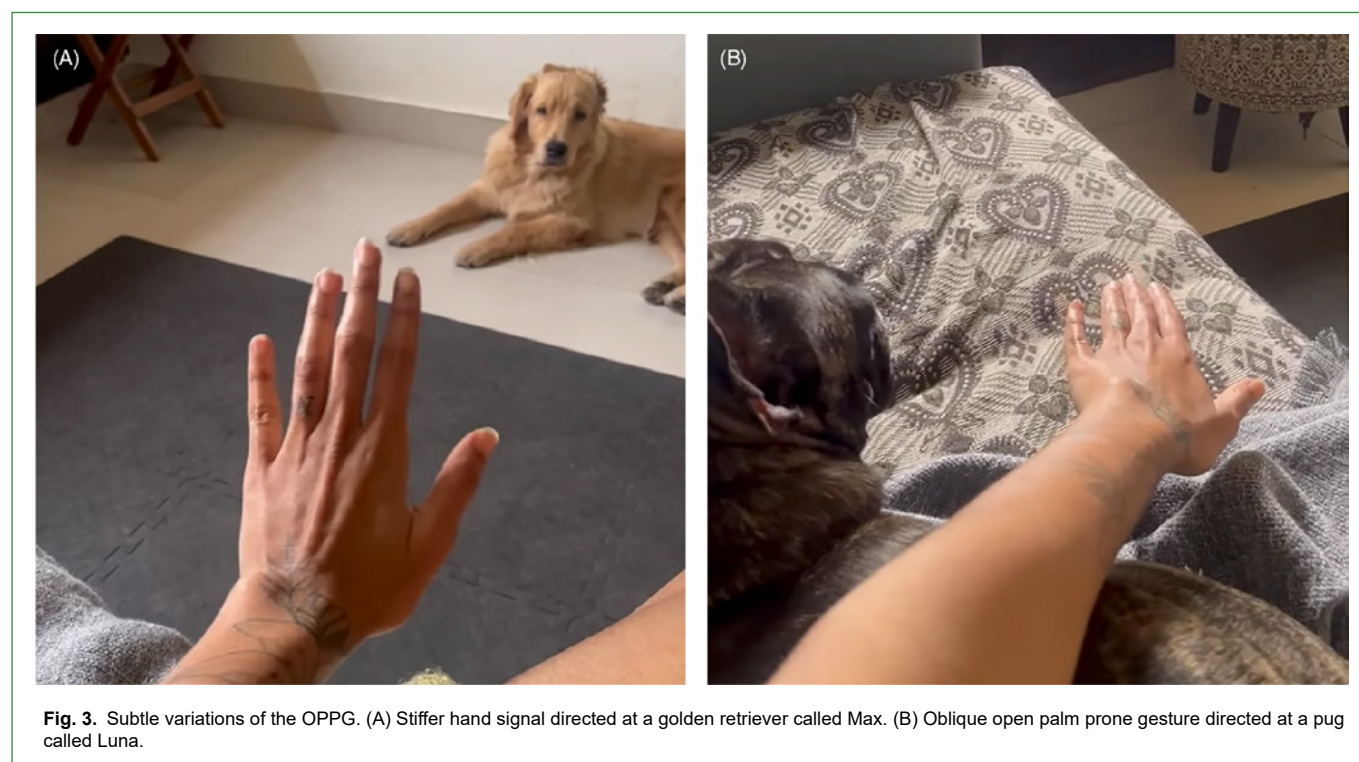


Fig. 3. Subtle variations of the OPPG. (A) Stiffer hand signal directed at a golden retriever called Max. (B) Oblique open palm prone gesture directed at a pug called Luna.

and Copple (2011a), transforms the movement into a “stronger message.” Given this possible shift in meaning, Max’s head turn in response is noteworthy.

As the video proceeds, Luna is offered the OPBG, this time at an oblique angle with the palm nearly facing downward (Fig. 3B). According to the video description, Luna is particularly sensitive to this orientation and responds by slightly shifting her head towards the palm. Harrison (2018d) describes a diagonal palm as a way to “weaken the strength of the warning,” while Calbris and Doyle (1990d) note that the oblique palm can communicate reassurance – messages such as “Fear nothing; do not worry.”

The video concludes with both dogs resting, a behaviour often associated with reduced physiological arousal.

Discussion: OPPGs are commonly interpreted in human interaction as a signal of interruption, inhibition, or non-approach. In several of the observations presented here, however, the apparent effect of the gesture extends beyond the interruption of overt behaviour. In the preliminary observations of heart rate, exposure to the gesture was correlated to reduced physiological arousal despite minimal visible behavioural change, while in the household examples, dogs often remained attentive to the environment while showing signs that may suggest reduced vigilance. Taken together,

these patterns encourage us to examine the gesture beyond its imperative function, extending consideration to its potential role in relational meaning-making within human–dog dyads.

The examples are considered cumulatively because their significance lies in their convergence. The free-living dog observations demonstrate the human tendency to use this gesture in their everyday interaction with dogs; the physiological observations suggest affective change as a plausible avenue of inquiry; and the household examples illustrate how this gesture may be used and what behavioural indicators of such affective change might look like in everyday interactions. Considered together, they not only build a cumulative case that affective functions of the gesture warrant further investigation but also provide practical tools for recognising and exploring these possibilities within everyday human–dog relationships.

The term *reassurance* will be introduced here cautiously to describe this possible function. Because gestures are context-dependent and often polysemous, the same hand movement may convey different meanings across situations. Nevertheless, human gesture research provides a basis for considering the OPPG within a reassuring context. Kendon (2004), drawing on Efron (1972), describes OPPGs as communicating meanings such as “take it easy” or “be calm”. The OPPGs are also documented as being associated with reassurance, protection, or calming across different cultural settings, both in usage and iconography (Rose, 1919; Calbris and Doyle 1990d; Payrató, 1993; Harrison, 2018d; Singh, 2022). The recurrence of these associations suggests that humans may repeatedly use this gesture as part of a broader embodied repertoire for regulating one another’s emotional states. If so, the accompanying posture, facial expression, vocal tone, and movement that often accompany the gesture may also be reproduced spontaneously when humans attempt to calm dogs. Examples from popular media, including news images and internet memes, which depict the gesture as reassuring (Xaquín *et al.*, 2013; See Appendix 2 in Supplementary Material for examples) may serve to illustrate this body language.

OPPGs may at times also be used by some handlers as a learned cue, where repeated reinforcement produces a trained response. This process cannot be ruled out in examples provided here. However, neither can it be firmly established from the available evidence, as the examples do not consistently exhibit the overt behavioural changes that would be required to demonstrate compliance with a directive. Instead, what is observed are more gradual changes in posture, facial expression, respiration, vigilance, physiological arousal, etc. While such observations may be insufficient to establish compliance with a directive, they become more informative when considering possible changes in emotional state. The relative abundance of these observations suggests that an affective perspective may provide a useful additional lens through which to examine the gesture. It is through this lens that the present analysis proceeds.

Scheider *et al.* (2013) argue that if the gesture were chiefly imperative, authoritative vocal tones or assertive postures produce better compliance. However, the examples examined here involve relaxed hand presentation, softened posture, gentle facial expression, and non-authoritative vocal tone. In these interactions, dogs frequently remain behaviourally engaged with the environment while showing subtle changes indicating potential reduction in arousal, rather than behavioural compliance. This pattern suggests that the gesture, used in this manner, may function less as an instruction and more as part of a co-regulatory exchange.

These examples also highlight the methodological challenge faced when interpreting such gestures. Trained behaviours can usually be assessed by whether a specific action occurs after a signal. Reassurance, by contrast, involves a change in internal state that must be inferred indirectly through behaviour, physiology

and context. This makes affective communication more difficult to study than trained responses that produce immediate observable outcomes.

The examples further suggest that the apparent effectiveness of the gesture may depend on ongoing adjustment between human and dog. Small differences in timing, hand shape, posture, or vocal tone appear to influence how the gesture is received, while dogs vary in how readily they respond. Rather than a fixed signal producing a uniform effect, the gesture may operate through a process of mutual regulation in which both participants contribute to the development of a shared communicative pattern, co-creating meaning.

Taken together, these observations suggest that the OPPG is better understood as a potential co-created, embodied form of emotional co-regulation rather than simply as a tool of behavioural control. Distinguishing between these possibilities may be important for future work examining how humans and dogs negotiate affective communication in everyday life.

MULTIMODALITY AND THE EMERGENCE OF MEANING

Example 4: Max the pug

In video V8, the OPPG is offered to Max, the pug. Unlike the previous example, the gesture here is accompanied by the human’s verbal reassurance, “It’s okay.” Max eventually resumes resting, similar to earlier observations. His eyes soften at one point, his pupils are not dilated, suggesting a calmer physiological state (Fig. 4A and B).

Discussion: This example raises the question of how accompanying modalities like voice shape the meaning of the OPPG. Addressing this requires situating the OPPG within a multimodal communicative framework rather than treating it as an isolated signal.

The OPPG is a polysemous, polysign gesture whose meaning varies with context (Calbris and Copple, 2011b). As Calbris and Doyle (1990a) note, ambiguity in such gestures is typically resolved through multimodal coordination. Accordingly, the OPPG functions as one element within a broader ensemble comprising handshape, movement, vocal tone, gaze, posture, and facial expression (Calbris and Copple, 2011a; Müller *et al.*, 2014b).

Experimental evidence suggests that dogs are sensitive to such ensembles (Huber and Lonardo, 2023). Gestures paired with friendly vocal tones elicit stronger responses, indicating that voice can reinforce affiliative intent (Scheider *et al.*, 2011). However, vocalisation does not appear essential. In the absence of speech, reassurance may be conveyed through relaxed posture, soft facial expression, gentle hand movements, gaze behaviour, and head nods—features associated with calming or positive valence in human interaction (Calbris and Doyle, 1990a, 1990c, 1990d; Harrison, 2018d; Csányi, 2000; McClave, 2000).

Gaze plays a particularly important role. Dogs use eye contact to assess communicative intent (Kaminski *et al.*, 2012), with brief eye contact interpreted as affiliative and prolonged staring potentially as threatening (Soproni *et al.*, 2001; Vas *et al.*, 2005). “Soft eyes”, “happy face” and gaze alternation may signal benevolence and facilitate coordination (Merola *et al.*, 2012a; Poggi, 2013; Müller *et al.*, 2015).

Dogs are capable of integrating information across modalities, including facial expression, tone, gesture, posture, and movement (Deputte and Doll, 2011; Scheider *et al.*, 2011). From this perspective, the meaning of the OPPG emerges through coordinated, multimodal use, with dogs incorporating the gesture into a broader assessment of human intent and affective stance.

These considerations also invite reflection on whether the gesture itself is essential to the reassuring exchange. Given dogs’ capacity to interpret and engage with the multimodal signals humans produce, it is plausible that the OPPG is not in itself a mandatory component, but one element within a broader behavioural and



Fig. 4. Max the pug is offered the open palm prone gesture; screenshots show softening of the eyes. (A) Dilated pupils. (B) “Softer eyes”.

emotional ensemble. What may matter more is the *configuration* of the ensemble that a dog repeatedly encounters.

As discussed in the preceding sections, human communication is inherently gestural. Our hands move even when words are unnecessary, and such movements are particularly salient to dogs – a species that, as shown earlier, displays exceptional sensitivity to human hand dynamics and the intentions they convey. This existing evidence supports treating gesture as a central yet integrated element within the multimodal repertoire of human–dog communication. For this reason, gesture becomes the focal point of this analysis. It may serve as an especially visible and easily reproducible locus within affective communication. The question explored here is therefore not whether the OPPG, on its own, communicates reassurance, but whether it can be effectively employed within multimodal affective communication, and what value it might add when humans attempt to soothe or reassure dogs.

RELATIONAL CONTEXT

Example 5a: Iti

Videos V9 and V10 show the OPPG being used for the first time on a free-living dog called Iti, captured in two videos filmed seconds apart. In the first, Iti alerts towards a bark and is offered the OPPG with a soothing voice. She glances at the human and briefly calms, but eventually rises and barks, suggesting limited effectiveness. In the second video, seemingly shot seconds later in the same context, the gesture appears effective: Iti is offered the OPPG and gentle vocal reassurance. She responds by intermittently looking at the human and then rests her head, closing her eyes, indicating reduced arousal.

Example 5b: Rusk and Mousse

Video V11 documents the first use of the OPPG with Rusk and Mousse, two foster puppies that had been in the household for less than 24 h. The dogs react to a sound from the kitchen while being offered the OPPG. Rusk quickly looks towards the human and rests, whereas Mousse initially flinches and scans her surroundings for some time, seemingly ignoring the gesture. But when the gesture is briefly withdrawn, she looks towards the human, after which the

gesture is reintroduced. She observes the gesture and eventually rests her head on Rusk.

Discussion: Communication in dog–human interaction is fundamentally socio-relational rather than purely informational (Stivers, 2008). This orientation may make dogs more receptive to affiliative gestures such as reassurance from attachment figures. Contemporary attachment research increasingly conceptualises attachment not simply as social preference, but as a system involved in emotional regulation and the management of stress, uncertainty, and proximity-seeking (de Souza *et al.*, 2025). As discussed earlier, the secure-base effect may further reduce fear in ambiguous or threatening situations, increasing openness to any form of communication.

This relational dimension can also be observed in the examples discussed. In both Mousse and Iti, the gesture does not seem to elicit an immediate response; a few seconds pass before visible indicators of de-escalation are observed. Several interpretations are possible. The delay may simply reflect differences in arousal level, attentional engagement, or previous experience with human gestures. However, within the framework of attachment theory discussed earlier, such pauses could also indicate that these dogs are in the process of assessing safety and establishing the human as a potential secure base. This interpretation is consistent with contemporary views of attachment as a dynamic regulatory system rather than merely a stable social bond (de Souza *et al.*, 2025). In Example 3c, by contrast, the human appears to have already adapted to Luna’s preferences. These interactions suggest that reassurance may emerge, not as a signal that is transmitted and received instantaneously, but as a product of gradual, mutual adjustment in which the dog plays an active role in shaping communicative alignment.

Communication can influence attachment. Gestures that signal alignment or shared stance may foster affiliative bonding, reinforcing the human as a secure base and strengthening the calming effect of later interactions (Duranton and Gaunet, 2015; Kumashiro and Arriaga, 2020). Conversely, dogs with histories of neglect, inconsistent support, or punishment during fear may be slower to notice or trust affiliative signals, as seen with Mousse and Iti (Horn *et al.*, 2013). Furthermore, Byrne *et al.* (2023) demonstrate that dogs engage in and seek to maintain shared engagement with humans beyond the immediate completion of a task. Such findings suggest

that the value of these interactions resides in the maintenance of social connection itself. Taken together, these examples and prior studies suggest that, like pointing, responsiveness to the OPPG is shaped by experience and use of OPPG in providing reassurance has the potential to shape future experience.

These observations caution against viewing reassurance gestures as mechanistic cues with predictable outcomes. Rather, they highlight a dynamic, relational process: reassurance is not merely informational, but relational and experiential.

SHARED ATTENTION, TIMING AND INTERNAL STATE OF THE DOG

Example 6a: Loki and Kitty

Video V12 opens with Loki and Kitty vocalising towards a window while the human presents the OPBG. As in Example 5a with Iti, immediate de-escalation is not apparent; however, this case differs from most others in that the dogs appear visibly agitated, occasionally pacing and vocalising. The videos show them moving repeatedly between the window and the bed. At one point, the human walks to the window, standing beside it with the OPBG directed towards the dogs (Fig. 5A). The sequence, composed of two videos, is longer than earlier examples. Although vocalisations cease early in the first clip, the description notes that Loki resumes barking later. Video V12 shows the second part of the interaction, in which both dogs remain on the bed but stay alert. A single whimper occurs at the end, and both remain in place: Loki alternates gaze between the window and the human with softer eyes (Fig. 5A and B), while Kitty faces away from the window. The absence of pacing or sustained barking may indicate a partial reduction in physiological arousal.

Example 6b: Snow

In video V14, a dog called Snow is seated on his bed. A man is seen entering the room, and Snow barks at the man. Video V15 is the next part of this interaction, where Snow is offered an OPPG. The person seated beside him makes a sound that seems to draw his attention towards the gesture offered. Subsequently, the man walks in again. Snow stretches his neck as if preparing to bark, but remains silent and does not leave his resting place. He seems behaviourally settled.

Discussion: In Example 6a, the dogs do not behaviourally settle until the human physically approaches the window – a pattern often noted in our field observations. This example could reveal conditions that impact the communicative effectiveness of the gesture.

A key consideration here is what gesture scholars call *reification*: the process of rendering an abstract or hypothetical perception experientially salient (Lapaire, 2006). Calbris and Copple (2011a) argue that an object must first be communicatively “made to exist” before it can be evaluated. As illustrated by Sweetser (2006) and Harrison (2018c), even an absence (e.g., “no milk in the refrigerator”) is understood through implicit comparison with an imagined alternative (“milk in the refrigerator”). Reification thus allows non-material concerns to become communicatively available.

This contrasts with an alternative strategy of rendering a perceived threat irrelevant by ignoring it altogether. Our field experience suggests that such non-response is often ineffective. Empirical evidence suggests that inaction may be perceived as atypical, producing confusion rather than reassurance (Duranton *et al.*, 2016), and dogs seem to reduce social referencing when humans

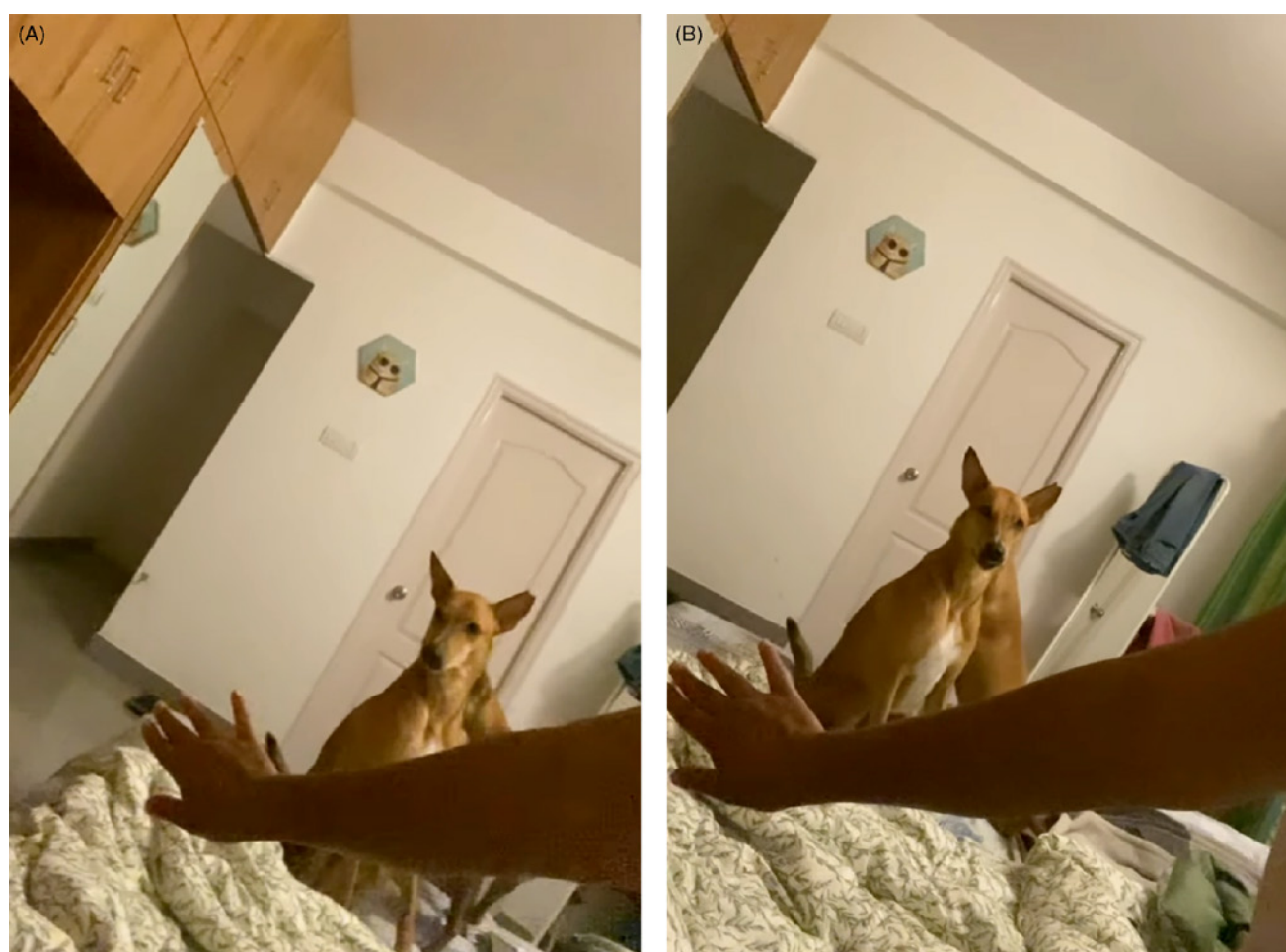


Fig. 5. Loki's reaction towards the end of the interaction. (A) Looking at the window. (B) Looking away with “soft eyes”.

remain unresponsive (Merola *et al.*, 2012a). In such cases, human failure to engage signals a breakdown in communication rather than safety.

From this perspective, the theoretical question is not simply whether the OPPG communicates reassurance, but how a human may first establish reification for the dog to make reassurance possible. Emery's (2000) discussion on joint and shared attention may be of salience in this context. Emery (2000) articulates this distinction by defining joint attention as attending to the same stimulus, and shared attention as mutual awareness of that attentional alignment. Thus, attending to the "object" of the dog's concern while drawing the dog's attention towards this may serve to reify the object of concern, thus providing the communicative grounding necessary for reassurance.

The concept of dogs engaging in shared attention with humans is not novel. Byrne *et al.* (2023) provide evidence that dogs participate in forms of joint engagement requiring awareness of a shared focus between dog and human. This is shared attention. Their findings further suggest that maintaining shared engagement may itself hold value, indicating that this form of social coordination is part of the dog's communicative repertoire. If such mechanisms already exist within dog-human interaction, it is useful to consider how those same mechanisms may be drawn upon when a human is attempting to reassure a dog.

Studies offer insight into how shared attention may be established through body language. Dogs are sensitive to cues such as gaze, head orientation and body posture when inferring human perspective (Szetei *et al.*, 2003). Gaze alternation between the object of concern and the dog may therefore establish shared attention (Gaunet and Deputte, 2011; Marshall-Pescini *et al.*, 2013). In some cases, such subtle reification appears sufficient to enable reassurance. In the present example, however, behavioural calming is slower and uneven: the dogs are more aroused, and the interaction is prolonged. Subtle cues may go unnoticed in such situations. In Example 6a, the human moves towards the window, orienting face and body towards the perceived source of concern, palm facing the dog and remaining there for a period. This more conspicuous, multimodal action likely functions as "louder" communication, without making it more assertive towards the dog. Example 6b shows another seeming "louder" form of reification, where the human makes a sound to draw the attention of the dog, seemingly to explicitly demonstrate shared attention.

Example 6a also highlights that the effectiveness of reassurance may be impacted by the dog's internal state. Elevated arousal, stress, or anxiety can reduce sensitivity to communicative cues (Duranton and Gaunet, 2016; Bhattacharjee *et al.*, 2020), and juveniles often respond less reliably than adults (Gácsi *et al.*, 2009b). Kitty, in this example, is a juvenile dog.

Finally, timing seems significant. In Example 6a, the dogs are already standing and vocalising at the onset of the interaction. Field observations suggest that the OPPG is most effective when used anticipatorily, before arousal escalates. This can be seen in Example 6b, where Snow is offered the OPPG before the man walks in, which is followed by behavioural calmness in Snow.

The observations in this example suggest that the OPPG may not operate as a universally effective signal, affecting immediate, predictable and consistent change in the dog. Rather, its apparent reassuring function may depend on whether necessary conditions are established at the onset or during the communicative exchange. These conditions may include, but are not limited to, the dog perceiving that the human has recognised the concern, the gesture being offered at an appropriate moment, and the dog being in a state in which social regulation is still possible. Under those conditions, the OPPG may become one component of a broader process of interspecies reassurance.

CONDITIONED RESPONSE OR COGNITIVE PROCESSING?

Could classical or operant conditioning account for the behaviours described above? Because dogs are highly responsive to human behaviour, this possibility must be examined before considering broader interpretations.

For the observations discussed here to be predominantly a result of classical conditioning, the OPPG would be the unconditioned stimulus (US), and it would need to be paired with a conditioned stimulus (CS) that already elicits a response (conditioned response or CR). In the present examples, however, a CS eliciting a CR that the gesture is systematically paired with is not identifiable. Although such pairings may exist within an individual dog's prior history, the observational material presented here does not show a stable pattern that would readily support a straightforward classical conditioning account.

A second possibility is operant conditioning, in which an antecedent or cue precedes a behaviour that is subsequently reinforced or punished. Although the gesture could function as an antecedent, there is no clear behaviour to reinforce, and reinforcing inaction is impractical. In some cases, subtle or inadvertent reinforcement cannot be excluded, and it remains possible that internal changes in affective state themselves may function as reinforcement. Such possibilities warrant further study.

At the same time, the observations suggest that conditioning alone may not fully account for the flexibility of these interactions. Across examples, responses appear to vary according to relational familiarity, gesture quality, timing, shared attention, and the dog's current state of arousal. These features suggest that the dog may be responding not simply to a hand movement, but to a larger communicative event.

Previous research offers several alternative frameworks that may help explain this possibility. As discussed earlier, dogs can isolate and integrate multiple components of multimodal communication. Some researchers have suggested that dogs may be sensitive to communicative intent rather than merely responding to discrete cues (Miklósi *et al.*, 2000, 2004; Espinosa *et al.*, 2023). For example, in search tasks guided by human gestures, dogs sustain their search only when contextual information is available, suggesting cognitive integration rather than rote cue-following (Scheider *et al.*, 2011). Similarly, agility-trained dogs do not outperform untrained dogs in pointing comprehension, indicating that extensive training does not straightforwardly explain gesture responsiveness (Gácsi *et al.*, 2009b).

Scholars caution against oversimplifying dichotomies among such behaviours as either "simple conditioning" or "high-level cognition" (Miklósi and Soproni, 2006) or "innate" versus "learned" (Tinbergen, 1968). Silva and Sousa (2011) and Andrews (2020) argue that favouring overly parsimonious explanations risks underestimating the complexity of animal minds. While the mechanisms underlying dogs' responses to the OPPG remain uncertain, the evidence supports a cautious openness to more complex, interactional explanations that may be at play, along with some forms of conditioning.

ENCULTURATION

The OPPG is subject to subtle cultural variation among humans. For example, Kabyle speakers use the gesture more often than French or American storytellers, and French speakers more than Americans (Ferré and Mettouchi, 2020). Elements of the broader multimodal ensemble, such as head nods, also vary cross-culturally (Maynard, 1987; Kita and Ide, 2007).

Anthrozoological research suggests that animals living closely with humans may become sensitive not only to repeated behaviours but also to socially patterned forms of meaning within human environments (Miklósi *et al.*, 2004). The OPPG may be one such

pattern: not innate, not universal, but acquired through participation in human social ecologies. Cultural variation in human gesture use therefore, implies corresponding variation in dogs' opportunities to encounter and learn such gestures.

At the same time, the examples presented here span dogs living in India and several European settings, including both free-living and companion dogs. Comparable responses were observed across these contexts. Although these observations remain preliminary, they suggest that the gesture may possess a degree of cross-cultural stability while still allowing for local variation in how it is expressed and interpreted.

Enculturation, therefore, offers a useful framework for understanding how a gesture such as the OPPG might acquire meaning across species. Rather than reducing the interaction to either fixed instinct or simple training, it allows the gesture to be understood as part of a shared communicative environment in which dogs may gradually learn to participate in culturally patterned forms of human social exchange.

FREE-LIVING DOGS AND HUMAN-DOG COEXISTENCE

The relevance of this work is especially pronounced in relation to free-living dogs. In India and many other regions, humans and dogs routinely share space without the mediating frameworks of ownership, training, or institutional control, and interactions unfold in unscripted, everyday contexts. In such settings, forms of communication that reduce fear and prevent escalation are not only ethically important but practically necessary. Coexistence is not passive, but actively maintained through interaction. If certain human gestures can signal non-threat, pause, or reassurance to dogs, recognising and refining these practices could contribute to safer coexistence without reliance on force or coercion. Crucially, this perspective shifts responsibility away from canine compliance and towards human communicative competence, reframing the problem from how dogs should be trained to respond, to how humans might more effectively attune to the embodied communicative practices that shape human-dog relations.

WELFARE IMPLICATIONS

Examining the OPPG in reassuring contexts is not only theoretically informative but has direct implications for canine welfare, given that human communication could influence a dog's emotional regulation and sense of safety.

As discussed earlier, dogs form attachment relationships with humans, with caregiver responsiveness playing a significant role in attachment quality, and this attachment is compared to that between a human infant and an adult (Topál *et al.*, 1998; Nagasawa *et al.*, 2009; MacLean and Hare, 2015). While trauma or early adversity can disrupt secure attachment, research in humans shows that attachment models are not fixed and can be reshaped through repeated experiences of reassurance and perceived availability of support (Collins and Feeney, 2000; Kumashiro and Arriaga, 2020; Akyirem *et al.*, 2022). Such "soft and safe" strategies are known to facilitate stress regulation and promote well-being (Gurung *et al.*, 1997), and given the documented parallels in attachment processes, these findings are plausibly relevant to dog-human relationships.

This perspective also invites a reassessment of common assumptions about welfare interventions: obedience training is often presumed to strengthen bonds, yet empirical studies show little evidence that it improves attachment or reduces behavioural problems (Voith *et al.*, 1992; Topál *et al.*, 1997). Behavioural control and emotional support are not the same process. A dog may learn to suppress behaviour without experiencing reduced distress. The examples considered in this article instead raise the possibility that certain forms of interaction may help regulate internal state rather than simply inhibit outward expression.

From this perspective, the significance of the OPPG may extend beyond a single gesture. The broader welfare question may be whether humans can learn to communicate in ways that reduce fear, uncertainty, and social tension without relying on force, correction, or restraint. If so, communicative competence may itself represent an under-recognised dimension of canine welfare.

This possibility may be especially relevant for fearful dogs, free-living dogs, newly adopted dogs, and dogs in unfamiliar environments. In such contexts, subtle forms of reassurance may at times matter as much as physical care. Understanding how dogs engage in these interactions may therefore contribute not only to behavioural science, but to a more relational understanding of welfare itself.

FUTURE DIRECTIONS AND RESEARCH CHALLENGES

Beyond its applied relevance, the OPPG raises a set of broader research questions that intersect with comparative cognition, gesture studies and interspecies communication. Dogs' close evolutionary and developmental relationship with humans makes them particularly suitable subjects for examining how communicative meaning emerges across species (Miklósi *et al.*, 2004; Hare and Tomasello, 2005). More specifically, examining how dogs interpret human gestures offers a valuable avenue for probing the cognitive mechanisms underlying interspecies communication. Miklósi and Soproni (2006) argue that animals' comprehension of human gestures can reveal the processes supporting social understanding.

The OPPG is also methodologically promising as it is likely to elicit measurable physiological responses. This allows researchers to move beyond task-based performance metrics. At the same time, the gesture engages complex processes, making it a candidate that combines empirical accessibility with conceptual depth.

In seeking to understand the OPPG as a cross-species communicative tool, several key questions arise: what emotional changes are associated with exposure to the OPPG; how arousal, internal state, prior experience and socialisation shape responses; how enculturation and cultural variation influence interpretation; how such interactions should be classified within communication models largely oriented towards command-response paradigms; and what dogs infer about human attentional or affective states when responding to the gesture (Hare and Tomasello, 2005).

Studying this form of communication nevertheless presents significant challenges. Multimodal, context-dependent, and culturally variable gestures like the OPPG complicate experimental control and standardisation (Calbris and Copple, 2011a; Harrison, 2018b). Experimental standardisation may risk stripping away the very interactional conditions that make the gesture meaningful. Recent work in canine cognition has also highlighted the importance of procedural details, suggesting that seemingly minor variations in study design can influence outcomes and interpretation (Espinosa *et al.*, 2023). This consideration may be particularly important because dogs cannot be instructed to produce gestures or report interpretations, and perception must be inferred indirectly.

If the relevant outcome is a change in internal state rather than a clearly discrete action, interpretation becomes more difficult. The absence of an overt behavioural response does not necessarily indicate the absence of communication. This complicates conventional experimental designs, which often depend on visible responses that can be easily coded and quantified.

Future work will need to balance ecological validity with methodological control. The following are some research strategies which may serve this purpose:

1. *Comparative studies* examining dogs' responses to different hand configurations under ecologically valid conditions.
2. *Cross-cultural research* exploring how variation in human gestural practices influences dogs' interpretations.
3. *Longitudinal studies* with free-living dogs and companion dogs.
4. *Physiological measures* combined with behavioural observation to examine emotional regulation rather than task performance.
5. *Participatory research* drawing on the experiences of people who regularly interact with dogs in non-instructional contexts.

Taken together, these considerations position the OPPG as a productive focal point for future inquiry. Its study offers a means of advancing understanding of gesture, affective communication, and meaning-making in interspecies interaction, while also expanding how interspecies communication is conceptualised within animal behaviour research.

CONCLUSION

This article proposes that the OPPG warrants closer consideration as a possible form of affective communication between humans and dogs. Rather than functioning simply as a command, the observations examined here suggest that under certain conditions, the gesture may contribute to emotional regulation through the interaction of gesture form, multimodal context, relational history, timing and the dog's internal state.

The argument remains provisional. These observations do not establish that dogs uniformly interpret the OPPG as reassurance, but they do suggest that existing frameworks centred primarily on command, conditioning or referencing may not fully account for the interactions between dogs and humans.

More broadly, this inquiry raises the possibility that some forms of human–dog communication may be oriented not only towards directing behaviour but also towards creating safety within shared social environments. If so, the OPPG may offer a useful starting point for examining how everyday communication can impact the well-being of the human–dog dyad.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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DATA AVAILABILITY

Video materials supporting the findings of this study are available via a combination of publicly accessible and unlisted links hosted on YouTube and Vimeo. Access details and URLs are provided in the Supplementary Material, subject to ethical, legal, and permission-based considerations.

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ETHICS STATEMENT

This study is based on observational analysis of video recordings documenting naturally occurring human–dog interactions. No experimental procedures were conducted, and no interactions were staged or manipulated for research purposes. The study does not involve recruitment of participants or collection of personal data.

The video corpus includes a mixture of publicly available recordings captured in public spaces, pilot study recordings, author-recorded videos, and contributor-submitted videos. Two videos are publicly available recordings captured in public spaces of public servants performing their public duties, while their identities remain hidden due to the low resolution of the videos. Two additional recordings derive from pilot studies: one shared via an unlisted link and one publicly available on the originating organization's website, both with blurred faces and with explicit written permission for scholarly use. Two videos were recorded by the author uploaded in a manner that does not reveal the author's identity. The remaining videos were submitted voluntarily by contributors with permission for scholarly use; some of these are publicly available, while others are shared via unlisted links, but all are included with consent.

Still frames extracted from these videos are used in the main article and in the Supplementary material. No still frames depicting identifiable individuals are reproduced. Only non-identifying material (e.g., graphical outputs) is presented in one case. All still frames are provided only with explicit written content.

In accordance with established ethical guidelines for observational research using publicly available and consented materials, formal institutional ethics committee approval was not required.

SUPPLEMENTARY MATERIAL

The supplementary material is available in the online version of this article.

Please note: CABI is not responsible for the content or functionality of supplementary files provided by the authors and any queries should be directed to the corresponding author.

References

- Akyirem, S., Salifu, Y., Bayuo, J., Duodu, P.A., Bossman, I.F. and Abboah-Offei, M. (2022) An integrative review of the use of the concept of reassurance in clinical practice. *Nursing Open* 9(3), 1515–1535. DOI: 10.1002/nop2.1102.
- Andrews, K. (2020) *How to Study Animal Minds*. Cambridge University Press, Cambridge, UK.
- Bhattacharjee, D. and Bhadra, A. (2020) Humans dominate the social interaction networks of urban free-ranging dogs in India. *Frontiers in Psychology* 11, 2153. DOI: 10.3389/fpsyg.2020.02153.
- Bhattacharjee, D., Nikhil Dev, N., Gupta, S., Sau, S., Sarkar, R. *et al.* (2017) Free-ranging dogs show age related plasticity in their ability to follow human pointing. *PLoS One* 12(7), e0180643. DOI: 10.1371/journal.pone.0180643.
- Bhattacharjee, D., Mandal, S., Shit, P., Varghese, M.G., Vishnoi, A. and Bhadra, A. (2020) Free-ranging dogs are capable of utilizing complex human pointing cues. *Frontiers in Psychology* 10, 507348. DOI: 10.3389/fpsyg.2019.02818.
- Bowlby, J. (1982) *Attachment and Loss: Attachment*. 2nd edn, Vol. 1, Basic Books, New York, NY.
- Bowlby, J. (2018) The nature of the child's tie to his mother 1. In: *Influential Papers from the 1950s*. Routledge, Abingdon, UK, pp. 222–273.
- Bressemer, J., Stein, N. and Wegener, C. (2015) Structuring and highlighting speech–discursive functions of holding away gestures in Savosavo. In: Ferré, G. and Tutton, M. (eds) *Proceedings of GESPIN*. Vol. 4, Université de Nantes, Nantes, France, pp. 49–54.

- Brookes, H. (2004) A repertoire of south African quotable gestures. *Journal of Linguistic Anthropology* 14(2), 186–224. DOI: 10.1525/jlin.2004.14.2.186.
- Brubaker, L., Dasgupta, S., Bhattacharjee, D., Bhadra, A. and Udell, M.A. (2017) Differences in problem-solving between canid populations: Do domestication and lifetime experience affect persistence? *Animal Cognition* 20, 717–723. DOI: 10.1007/s10071-017-1093-7.
- Budiansky, S. (1992) *The Covenant of the Wild: Why Animals Chose Domestication: With a New Preface*. Yale University Press, New Haven, CT, USA.
- Budzinski, A. and Gomes-Budzinski, C. (2023) *The Hand Signal*. DogFieldStudy. Available at: <https://www.dogfieldstudy.com/en/hand-signal> (accessed 23 March 2024).
- Buttelmann, D. and Tomasello, M. (2013) Can domestic dogs (*Canis familiaris*) use referential emotional expressions to locate hidden food? *Animal Cognition* 16(1), 137–145. DOI: 10.1007/s10071-012-0560-4.
- Byrne, M., Horschler, D.J., Schmitt, M. and Johnston, A.M. (2023) Pet dogs (*Canis familiaris*) re-engage humans after joint activity. *Animal Cognition* 26(4), 1277–1282. DOI: 10.1007/s10071-023-01754-7.
- Calbris, G. and Copple, M.M. (2011a) Identifying the referential function of gesture. In: *Elements of Meaning in Gesture*. John Benjamins Publishing Company, Amsterdam/Philadelphia, pp. 57–72.
- Calbris, G. and Copple, M.M. (2011b) One gesture represents different notions: Polysemy and polysign. In: *Elements of Meaning in Gesture*. John Benjamins Publishing Company, Amsterdam/Philadelphia, pp. 163–196.
- Calbris, G. and Doyle, O. (1990a) 1. Determining the relevant features of a gestural expression. In: *The Semiotics of French Gestures*. Indiana University Press, Bloomington and Indianapolis, Indiana, pp. 1–25.
- Calbris, G. and Doyle, O. (1990b) 3. Physical components of the gestural sign. In: *The Semiotics of French Gestures*. Indiana University Press, Bloomington and Indianapolis, Indiana, pp. 41–83.
- Calbris, G. and Doyle, O. (1990c) 4. Semantic fields of the gestural sign. In: *The Semiotics of French Gestures*. Indiana University Press, Bloomington and Indianapolis, Indiana, pp. 84–103.
- Calbris, G. and Doyle, O. (1990d) 6. The relationship between signifier and signified. In: *The Semiotics of French Gestures*. Indiana University Press, Bloomington and Indianapolis, Indiana, pp. 116–153.
- Clutton-Brock, J. (2016) Origins of the dog: The archaeological evidence. In: Serpell, J. (ed) *The Domestic Dog: Its Evolution, Behavior and Interactions with People*, Cambridge University Press, Cambridge, United Kingdom, pp. 7–21.
- Cohn, J. (1997) How wild wolves became domestic dogs. *Bioscience* 47(11), 725. DOI: 10.2307/1313090.
- Collins, N.L. and Feeney, B.C. (2000) A safe haven: An attachment theory perspective on support seeking and caregiving in intimate relationships. *Journal of Personality and Social Psychology* 78(6), 1053. DOI: 10.1037/0022-3514.78.6.1053.
- Cooper, J.J., Ashton, C., Bishop, S., West, R., Mills, D.S. and Young, R.J. (2003) Clever hounds: Social cognition in the domestic dog (*Canis familiaris*). *Applied Animal Behaviour Science* 81(3), 229–244. DOI: 10.1016/S0168-1591(02)00284-8.
- Csányi, V. (2000) The “human behavior complex” and the compulsion of communication: Key factors of human evolution. *Semiotica* 128(3–4), 243–258. DOI: 10.1515/semi.2000.128.3-4.243.
- de Souza, M.C., Bastos, G.Q. and Tokumaru, R.S. (2025) Attachment theory applied to the human-dog relationship. *Journal of Veterinary Behavior: Clinical Applications and Research* 82, 8–19. DOI: 10.1016/j.jveb.2025.09.005.
- Deputte, B.L. and Doll, A. (2011) Do dogs understand human facial expressions? *Journal of Veterinary Behavior: Clinical Applications and Research* 6(1), 78–79. DOI: 10.1016/j.jveb.2010.09.001.
- Duranton, C. and Gaunet, F. (2015) Canis sensitivus: Affiliation and dogs’ sensitivity to others’ behavior as the basis for synchronization with humans? *Journal of Veterinary Behavior* 10(6), 513–524. DOI: 10.1016/j.jveb.2015.06.003.
- Duranton, C. and Gaunet, F. (2016) Effects of shelter housing on dogs’ sensitivity to human social cues. *Journal of Veterinary Behavior* 14, 20–27. DOI: 10.1016/j.jveb.2016.05.005.
- Duranton, C., Bedossa, T. and Gaunet, F. (2016) When facing an unfamiliar person, pet dogs present social referencing based on their owners’ direction of movement alone. *Animal Behaviour* 113, 147–156. DOI: 10.1016/j.anbehav.2016.01.011.
- Efron, D. (1972) Gesture, race and culture: A tentative study of the spatio-temporal and “linguistic” aspects of the gestural behavior of eastern Jews and southern Italians in New York City, living under similar as well as different environmental conditions. *Approaches to Semiotics*, Vol. 9, Mouton, The Hague, The Netherlands, 226 pp.
- Elgier, A.M., Jakovcovic, A., Mustaca, A.E. and Bentosela, M. (2009) Learning and owner–stranger effects on interspecific communication in domestic dogs (*Canis familiaris*). *Behavioural Processes* 81(1), 44–49. DOI: 10.1016/j.beproc.2008.12.023.
- Emery, N.J. (2000) The eyes have it: The neuroethology, function and evolution of social gaze. *Neuroscience & Biobehavioral Reviews* 24(6), 581–604. DOI: 10.1016/S0149-7634(00)00025-7.
- Erdőhegyi, Á., Topál, J., Virányi, Z. and Miklósi, Á. (2007) Dog-logic: Inferential reasoning in a two-way choice task and its restricted use. *Animal Behaviour* 74(4), 725–737. DOI: 10.1016/j.anbehav.2007.03.004.
- Espinosa, J., Stevens, J.R., Alberghina, D., Alway, H.E., Barela, J.D. et al. (2023) ManyDogs 1: A multi-lab replication study of dogs’ pointing comprehension. *Animal Behavior and Cognition* 10(3), 232–286. DOI: 10.26451/abc.10.03.03.2023.
- Ferré, G. and Mettouchi, A. (2020) A cultural study of open-palm hand gestures and their prosodic correlates. In: *10th International Conference on Speech Prosody 2020*, ISCA, Tokyo, Japan, pp. 285–289.
- Freedman, A.H. and Wayne, R.K. (2017) Deciphering the origin of dogs: From fossils to genomes. *Annual Review of Animal Biosciences* 5, 281–307. DOI: 10.1146/annurev-animal-022114-110937.
- Gácsi, M., Topál, J., Miklósi, Á., Dóka, A. and Csányi, V. (2001) Attachment behavior of adult dogs (*Canis familiaris*) living at rescue centers: Forming new bonds. *Journal of Comparative Psychology* 115(4), 423. DOI: 10.1037/0735-7036.115.4.423.
- Gácsi, M., Miklósi, Á., Varga, O., Topál, J. and Csányi, V. (2004) Are readers of our face readers of our minds? Dogs (*Canis familiaris*) show situation-dependent recognition of human’s attention. *Animal Cognition* 7, 144–153. DOI: 10.1007/s10071-003-0205-8.
- Gácsi, M., Györi, B., Virányi, Z., Kubinyi, E., Range, F., Belényi, B. and Miklósi, Á. (2009a) Explaining dog wolf differences in utilizing human pointing gestures: Selection for synergistic shifts in the development of some social skills. *PLoS One* 4(8), e6584. DOI: 10.1371/journal.pone.0006584.
- Gácsi, M., Kara, E., Belényi, B., Topál, J. and Miklósi, Á. (2009b) The effect of development and individual differences in pointing comprehension of dogs. *Animal Cognition* 12, 471–479. DOI: 10.1007/s10071-008-0208-6.
- Gaunet, F. and Deputte, B.L. (2011) Functionally referential and intentional communication in the domestic dog: Effects of spatial and social contexts. *Animal Cognition* 14, 849–860. DOI: 10.1007/s10071-011-0418-1.
- Germonpré, M., Sablin, M.V., Stevens, R.E., Hedges, R.E., Hofreiter, M., Stiller, M. and Després, V.R. (2009) Fossil dogs and wolves from Palaeolithic sites in Belgium, the Ukraine and Russia: Osteometry, ancient DNA and stable isotopes. *Journal of Archaeological Science* 36(2), 473–490. DOI: 10.1016/j.jas.2008.09.033.
- Germonpré, M., Lázníčková-Galetová, M. and Sablin, M.V. (2012) Palaeolithic dog skulls at the Gravettian Předmostí site, the Czech Republic. *Journal of Archaeological Science* 39(1), 184–202. DOI: 10.1016/j.jas.2011.09.022.
- Givens, D.B. (2016) Reading palm-up signs: Neurosemiotic overview of a common hand gesture. *Semiotica* 2016(210), 235–250. DOI: 10.1515/sem-2015-0138.
- Gurung, R., Sarason, B. and Sarason, I. (1997) *Close personal relationships and health outcomes: A key to the role of social support*. In: *Handbook of Personal Relationships: Theory, Research and Interventions*, John Wiley & Sons Ltd, Chichester, United Kingdom, pp. 547–573.
- Hare, B. and Tomasello, M. (1999) Domestic dogs (*Canis familiaris*) use human and conspecific social cues to locate hidden food. *Journal of Comparative Psychology* 113(2), 173. DOI: 10.1037/0735-7036.113.2.173.
- Hare, B. and Tomasello, M. (2005) Human-like social skills in dogs? *Trends in Cognitive Sciences* 9(9), 439–444. DOI: 10.1016/j.tics.2005.07.003.

- Hare, B., Brown, M., Williamson, C. and Tomasello, M. (2002) The domestication of social cognition in dogs. *Science* 298(5598), 1634–1636. DOI: 10.1126/science.1072702.
- Hare, B., Rosati, A., Kaminski, J., Bräuer, J., Call, J. and Tomasello, M. (2010) The domestication hypothesis for dogs' skills with human communication: A response to Udell et al. (2008) and Wynne et al. (2008). *Animal Behaviour* 79(2), e1–e6. DOI: 10.1016/j.anbehav.2009.06.031.
- Harrison, S. (2009) The expression of negation through grammar and gesture. *Studies in Language and Cognition*, Cambridge Scholars Publishing, Newcastle upon Tyne, United Kingdom, pp. 421–435. DOI: 10.10326/978-3-653-05157-3/39.
- Harrison, S. (2018a) 1. The impulse to gesture. In: *The Impulse to Gesture: Where Language, Minds, and Bodies Intersect*. Cambridge University Press, Cambridge, United Kingdom, pp. 1–20. DOI: 10.1017/9781108231806.
- Harrison, S. (2018b) 2. The grammar–gesture nexus. In: *The Impulse to Gesture: Where Language, Minds, and Bodies Intersect*. Cambridge University Press, Cambridge, United Kingdom, pp. 21–46. DOI: 10.1017/9781108231806.
- Harrison, S. (2018c) 4. Gesture as construal. In: *The Impulse to Gesture: Where Language, Minds, and Bodies Intersect*. Cambridge University Press, Cambridge, United Kingdom, pp. 73–103. DOI: 10.1017/9781108231806.
- Harrison, S. (2018d) 6. Patterns of gesturing. In: *The Impulse to Gesture: Where Language, Minds, and Bodies Intersect*. Cambridge University Press, Cambridge, United Kingdom, pp. 125–158. DOI: 10.1017/9781108231806.
- Harrison, S. (2018e) 8. Impulse theory. In: *The Impulse to Gesture: Where Language, Minds, and Bodies Intersect*. Cambridge University Press, Cambridge, United Kingdom, pp. 168–215. DOI: 10.1017/9781108231806.
- Horn, L., Huber, L. and Range, F. (2013) The importance of the secure base effect for domestic dogs—evidence from a manipulative problem-solving task. *PLoS ONE* 8(5), e65296. DOI: 10.1371/journal.pone.0065296.
- Huber, L. and Lonardo, L. (2023) Canine perspective-taking. *Animal Cognition* 26(1), 275–298. DOI: 10.1007/s10071-022-01677-5.
- Joly-Mascheroni, R.M., Senju, A. and Shepherd, A.J. (2008) Dogs catch human yawns. *Biology Letters* 4(5), 446–448. DOI: 10.1098/rsbl.2008.0333.
- Kaminski, J., Bräuer, J., Call, J. and Tomasello, M. (2009) Domestic dogs are sensitive to a human's perspective. *Behaviour* 146(7), 979–998. DOI: 10.1163/156853909X438214.
- Kaminski, J., Schulz, L. and Tomasello, M. (2012) How dogs know when communication is intended for them. *Developmental Science* 15(2), 222–232. DOI: 10.1111/j.1467-7687.2011.01120.x
- Kendon, A. (2004) 13. Two gesture families of the open hand. In: *Gesture: Visible Action as Utterance*. Cambridge University Press, Cambridge, UK, pp. 248–283. DOI: 10.1017/CBO9780511807578.
- Kikusui, T., Nagasawa, M., Nomoto, K., Kuse-Arata, S. and Mogi, K. (2019) Endocrine regulations in human–dog coexistence through domestication. *Trends in Endocrinology & Metabolism* 30(11), 793–806. DOI: 10.1016/j.tem.2019.09.002.
- Kita, S. and Ide, S. (2007) Nodding, aizuchi, and final particles in Japanese conversation: How conversation reflects the ideology of communication and social relationships. *Journal of Pragmatics* 39(7), 1242–1254. DOI: 10.1016/j.pragma.2007.02.009.
- Kita, S. (2020) Cross-cultural variation of speech-accompanying gesture: A review. In: Holler, J. and Levinson, S.C. (eds) *Speech Accompanying-Gesture*. Routledge, London, United Kingdom, pp. 145–167. DOI: 10.4324/9781003059783-1.
- Kumashiro, M. and Arriaga, X.B. (2020) Attachment security enhancement model: Bolstering attachment security through close relationships. *Interpersonal Relationships and the Self-concept*. Routledge, New York, NY, pp. 69–88. DOI: 10.4324/9780429273908-5.
- Lakatos, G., Soproni, K., Dóka, A. and Miklósi, Á. (2009) A comparative approach to dogs' (*Canis familiaris*) and human infants' comprehension of various forms of pointing gestures. *Animal Cognition* 12, 621–631. DOI: 10.1007/s10071-009-0221-4.
- Lapaire, J.R. (2006) Negation, reification and manipulation in a cognitive grammar of substance. *Les Cahiers du GRAAT-La Négation* 35, 333–349.
- Larson, G., Karlsson, E.K., Perri, A., Webster, M.T., Ho, S.Y. et al. (2012) Rethinking dog domestication by integrating genetics, archaeology, and biogeography. *Proceedings of the National Academy of Sciences* 109(23), 8878–8883. DOI: 10.1073/pnas.1203005109.
- MacLean, E.L. and Hare, B. (2015) Dogs hijack the human bonding pathway. *Science* 348(6232), 280–281. DOI: 10.1126/science.348.6232.280-a.
- Marshall-Pescini, S., Colombo, E., Passalacqua, C., Merola, I. and Prato-Previde, E. (2013) Gaze alternation in dogs and toddlers in an unsolvable task: Evidence of an audience effect. *Animal Cognition* 16, 933–943. DOI: 10.1007/s10071-013-0627-x.
- Marshall-Pescini, S., Rao, A., Virányi, Z. and Range, F. (2017) The role of domestication and experience in 'looking back' towards humans in an unsolvable task. *Scientific Reports* 7(1), 46636. DOI: 10.1038/srep46636.
- Maynard, S.K. (1987) Interactional functions of a nonverbal sign head movement in Japanese dyadic casual conversation. *Journal of Pragmatics* 11(5), 589–606. DOI: 10.1016/0378-2166(87)90103-7.
- McClave, E.Z. (2000) Linguistic functions of head movements in the context of speech. *Journal of Pragmatics* 32(7), 855–878. DOI: 10.1016/S0378-2166(99)00079-X.
- Merola, I., Prato-Previde, E. and Marshall-Pescini, S. (2012a) Dogs' social referencing towards owners and strangers. *PLoS ONE* 7(10), e47653. DOI: 10.1371/journal.pone.0047653.
- Merola, I., Prato-Previde, E. and Marshall-Pescini, S. (2012b) Social referencing in dog-owner dyads? *Animal Cognition* 15, 175–185. DOI: 10.1007/s10071-011-0443-0.
- Merola, I., Prato-Previde, E., Lazzaroni, M. and Marshall-Pescini, S. (2014) Dogs' comprehension of referential emotional expressions: Familiar people and familiar emotions are easier. *Animal Cognition* 17, 373–385. DOI: 10.1007/s10071-013-0668-1.
- Miklósi, Á. and Soproni, K. (2006) A comparative analysis of animals' understanding of the human pointing gesture. *Animal Cognition* 9, 81–93. DOI: 10.1007/s10071-005-0008-1.
- Miklósi, Á. and Topál, J. (2013) What does it take to become 'best friends'? Evolutionary changes in canine social competence. *Trends in Cognitive Sciences* 17(6), 287–294. DOI: 10.1016/j.tics.2013.04.005.
- Miklósi, Á., Polgárdi, R., Topál, J. and Csányi, V. (1998) Use of experimenter-given cues in dogs. *Animal Cognition* 1, 113–121. DOI: 10.1007/s100710050016.
- Miklósi, Á., Polgárdi, R., Topál, J. and Csányi, V. (2000) Intentional behaviour in dog-human communication: An experimental analysis of "showing" behaviour in the dog. *Animal Cognition* 3, 159–166. DOI: 10.1007/s100710000072.
- Miklósi, Á., Kubinyi, E., Topál, J., Gácsi, M., Virányi, Z. and Csányi, V. (2003) A simple reason for a big difference: Wolves do not look back at humans, but dogs do. *Current Biology* 13(9), 763–766. DOI: 10.1016/S0960-9822(03)00263-X.
- Miklósi, Á., Topál, J. and Csányi, V. (2004) Comparative social cognition: What can dogs teach us? *Animal Behaviour* 67(6), 995–1004. DOI: 10.1016/j.anbehav.2003.10.008.
- Morisaki, A., Takaoka, A. and Fujita, K. (2009) Are dogs sensitive to the emotional state of humans? *Journal of Veterinary Behavior* 4(2), 49. DOI: 10.1016/j.jveb.2008.09.021.
- Müller, C., Cienki, A., Fricke, E., Ladewig, S.H., McNeill, D. and Bressemer, J. (eds.) (2014a) 118. Recurrent gestures. In: *Body - Language - Communication*. Vol. 2, De Gruyter, Inc., Berlin, Germany, pp. 1558–1574. DOI: 10.1515/9783110302024.
- Müller, C., Cienki, A., Fricke, E., Ladewig, S.H., McNeill, D. and Bressemer, J. (eds.) (2014b) 120. The family of away gestures: Negation, refusal, and negative assessment. In: *Body - Language - Communication*. Vol. 2, De Gruyter, Inc. Berlin, Germany, pp. 1592–1604. DOI: 10.1515/9783110302024.
- Müller, C.A., Schmitt, K., Barber, A.L. and Huber, L. (2015) Dogs can discriminate emotional expressions of human faces. *Current Biology* 25(5), 601–605. DOI: 10.1016/j.cub.2014.12.055.

- Nagasawa, M., Mogi, K. and Kikusui, T. (2009) Attachment between humans and dogs. *Japanese Psychological Research* 51(3), 209–221. DOI: 10.1111/j.1468-5884.2009.00402.x.
- Nagasawa, M., Murai, K., Mogi, K. and Kikusui, T. (2011) Dogs can discriminate human smiling faces from blank expressions. *Animal Cognition* 14, 525–533. DOI: 10.1007/s10071-011-0386-5.
- Nandi, S., Chakraborty, M., Lahiri, A., Gope, H., Bhaduri, S.K. and Bhadra, A. (2024) Free-ranging dogs quickly learn to recognize a rewarding person. *Applied Animal Behaviour Science* 278, 106360. DOI: 10.1016/j.applanim.2024.106360.
- Paxton, D.W. (2000) A case for a naturalistic perspective. *Anthrozoös* 13(1), 5–8. DOI: 10.2752/089279300786999680.
- Payrató, L. (1993) A pragmatic view on autonomous gestures: A first repertoire of Catalan emblems. *Journal of Pragmatics* 20(3), 193–216. DOI: 10.1016/0378-2166(93)90068-V.
- Pennisi, E. (2002) A shaggy dog history. *Science* 298(5598), 1540–1542. DOI: 10.1126/science.298.5598.1540.
- Pettersson, H., Kaminski, J., Herrmann, E. and Tomasello, M. (2011) Understanding of human communicative motives in domestic dogs. *Applied Animal Behaviour Science* 133(3–4), 235–245. DOI: 10.1016/j.applanim.2011.05.014.
- Plourde, V. and Fiset, S. (2013) Pointing gestures modulate domestic dogs' search behavior for hidden objects in a spatial rotation problem. *Learning and Motivation* 44(4), 282–293. DOI: 10.1016/j.lmot.2013.05.004.
- Poggi, I. (2013) Minds, hands, face and body: A sketch of a goal and belief view of multimodal communication. In: *Body–Language–Communication: An International Handbook on Multimodality in Human Interaction*. Vol. 1, Walter de Gruyter GmbH, Berlin/Boston, pp. 627–647. DOI: 10.1515/9783110302024.
- Range, F., Marshall-Pescini, S., Kratz, C. and Virányi, Z. (2019) Wolves lead and dogs follow, but they both cooperate with humans. *Scientific Reports* 9(1), 3796. DOI: 10.1038/s41598-019-40468-y.
- Reid, P.J. (2009) Adapting to the human world: Dogs' responsiveness to our social cues. *Behavioural Processes* 80(3), 325–333. DOI: 10.1016/j.beproc.2008.11.002.
- Rose, H.A. (1919) The language of gesture. *Folklore* 30(4), 312–315. DOI: 10.1080/0015587X.1919.9719118.
- Rugaas, T. (2008) *Barking: The Sound of a Language*. Dogwise Pub, Wenatchee, WA, p. 41, 54.
- Rugaas, T. (2005) *On Talking Terms with Dogs: Calming Signals*. 2nd edn, Dogwise Publishing, Wenatchee, WA.
- Sarkar, R., Pal, T.S., Murmu, S. and Bhadra, A. (2024) The mouth speaks as much as the eyes: Free-ranging dogs depend on inner facial features for human recognition. *arXiv preprint arXiv:2407.07192*.
- Scheider, L., Grassmann, S., Kaminski, J. and Tomasello, M. (2011) Domestic dogs use contextual information and tone of voice when following a human pointing gesture. *PLoS ONE* 6(7), e21676. DOI: 10.1371/journal.pone.0021676.
- Scheider, L., Kaminski, J., Call, J. and Tomasello, M. (2013) Do domestic dogs interpret pointing as a command? *Animal Cognition* 16, 361–372. DOI: 10.1007/s10071-012-0577-8.
- Sen Majumder, S., Paul, M., Sau, S. and Bhadra, A. (2016) Denning habits of free-ranging dogs reveal preference for human proximity. *Scientific Reports* 6(1), 32014. DOI: 10.1038/srep32014.
- Silva, K. and de Sousa, L. (2011) 'Canis empathicus'? A proposal on dogs' capacity to empathize with humans. *Biology Letters* 7(4), 489–492. DOI: 10.1098/rsbl.2011.0083.
- Singh, A.K. (2022) Hidden Markov model for gesture recognition. In: *Challenges and Applications for Hand Gesture Recognition*. IGI Global, Hershey, PA, USA, pp. 109–123. DOI: 10.4018/978-1-7998-9183-6.ch006.
- Soproni, K., Miklósi, Á., Topál, J. and Csányi, V. (2001) Comprehension of human communicative signs in pet dogs (*Canis familiaris*). *Journal of Comparative Psychology* 115(2), 122. DOI: 10.1037/0735-7036.115.2.122.
- Stivers, T. (2008) Stance, alignment, and affiliation during storytelling: When nodding is a token of affiliation. *Research on Language and Social Interaction* 41(1), 31–57. DOI: 10.1080/08351810701691123.
- Sweetser, E. (2006) Negative spaces: Levels of negation and kinds of spaces. In: Bonnefille, S. and Salbayre, S. (eds) *Proceedings of the Conference "Negation: Form, Figure of Speech, Conceptualization"*. Tours: Publications Universitaires François Rabelais, pp. 313–332.
- Szetei, V., Miklósi, Á., Topál, J. and Csányi, V. (2003) When dogs seem to lose their nose: An investigation on the use of visual and olfactory cues in communicative context between dog and owner. *Applied Animal Behaviour Science* 83(2), 141–152. DOI: 10.1016/S0168-1591(03)00114-X.
- Tinbergen, N. (1968) On war and peace in animals and man: An ethologist's approach to the biology of aggression. *Science* 160(3835), 1411–1418. DOI: 10.1126/science.160.3835.1411.
- Topál, J., Miklósi, Á. and Csányi, V. (1997) Dog-human relationship affects problem solving behavior in the dog. *Anthrozoös* 10(4), 214–224. DOI: 10.2752/089279397787000987.
- Topál, J., Miklósi, Á., Csányi, V. and Dóka, A. (1998) Attachment behavior in dogs (*Canis familiaris*): A new application of Ainsworth's (1969) strange situation test. *Journal of Comparative Psychology* 112(3), 219. DOI: 10.1037/0735-7036.112.3.219.
- Turcsán, B., Szánthó, F., Miklósi, Á. and Kubinyi, E. (2015) Fetching what the owner prefers? Dogs recognize disgust and happiness in human behaviour. *Animal Cognition* 18, 83–94. DOI: 10.1007/s10071-014-0791-6.
- Udell, M.A. and Wynne, C.D. (2010) Ontogeny and phylogeny: Both are essential to human-sensitive behaviour in the genus *Canis*. *Animal Behaviour* 79(2), e9–e14. DOI: 10.1016/j.anbehav.2009.11.033.
- Vas, J., Topál, J., Gácsi, M., Miklósi, A. and Csányi, V. (2005) A friend or an enemy? Dogs' reaction to an unfamiliar person showing behavioural cues of threat and friendliness at different times. *Applied Animal Behaviour Science* 94(1–2), 99–115. DOI: 10.1016/j.applanim.2005.01.001.
- Vilà, C., Savolainen, P., Maldonado, J.E., Amorim, I.R., Rice, J.E. et al. (1997) Multiple and ancient origins of the domestic dog. *Science* 276(5319), 1687–1689. DOI: 10.1126/science.276.5319.1687.
- Virányi, Z., Topál, J., Gácsi, M., Miklósi, Á. and Csányi, V. (2004) Dogs respond appropriately to cues of humans' attentional focus. *Behavioural Processes* 66(2), 161–172. DOI: 10.1016/j.beproc.2004.01.012.
- Voith, V.L., Wright, J.C. and Danneman, P.J. (1992) Is there a relationship between canine behavior problems and spoiling activities, anthropomorphism, and obedience training? *Applied Animal Behaviour Science* 34(3), 263–272. DOI: 10.1016/S0168-1591(05)80008-8.
- Xaquín, G.V., Peçanha, S. and Cipriano, G. (2013) A short lexicon of Italian gestures. *The New York Times*. Available at: <https://archive.nytimes.com/www.nytimes.com/interactive/2013/07/01/world/europe/A-Short-Lexicon-of-Italian-Gestures.html> (accessed 23 March 2024).
- Yong, M.H. and Ruffman, T. (2014) Emotional contagion: Dogs and humans show a similar physiological response to human infant crying. *Behavioural Processes* 108, 155–165. DOI: 10.1016/j.beproc.2014.10.006.