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"Reactivity" in Dogs: A Critical Review of a Spreading Label and a Proposed Ethological Reconstruction

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Abstract

This review examines the term "reactivity" as applied to domestic dogs and argues that it groups motivationally distinct behaviors under a single output-based label. The objective is to show that the criterion holding the category together, intensity of behavioral output, sits at the proximate level of behavioral form while the systems producing the behavior operate at the analytical levels Mayr (1961) and Tinbergen (1963) established as distinct. The method is a critical reading of ethology, the neuroscience of fear and aggression, incentive-salience research, the neurophysiology of frustration, and recent quantitative studies of dogs labeled reactive. The findings are that behaviors collected under the descriptor span fear-induced defense, frustrated approach, appetitive predatory sequences, and operantly maintained patterns, which differ in neural substrate, neurochemistry, and pharmacological response, so the label leaves all four of Tinbergen's questions unaddressed. Because defensive and offensive behaviors are organized through mutually inhibitory circuits, an intensity-based descriptor cannot specify the motivational system in play. The conclusion proposes, in place of the label, a two-step assessment built on Moyer's (1968) motivational typology and Tinbergen's four questions, together with the validation any classification, current or proposed, would need to meet.

Keywords: Canine behavior, agonistic behavior, ethological assessment, motivational state, intention movements

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Introduction

The word "reactive" appears to have entered applied dog training from veterinary behavioral medicine, where it carried a precise meaning anchored in the Pavlovian tradition of individual differences in nervous-system excitability and inhibition. Lindsay (2000, 2001, 2005) formalized it as a heritable temperament dimension reflecting an individual's excitatory-inhibitory balance, a heritability since quantified across breeds by MacLean et al. (2019), and Overall (1997, 2013) applied it clinically to describe excessive responses to ordinarily unremarkable stimuli, anchoring the term within a neurobiological model linking arousal, limbic function, and anxiety-spectrum pathology. That precision did not fully survive the label's migration into popular training culture. Through the 2000s and 2010s, the term accumulated incompatible definitions, with some users treating it as a motivational state, others as a behavioral response, and others as a deviation from an implicit threshold of normal responding. The word retained the surface of scientific grounding while shedding the operational content that made the original construct usable, so that what circulates today often functions as a popular label applied without consensus across a behaviorally heterogeneous population whose members share no common causal profile, with practical consequences borne by individual dogs.

Stephens-Lewis et al. (2024), in a survey of 175 respondents drawn from practitioner and owner populations, documented that no consensus definition of reactivity exists within any group that uses the term, and that the label is regularly invoked in contexts of relinquishment and euthanasia. The prevalence figures circulating in the literature add complications. Lima (2023) reported that approximately 43.8% of dogs scored above average on a standardized aggression index derived from a large cross-sectional dataset, a figure rooted in fear-aggression covariation and containing no reactivity component. Batista et al. (2025), studying what they termed reactive and aggressive manifestations, drew on that estimate to frame the welfare burden on individual dogs and their caregivers, extending an aggression measure to a behavioral category the originating study had not defined. Hitchcock et al. (2024) found that behavioral-euthanasia research remains sparse, that existing studies have not tracked the motivational profiles or treatment histories of the individuals involved, and that practitioners make decisions of irreversible consequence without the causal information that would distinguish an appropriate from a mismatched intervention. Pharmacological prescriptions, behavior-modification program designs, and relinquishment decisions follow the same pattern, calibrated to a label whose causal content remains unspecified.

The limitations of "reactivity" trace to its categorical architecture rather than to a need for refinement. A label that sorts behavioral outputs by

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intensity and leaves the motivational systems that produce them unaddressed supplies the appearance of a diagnosis without its content. The alternative developed in the closing sections takes the form of a motivationally specific, ethologically grounded assessment applied to each presenting individual, drawing on fear-circuit neuroscience, the neurobiology of aggression, the neurophysiology of frustration, learning theory, and the ethological principles set out by Tinbergen (1963), Hinde (1970, 1982), and Moyer (1968). Their integration remains current in recent behavioral biology (Bateson & Laland, 2013; Battivelli et al., 2024). Van Haevermaet et al. (2026) provide the central empirical test case, since their cluster analysis of dog-reactive dogs shows both what careful quantitative work within the popular model can achieve and what remains beyond its reach when popular taxonomy supplies the conceptual starting point. The framework that follows is informed by an internal observational record at Human-Animal Science, documented in Barata (2024a), used illustratively rather than as a primary evidentiary basis, and is presented as a starting point for a discussion of replacement. A further thread concerns the difference between behavioral frequency and behavioral sequence, since a classification based on co-occurrence frequencies cannot capture the temporal ordering that ethological theory requires for motivational analysis.

1. Methods

This is a critical, theoretical review rather than a systematic one. Literature was identified through Google Scholar, PubMed, and ScienceDirect using the terms “reactivity,” “reactive dog,” “canine aggression,” “agonistic behavior,” “frustration,” and “predatory behavior,” and by consulting the primary sources of ethology, aggression neuroscience, and incentive-salience research. Coverage was selected for conceptual relevance to the argument rather than by exhaustive inclusion criteria. Sources are treated at three levels of evidentiary weight: peer-reviewed empirical and theoretical work, clinical and practitioner manuals, and popular training materials, and the text marks which category a source belongs to when the distinction affects the claim it supports. The two evidentiary streams for the proposed framework, the published literature and an illustrative practitioner observational record, are kept distinct throughout, and the status of the observational material is stated in the framework section.

2. The Problem with the Term "Reactivity"

2.1 Clinical and Psychophysiological Origins

Psychophysiology and stress physiology use "reactivity" to designate a quantified change score, whether a cortisol delta, a heart-rate deviation elicited by a standardized stressor, or a sympathetic-arousal measure

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referenced against a physiological baseline, each operationalized through specified protocols with a defined somatic referent (Dreschel and Granger, 2005; Lensen et al., 2019). The meaning differs in veterinary medicine, where it covers chemical, immunological, and behavioral responses to stimulation collectively, and again in experimental psychology, where it refers to the modification of a subject's behavior prompted by awareness of being observed.

The clinical entry point for canine usage traces to Overall (1997, 2013), who characterized reactivity as an excessive response to ordinarily unremarkable stimuli, grounded in a neurobiological model linking arousal, limbic function, and anxiety-spectrum pathology. Lindsay (2000, 2001, 2005), within the Pavlovian tradition of nervous-system excitability and inhibition, framed the term as a heritable temperament dimension, a heritability since quantified across breeds by MacLean et al. (2019), and noted that training events produce emotional states with pronounced effects on mood and reactive behavior, a construct that is state-dependent and emotionally mediated. That framing has a surface alignment with the reactive coping style formalized by Koolhaas et al. (1999) in comparative behavioral biology, although the alignment is incomplete: in the comparative model, reactive individuals show low aggression, high behavioral flexibility, and passive avoidance, a profile opposite to the intense, arousal-driven expression the training community later assigned to the same word. Scott and Fuller's (1965) longitudinal study of emotional reactivity across five breeds, measuring heart rate, electromyographic activity, escape latency, and tremor, documented the consistency of breed differences in this psychophysiological dimension, a pattern the large-scale genomic work of Morrill et al. (2022) has since re-examined and broadly supported. Haug (2008), within a clinical veterinary context, applied the label to dogs whose intense responses to low-level or apparently nonthreatening stimuli approximated the profile of intermittent explosive disorder, anchoring that parallel in a framework centered on amygdalar hyperreactivity, serotonin-mediated inhibitory deficits, and circuit-level impulsivity. As the term moved into popular and training discussion, it gradually shed that mechanistic content, leaving a descriptive behavioral category that names a pattern of behavior without committing to an account of its causes.

As "reactive" entered popular training culture through the 2000s, it served increasingly as a substitute for "aggressive," a label that professional scrutiny was already discouraging, and it inherited that term's vagueness along with its popularity (McDevitt, 2007; Greenebaum, 2010). The popularizing literature registered the shift directly, with the second edition of McConnell and London's Feisty Fido (2003, 2009) retitling the original from "leash-aggressive" to "leash-reactive." The substitution occurred without definition.

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Overall et al. (2016) subsequently noted that the necessary and sufficient diagnostic criteria for labeling a dog as noise-reactive or phobic are absent from most published studies. They added that without standardized thresholds, the ability to identify familial, breed, and population associations is markedly diminished.

2.2 Proliferation and Loss of Definition

The migration from clinical settings into popular training culture produced a term that different users defined with incompatible categorical commitments. Some treated it as a behavioral-output category. Stewart (2016) defined it as fear, aggression, or frustration responses exceeding the level that dog-savvy humans consider normal, placing the threshold in the subjective judgment of an imagined knowledgeable observer. Gibeault (2024) defined reactive dogs as those who respond to normal, everyday stimuli with disproportionate arousal, producing barking, lunging, cowering, and leash-pulling that are disproportionate to the situation, and noted that the term is routinely confused with aggression, even though it refers to a different phenomenon. A popular training resource made the same conflation explicit, describing reactivity as the appropriate term for fear-based behaviors resembling aggression (Brown, 2004). These accounts share an output-level logic, yet they disagree on whether intensity, topography, or assumed emotional cause is the defining criterion. A common defense holds that reactivity differs from aggression because reactive behavior reflects emotional overarousal without intent to harm (Gibeault, 2024). That distinction does real work at the level of clinical triage, and it rests on the same response-and-arousal logic from which the label is built, sorting cases by the presence or absence of intent to harm while leaving the motivational systems that generate the arousal, namely fear, frustration, predatory approach, and learned instrumental responding, gathered under one descriptor. Defining reactivity by the absence of intent marks the outer boundary of the category and supplies no positive account of the motivational architecture the term claims to name.

Other authors treated reactivity as a motivational attribution. Overall et al. (2019) designated as reactive those dogs who are continuously and characteristically distressed by noises and fail to meet diagnostic criteria for a phobia, a residual category defined by exclusion. Greenebaum (2010), approaching training culture sociologically, used "reactive" as a socially preferred alternative to "aggressive" on the grounds that it framed behavior as situational rather than dispositional. Gacsi et al. (2013), in an attachment study, applied "behaviorally reactive" to two separate phenomena, designating as reactive any dog that showed distress vocalization during owner absence (N = 18) and, separately, any dog that growled or barked at a threatening stranger (N = 17). The motivational bases of separation distress and

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conspecific-threat response are clinically and neurobiologically distinct, and the fact that both profiles received the same label follows from starting with a term that has no agreed-upon behavioral referent. Craig et al. (2017) illustrate the resulting terminological state, using "aggressive/reactivity," "reactive dog," and "non-aggressive" interchangeably within the same work.

The term has subsequently been absorbed back into peer-reviewed literature without the definitional scrutiny its history warrants. Recent papers operationalize reactivity using the same composite of barking, lunging, growling, and similar high-output behaviors that originated in popular discussion and treat these output-level features as an established construct. Gobbo and Semrov (2022) and Hart and King (2024) recruit "reactive" dogs as a study population without independent definitional or motivational specification. Arata et al. (2014) used "reactivity to stimuli" as a temperamental factor, retaining the psychophysiological flavor of the original construct while applying it to behavioral-output measures. Moser et al. (2024), in a scoping review of canine behavioral testing, observed that test stimuli and outcome measures vary widely across the literature, with no common operational basis. In scientific use, the term has become close to circular, defined by the populations that already self-identify with it.

2.3 Arousal Distinguished from Motivation

A foundational source of confusion in the popular label is the conflation of arousal with motivation. Hebb (1955) and Duffy (1957) established arousal as a nonspecific energetic dimension reflecting the activation level of the central nervous system, distinct from the motivational state that directs behavior. A high-arousal individual may be in fear, in approach motivation, in frustration, or in pursuit, and the arousal level alone says nothing about which. Jones and Gosling (2005), reviewing canine personality research, observed that the activity and arousal dimension recurs across instruments and remains analytically distinct from the motivational dimensions that organize behavior.

2.4 Practitioner Experience in the Clinic

The difficulty of inferring motivation from output is reported by practitioners themselves, pointing to a genuine clinical problem rather than a shortcoming of any individual assessor. Wilson et al. (2024), in semi-structured interviews with ten clinical animal behaviorists, found that assessment processes were variable and often guided by intuition and prior expectation rather than by hypothesis-driven frameworks, with little consensus on how to define or differentiate fear from frustration. The practitioners perceived the two states as distinct experiences that may require different treatment but could not reliably specify the observational criteria by

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which they distinguished them. Wilson et al. (2025), in a follow-up assessment of dogs' facial expressions, found weak consensus even among experts attempting to distinguish frustration from fear by visual observation alone. Shnookal et al. (2025) documented the applied consequence in trainer accounts: one trainer described uncertainty about whether a dog was "lead reactive or fear reactivity," a case resolved only by releasing the individual off-leash, at which point it approached the stimulus in social greeting. The ambiguity dissolved once the leash was removed, because the leash had been the source of frustration, and the individual was exhibiting a frustrated approach, a profile that requires different management from fear-induced defensive responding.

The leash context compounds this diagnostic problem. Barata (2024a), in illustrative observations of dogs presenting with aggressive behavior on lead, described a correlation between on-leash displays and the type of equipment used, and suggested that behavior commonly labeled "leash reactive" can reflect the transmission of the handler's intentional or unintentional mechanical responses through the leash rather than a motivational disposition intrinsic to the individual. The leash serves as a continuous conduit for proprioceptive information during locomotion, and minor mechanical events can take on disproportionate behavioral significance when paired with strong or inconsistent handler responses. The same display in the same context can reflect fear, a frustrated approach, a learned response to leash tension, or a conditioned association between the practitioner's state and the environmental stimulus. The existing label offers no model for distinguishing among these possibilities, even in the context where it is most often applied.

2.5 A Comparative Outlier

Wolf behavioral research uses fine-grained agonistic classification, distinguishing ritualized fighting, ambush threat, bite threat, defensive snapping, active and passive submission, standing-over, and distinct inter-pack behaviors (Schenkel, 1947, 1967; Mech & Boitani, 2003). The domestic dog literature from which applied discussions take their orientation has developed nothing equivalent. Feddersen-Petersen (1991, 2007), using recordings from approximately 200 canines across species and morphotypes, observed that domestic dogs show higher levels of aggressive behavior than wolf cubs and have lost many of the conflict-resolution strategies wolves employ. A morphological layer compounds the problem. Goodwin et al. (1997) examined agonistic signaling across ten breeds selected for physical dissimilarity to the wolf and found that the number of ancestral dominant and submissive patterns available to a breed ranged from two in the most paedomorphic subjects to fifteen in those whose morphology most resembled

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the ancestral form. Paedomorphosis refers to the retention of juvenile traits into adulthood through selective breeding. Many dogs assessed in applied settings belong to breeds whose morphological changes have truncated their available agonistic vocabulary, so that the early, low-intensity signals carrying motivational information are already reduced, and the difficulty the label creates is most pronounced for the populations where it is most often applied. The proactive-reactive coping-style framework of Koolhaas et al. (1999) defines reactive individuals as shy, behaviorally flexible, less exploratory, and less aggressive than their proactive counterparts, close to the opposite of what the training culture intends when it labels a dog reactive. Reale et al. (2007), proposing a standardized cross-species temperament taxonomy, treated reactivity only as a physiological dimension and viewed it as a property of arousal systems rather than a behavioral classification. Hart and Hart's (1985) finding that a reactivity factor loaded independently of aggressiveness in breed assessments means that the principal dimensional frameworks of the comparative literature provide no basis for treating high-arousal displays and agonistic motivation as a unified construct. The applied training category is, in this sense, a local terminological development whose content runs contrary to its scientific antecedents.

3. Theoretical Basis

The case that "reactivity" groups neurobiologically distinct phenomena under one descriptor rests on convergent evidence from several research traditions. Aggression is non-unitary, fear is non-unitary, and appetitive approach, frustration, and instrumental learning each operate through their own substrates. The behaviors gathered under the reactive label cut across these distinctions in ways that an output-based classification cannot recover.

3.1 One Label, Separate Neural Systems

Aggression in mammals operates through at least two anatomically and functionally distinct systems, with reactive and proactive subtypes recognized across the developmental, neuropsychiatric, and animal-aggression literatures (Vitiello & Stoff, 1997; Blair et al., 2006; Buchmann et al., 2014). Reactive-impulsive aggression, prompted by perceived threat or frustration, recruits subcortical circuits including the amygdala, hypothalamus, and periaqueductal gray (PAG), with limited prefrontal modulation and a noradrenergic and serotonergic signature. Proactive-instrumental aggression, organized around goal-directed action, recruits prefrontal-striatal-limbic circuitry calibrated to reinforcement contingencies, with a different neurochemical profile and a developmental trajectory that diverges from the reactive subtype. The two subtypes diverge under

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perturbation: reactive-impulsive aggression escalates under threat and reduces with anxiolytic intervention, whereas proactive-instrumental aggression persists under threat and responds to reinforcement-based modification rather than affective remediation. A label that treats high-output agonistic behavior as a single phenomenon obscures this distinction. Empirical support for such an architecture in the domestic dog has begun to emerge. Rowland et al. (2025), in a survey of 21 common behavioral problems in dogs aged three to six months, estimated a conditional-dependency network whose four clusters were interpreted as corresponding to four emotional operating systems, SEEKING, FEAR, RAGE, and PANIC, in Panksepp's (1998) terminology, and recommended that behavioral management address emotional control systems instead of individual responses. If problems cluster by motivational system rather than by output category, a classification based on output intensity will not capture the structure that both research and intervention require.

The fear side is likewise plural. Gross and Canteras (2012) identified three parallel and largely non-overlapping circuits: fear of pain through the central amygdala and ventrolateral PAG, fear of predators through predator-responsive nuclei of the medial hypothalamus and the dorsolateral PAG, and fear of aggressive conspecifics through separate conspecific-responsive medial hypothalamic nuclei and the dorsomedial PAG. A shared hippocampal, septal, and cortical mechanism encodes learned fear across all three. A dog responding to an approaching conspecific on leash and a dog responding to a sudden overhead stimulus may engage different neural architectures before any motivational classification begins, so applying a single label to both assigns a single category to individuals whose threat-processing systems may share no circuit-level overlap. The wider debate about the nature of fear reinforces the applied implication without needing resolution here. Panksepp's primary-process framework (1998, 2010; Panksepp and Biven, 2012) distinguishes RAGE, defensive aggression triggered by restraint or thwarted approach, from predatory motivation, classified as a SEEKING-system manifestation driven by appetitive circuitry, a dissociation that maps onto the lateral-versus-medial hypothalamic distinction of Weinshenker and Siegel (2002). The framework has been contested on methodological grounds, and Barata (2024a) cautions against applying it uncritically in applied contexts where its phenomenological commitments may exceed what practitioners can reliably assess. LeDoux (2012, 2014) argued that attributing conscious experience to subcortical defensive circuits has produced confusion in research and clinical translation, a concern shared by Adolphs and Anderson (2018), whose internal-brain-states proposal seeks to preserve neurobiological tractability while bracketing the phenomenological question, and Barrett (2017a, 2017b) found no consistent neural fingerprints for discrete emotions

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and argued that emotional categories are constructed. These positions need not be resolved here, because states with distinct neural substrates, pharmacological profiles, and developmental trajectories call for distinct behavioral analyses regardless of one's view of their subjective character.

A further appetitive pathway is regularly merged with defensive and frustration-driven states. Berridge's incentive-salience framework dissociates wanting, the mesolimbic dopaminergic drive toward a stimulus, from liking, the opioid-mediated hedonic response to its consummation (Berridge and Robinson, 1998; Berridge, 2007; Berridge and Kringelbach, 2015). A dog straining toward an approaching conspecific, a moving bicycle, or a retreating animal expresses incentive salience, with heightened attentional capture and approach motivation driven by dopaminergic activation, a profile whose neurochemistry differs from the noradrenergic signature of threat circuits and from the prediction-error circuitry of frustration. Elevated responses such as barking, lunging, and sustained orientation are common to all three, while the motivational architecture differs. Craig's (1917) distinction between appetitive behavior and consummatory acts, central to ethology through Lorenz and Tinbergen and discussed in Hogan (2017), formalizes the same observation at the functional level. Slater (1980) argued that behaviors that superficially resemble one another but differ in causal basis should be classified separately, because merging differently caused patterns produces confusion at the first stage and intervention errors at every stage that follows. Frustration constitutes a further pathway, distinct from both fear-based defense and appetitive approach. The frustration-aggression hypothesis of Dollard et al. (1939), revised by Berkowitz (1989), holds that blocking goal-directed behavior generates aversive affect that, under increased negative affect, promotes aggressive responding. Ishino et al. (2023) characterized Type 2 dopamine neurons in the lateral ventral tegmental area (VTA) that increase firing upon reward omission and decrease firing upon unexpected reward, the opposite of classical reward-prediction-error neurons, a signal that supports active adjustment to an absent expected outcome. McPeake et al. (2019), developing the Canine Frustration Questionnaire because frustration warranted a dedicated instrument instead of subsumption under existing labels, specified that clinical assessment requires differentiating fear and anxiety from frustration, since the observable signs may be similar while the appropriate interventions diverge. McPeake et al. (2021) validated the questionnaire against physiological markers separable from those of fear and anxiety. Co-selection evidence situates this within a phylogenetic framework: Dutrow et al. (2022), analyzing over 4,000 DNA samples alongside Canine Behavioral Assessment and Research Questionnaire (C-BARQ) data from 46,000 dogs, found that some herding breeds carry variants associated with both increased anxiety and pup-gathering behavior, as well as the exaggerated

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predatory motor sequence underlying herding. As Udell and colleagues observe (as cited in Ha et al., 2024), the orient-stalk-chase directed at livestock may reflect appetitive activation, while circling and gathering directed at family members may reflect anxiety-driven monitoring, two motivationally distinct profiles in the same dog, both classifiable as reactive on identical grounds if each involves intense or distance-influencing behavior. An intensity-based label applied to the output cannot register the distinction.

3.2 Levels of Analysis and the Intensity Criterion

The criterion that groups these behaviors, intensity of output, cannot distinguish among the circuits, and the reason runs deeper than measurement. Intensity is a property of the response, whereas the systems producing behavior operate at a different level of organization, so a criterion at the wrong level cannot be corrected by measuring it more precisely. Sixty years ago, Mayr (1961) drew the foundational distinction between proximate causes, which concern the mechanisms producing behavior, and ultimate causes, which explain why a behavior pattern exists in evolutionary terms, and held that explanations adequate to one level cannot substitute for explanations at another. Tinbergen (1963) elaborated this into four complementary levels: causation, ontogeny, function, and phylogeny, and held that a science of behavior must address each and their integration. Bateson and Laland (2013) noted that behavioral work often addresses only one or two levels and treats that partial account as sufficient. A label built from output intensity addresses none of Mayr's two questions and none of Tinbergen's four. Hinde's (1970, 1982) analysis showed that the same motor pattern can be produced by different motivational states, and a motivational state is defined by the full configuration of causal factors operating at once, not by the topography of the behavior those factors produce. Hogan (2017), discussing Lorenz's (1966) analysis of canine facial expressions, showed how identical postural features can appear within fear, aggression, or an ambivalent mixture, depending on the relative activation of the systems involved, so that topographic similarity provides no evidence of motivational equivalence.

Intensity belongs to the same descriptive level as topography and duration. The same motivational system produces varying intensities depending on stimulus salience, individual threshold, learning history, and activational state (Berkowitz, 1989; Rescorla and Solomon, 1967), and different systems produce similar intensities where their activating conditions are comparably strong. A dog distressed by an approaching conspecific and a dog motivated to approach the same individual may produce barking and physical effort of identical magnitude through circuits with no functional overlap. Barlow (1977), defining behavioral units in ethology, individuated behavior patterns by structural regularities across location, orientation,

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topography, intrinsic properties, and physical effects, deliberately omitting intensity, so a classification whose sole criterion is response magnitude rests on a property that the foundational methodology of the field excluded from the definition of behavioral units. A defender might reply that "reactivity" was meant as a triage flag rather than a motivational classification, and that reply would hold if the label functioned as a triage flag in practice. The evidence from Wilson et al. (2024), Shnookal et al. (2025), and the pharmacological prescription patterns in the clinical literature indicates that practitioners often treat it as a working diagnosis that guides intervention, so that, in practical terms, it serves the role of a diagnosis without the causal content a diagnosis requires.

3.3 Intention Movements, Ritualization, and the Predatory Sequence

A second ethological consideration tightens the conclusion. Foundational models established that the behaviors most visible during agonistic encounters are often incomplete or preparatory motor patterns that precede full sequences, which Daanje (1950) and Tinbergen (1952) termed intention movements, the physical beginnings of actions that become legible to receivers before the complete sequence unfolds. Hogan (2017) formalized intention movements as incipient movements of suppressed behavioral systems whose presence reveals the relative strength of competing causal factors, so that, in conflict situations, the intention movements of the suppressed system remain visible alongside those of the expressed one, generating ambivalent postures. Hinde (1966) defined ritualization as the progressive modification by which such movements become communicative, and Cullen (1966) described how stereotypy and conspicuousness increase as the movement becomes independent of the motivational context that generated its precursor. Maglieri et al. (2022) demonstrated this in domestic dogs, showing that the relaxed open mouth satisfies the criteria for a ritualized signal, structurally homologous to a preparatory movement preceding play-biting but temporally dissociated from agonistic contact. The snarl is a complementary case from the agonistic register: lip retraction originated as a protective movement preceding a bite and, through ritualization, became a threat signal whose communicative function persists even as its coupling to actual attack has weakened. In both cases, the surface topography carries limited information about what the individual will do next, which is the difficulty a topography-based label inherits.

These concepts bear directly on behaviors classed as reactive or as predatory aggression. The full predatory sequence in wolves and dogs proceeds from orienting through eye contact and stalking into chasing, grab-biting, kill-biting, dissection, and consumption (Coppinger and Coppinger, 2001; Udell et al., 2014). The components preceding the grab-bite, orient, eye,

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stalk, and initial chase are intention movements relative to the full sequence, and in domestic dogs they are frequently expressed without culmination, with artificial selection amplifying or suppressing specific components across breeds, as in the exaggerated eye-stalk-chase and suppressed kill-bite of the Border Collie (Dutrow et al., 2022; Udell et al., 2014). The label "predatory aggression," used in veterinary behavioral medicine and absorbed into the reactive umbrella, rests on an ethological category error, classifying preparatory or incomplete acts as members of the same category as the terminal acts they precede. The same error appears in the field's reference terminology, since the APA Dictionary of Psychology defines predatory aggression as a form of aggressive behavior (American Psychological Association, n.d.), embedding the conflation in a standard definitional resource. The predatory orient-eye-stalk sequence and the agonistic threat approach share postural elements, forward weight, focused gaze, and a stiff body, while their substrates differ. The predatory sequence operates through lateral-hypothalamic SEEKING circuits and appetitive dopaminergic motivation toward prey acquisition, and through medial-hypothalamic and PAG defensive circuits and social signaling toward conspecifics, in the agonistic threat approach (Moyer, 1968; Weinshenker and Siegel, 2002). Craig (1917) and Hogan (2017) place these in different behavioral categories, and Abrantes (2014), working within an ethological terminology model for domestic dogs, defines aggressive behavior as directed toward eliminating competition from an opponent and explicitly excludes predatory behavior from this definition. D'Ingeo et al. (2021) showed that emotional states, including frustration and anxiety, can lower the threshold at which components of the predatory sequence are expressed, thereby confirming motivational distinctness rather than fusion, since the emotional modulator and the behavioral system it activates remain separable. A dog whose predatory behavior has no identified affective substrate, a dog in which fear or frustration has lowered the predatory threshold, and a dog whose attack on a smaller conspecific topographically resembles predation while arising from agonistic motivation with insufficient inhibitory signaling, a profile documented by Schilder et al. (2019), present three distinct cases that the single label collapses into one. Barata (2024b) develops this critique of "predatory aggression" in greater detail.

3.4 From Affective Response to Operant Routine

Time adds a dimension that the reactive label cannot accommodate. Morris (1956) described stylization in ontogeny as the progressive stereotypy of acquired behavior through repeated performance, and Eibl-Eibesfeldt (1975) documented that acquired patterns become progressively stereotyped, losing their initial functional connection to the triggering condition. A dog that

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has executed the same bark-lunge-retreat sequence many times produces it with reduced variability and latency and in response to increasingly distal conditions, so the sequence acquires the formal properties of a ritualized signal with stereotypy and motivational independence from the state that originally generated it. Adolphs and Anderson (2018) distinguish emotion states, flexible and broadly generalized, from reflexes, narrow and stimulus-specific, and a heavily stereotyped sequence migrates toward the reflex end of that continuum even as the original emotional trigger recedes as the primary cause. Rescorla and Solomon's (1967) two-process analysis supplies the mechanism, with classical conditioning establishing the affective state that initially motivates instrumental avoidance and the instrumental sequence then becoming semi-autonomous, maintained by its reinforcement history.

Moyer (1968, 1976) placed instrumental aggression in a distinct explanatory category for this reason, since it is the only type without an independent neural substrate, defined by reinforcement history instead of a proximate mechanism. All five defensively oriented types can transition into it once the individual learns that aggressive behavior reliably produces a reinforcing result, typically through negative reinforcement when an aversive stimulus withdraws. Haug (2008) noted that learned maintenance of aggressive behavior is well documented clinically and that treatment must address the reinforcement contingency rather than the original emotional state, so a practitioner applying anxiety-management protocols calibrated to defense may be treating a motivational architecture that is no longer operating. Developmental psychology has worked with a formal version of this distinction since Dodge and Coie (1987), who established reactive aggression as a retaliatory defensive response and proactive aggression as goal-directed behavior maintained through reinforcement, with distinct processing profiles confirmed by Crick and Dodge (1996) and meta-analytically by Card and Little (2006). Whether the reactive-to-proactive transition occurs in dogs, as described in the human literature, remains an empirical question, although patterns documented in applied practice support it as a working hypothesis that merits dedicated study.

The neurobiology adds a dimension that the clinical literature often misjudges. Defensive and offensive behaviors are organized as competing strategies rather than co-occurring affective states, an organization recognized since Bolles (1970) introduced species-specific defense reactions and Fanselow and Lester (1988) developed the predatory-imminence continuum, with defensive responses arranged hierarchically and selected by perceived distance to threat. Tovote et al. (2015, 2016) demonstrated that flight and freezing are mediated by adjacent but distinct, reciprocally inhibitory PAG populations under central-amygdala control, and Fadok et al. (2017) identified mutually inhibitory central-amygdala populations that switch behavior

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between freezing and flight. Offensive aggression operates through a distinct hypothalamic-midbrain pathway, with Lin et al. (2011) showing that activation of the ventrolateral ventromedial hypothalamus drives attack and its silencing abolishes inter-male aggression, and Falkner et al. (2016) extending the region's role to aggression-seeking in the absence of immediate threat. Adams (2006) identified offense and defense as separate motivational mechanisms with distinct substrates. The implication is that an individual showing aggression once flight has been blocked does so because the agonistic alternatives have been foreclosed, and the resulting pattern reflects a shift from a defensive strategy that retains escape as the preferred response to an offensive strategy that has replaced it. The term "fear aggression," common in applied medicine, treats this circuit shift as a single fused state, combining the fear that prompted withdrawal and the defensive attack that replaced it once withdrawal was unavailable, thereby concealing a transition between systems that can occur within weeks under consistent reinforcement. A behavior performed repeatedly under consistent reinforcement undergoes progressive stereotypy, becoming faster, less variable, and more responsive to specific releasing stimuli, with a quality owners describe as automatic, resulting from rehearsal rather than current emotional intensity. The reactive label captures a response at a moment and assigns a dispositional term to it, leaving the assessor without a means to determine whether the individual is in an acute affective state or is executing a well-established operant sequence. These are different clinical pathways whose selection turns on the causal architecture currently sustaining the behavior.

3.5 What Empirical Work Inside the Label Shows

Empirical work operating within the label's own boundaries provides an informative test of the structural argument, and Van Haevermaet et al. (2026) provide the primary illustrative case as the most methodologically careful effort yet to impose empirical structure on the population of dogs labeled reactive. The study is treated here as a constructive reference rather than a target. Its contributions show that a heterogeneous population can be organized into behavioral profiles of varying clinical risk, that frustration-related and agonistic signaling dimensions are empirically separable, and that demographic variables predict cluster membership in ways consistent with developmental theory. What the analysis also exposes is the structural limits of cluster analysis when popular taxonomy supplies the conceptual starting point. The working definition was generated through word-frequency analysis of an open survey to which 52 people replied, 25 of whom reported working with reactive dogs, and the nine behaviors retained- barking, growling, snarling, lunging, snapping, nipping, biting, whining, and stiff posture with raised hackles and intense staring- were those most frequently used to describe

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their dogs. The authors note that de-escalation behaviors were referenced too infrequently to be included and that subtle agonistic signals earlier in sequences are often unnoticed, an acknowledgment that carries weight, since a definition built from the most visible, intensity-proximal responses excludes the earlier, lower-cost stages that carry the motivational information needed to distinguish fear-based, frustration-based, and approach-motivated profiles.

The principal component analysis yielded Oral Attack, Posturing, and a Frustration component grouping barking, lunging, and whining, and the authors carefully present the Frustration component as capturing behavior produced when access or escape is thwarted, regardless of motivation. That candor is precisely what makes it unsuitable as a clinical category, since a grouping defined without reference to motivation cannot direct an intervention that depends on it: a dog blocked from approach, reflecting SEEKING-system activation, and a dog blocked from escape, reflecting defensive activation, are neurobiologically opposite yet indistinguishable within the component. The paper references the Ladder of Aggression (Shepherd, 2009) as its interpretive model, noting that the Ladder has not been empirically validated, then employs it as a framework and presents the cluster structure as partial support for it. That relationship is difficult to sustain, since a clinical heuristic of escalation differs from a theoretical model derived from contest theory, and a framework of the latter kind, such as that of Maynard Smith and Harper (2003), would require sequential data that the design did not collect. The sample was drawn from a community organized around prior acceptance of the label, so the working definition was derived from and applied to a population that had already self-identified as reactive. Hart and Hart (1985) and Bradshaw and Goodwin (1999), whose factor analyses found that perceptions of breed reactivity vary across countries, indicate how such a definition inherits a community's perceptual and cultural biases. The analysis rests on frequency data, and the authors acknowledge that sequential data were not collected and that it is unknown whether the behaviors in each component occur together or in sequence. Riechert (1998), in the foundational application of game theory to animal contests, mapped 81 territorial sequences across 33 behavioral acts and showed that contest variability is underestimated where authors focus on consequences rather than on temporal structure, which is the benchmark a contest-theory framing of reactivity would need to meet. Where the most rigorous empirical work within the framework leaves the motivational question structurally unresolved, the framework itself, rather than the analysis, is the source of the limitation.

4. A Proposed Ethological Framework

The difficulty described so far lies in categorical architecture, and the alternative offered here is a method rather than a new label, organized around

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the motivational systems whose distinctiveness the foregoing material documents. Two evidentiary streams underlie it. The first is the published literature reviewed above, which establishes that the popular label groups motivationally distinct phenomena and supplies the building blocks for a motivationally specific alternative. The second is an internal observational record at Human-Animal Science, used illustratively to show the kinds of presenting cases the framework is designed to support, not as evidence for its empirical adequacy. Moyer's (1968) motivational typology and Tinbergen's (1963) four questions are individually well-established within ethology, and their integration into a structured assessment protocol for canine on-leash agonistic presentations is offered as one way to open a conversation about replacement. The operationalization is given to make the proposal concrete enough to be tested, refined, or set aside through the validation described in Section 5.

Behavioral problems gathered under the reactivity label are among the leading cited reasons for relinquishment and behavioral euthanasia in dogs (Salman et al., 1998; Hitchcock et al., 2024), and pharmacological intervention is reported in this population. The clinical literature reviewed below indicates that agents such as fluoxetine are prescribed for presumed motivational states that the label does not independently specify. Odore et al. (2020) reported that fluoxetine combined with behavior modification produced clinical change in a small sample of dogs with owner-directed aggression, with circulating concentrations correlating with clinical scores at six-month follow-up, though the motivational substrate was not characterized independently of the diagnosis. Chutter et al. (2019), in a retrospective study, reported positive response rates of 69% in dogs diagnosed with anxiety, 55% in those diagnosed with aggression, and 50% in those with other diagnoses, with a 13% negative response rate in the aggression category, a differential that suggests the motivational substrate matters for outcome while the categories remain heterogeneous. Sheppard and Mills (2003) identified a systemic pattern in veterinary behavioral medicine in which interventions are calibrated to assumed rather than assessed mechanisms, and De Assis et al. (2020), using separation-related problems, showed that an apparently homogeneous syndrome can comprise several motivationally distinct subtypes, each requiring a different intervention. Rowland et al.'s (2025) finding that puppy behavioral problems group by emotional system rather than output category indicates that a classification grouping outputs will misalign with the structure of the phenomenon, and Handegård et al. (2021) show that heritability estimates for motivationally heterogeneous phenotypes are difficult to interpret because the measured trait conflates states with different architectures.

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The persistence of the label may also reflect incentives beyond the scientific, and this point is offered as a hypothesis warranting empirical study rather than as an established finding. Stephens-Lewis et al. (2024) found that participants explicitly described "reactive" as a term chosen to avoid labeling a dog as aggressive and the stigma that follows, identifying a structural incentive operating alongside scientific considerations. The dog-training profession is largely unregulated, with substantial variation in qualifications and practices across orientations (DeLeeuw and Williams, 2026), and in that setting, an assessment vocabulary that attributes behavior to emotional overarousal rather than to aggression carries lower administrative and reputational cost for owners and practitioners alike. Whether practitioners systematically select terminology with such consequences in mind has not been studied, and the suggestion is raised to prompt that investigation, not to assert it as fact.

4.1 The Illustrative Observational Material

The framework was informed by internal observational notes from Human-Animal Science covering 107 client-owned dogs presenting with on-leash aggressive behavior between 2017 and 2024, used here strictly as an illustration of the kinds of presenting patterns the framework is designed to support. These records are not empirical findings, do not test the framework, and carry no evidentiary weight for any claim in this paper. Every such claim rests on the peer-reviewed literature reviewed above. Records were kept for dogs aged between four and twelve months at first consultation with a presenting complaint of aggressive behavior on lead, an age window chosen because initial agonistic responses, frustration sensitization, and operant consolidation occur during it. The dogs were of varied breeds, drawn from veterinary referrals, trainer referrals, and self-referrals, and each was observed across at least three sessions, with a caregiver interview, in-context observations during structured leash walks, and equipment recordings. The record is offered for two reasons: it illustrates the kinds of motivational discrimination the framework aims to recover, and it serves as a model that practitioners might adapt, since structured observational records of working caseloads are a practice the field has not yet established.

Three qualitative patterns in the notes show the discriminations at issue, and none is advanced as a quantitative result. First, displays of comparable topography corresponded to different motivational profiles once contextual information about prior socialization, equipment, practitioner responses to leash tension, and off-leash behavior was considered. Second, brief off-leash exposure within a controlled context, where it could be arranged, sometimes dissolved an apparent agonistic display, with the individual approaching the previously triggering stimulus in social greeting,

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converging with the trainer accounts of Shnookal et al. (2025). Third, the equipment in use appeared to relate to display characteristics in a way consistent with mechanical transmission of handler movement through the leash, independent of any underlying motivational disposition (Barata, 2024a). These observations carry the limitations characteristic of practitioner-led notes, including the absence of a comparison group, formal inter-rater reliability testing, and blinded assessment, and the records present cases referred to a single practice rather than a representative sample, a selection structure similar to that of the single online community sampled by Van Haevermaet et al. (2026). Their function here is illustrative, and the framework's adequacy at the population level depends on the validation described in Section 5.

4.2 Step One: Identifying the Motivational System

The first step is to provisionally identify the motivational system using the instruments already available. The full approach is summarized in Table 1. The Canine Frustration Questionnaire (McPeake et al., 2019, 2021) assesses frustration as a motivational variable, distinct from fear and anxiety, and has been validated against physiological markers. The C-BARQ (Hsu and Serpell, 2003), validated across 1,851 dogs in a factor analysis yielding 11 dimensions including stranger-directed and dog-directed aggression and fear as separate subscales, provides a multidimensional profile that partly separates dimensions the label conflates. The off-leash probe documented by Shnookal et al. (2025) offers a third, low-cost means of discriminating between frustrated approach and avoidance. No single existing instrument performs the full motivational discrimination that the framework requires, which itself indicates how far the field has organized around output categories instead of motivational systems. The absence of a validated, integrated instrument is the most pressing methodological need the proposal generates. The full four-question analysis described next belongs at the referral and research end of practice rather than at every consultation, and the practical point is that the motivational question be asked at whatever level of resolution the case and the practitioner's training permit, since the reactivity label removes the incentive to ask it at any level.

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Table 1: A two-step motivational assessment for on-leash agonistic presentations

Motivational system	Discriminating observation	Assessment instrument	Differentiating Tinbergen question	Intervention implication
Fear / affective defense	Distance-increasing signals and avoidance; if released off-leash, still avoids rather than approaches	C-BARQ fear subscales; off-leash probe	Causation: threat and defense circuit active (function is distance increase)	Reduce threat exposure; desensitization and counter-conditioning
Frustration (thwarted approach)	Display dissolves into social greeting once off-leash	Canine Frustration Questionnaire; off-leash probe	Causation: appetitive approach blocked (thwarting)	Manage access; impulse-control and alternative-strategy training
Predatory / appetitive (SEEKING)	Silent orient-eye-stalk toward a moving stimulus; no threat display or defensive affect	Behavioral history; predatory motor-sequence observation	Causation: appetitive circuit (evolutionary function is foraging, often decoupled in domestic dogs)	Manage exposure and interrupt the motor sequence; anxiolytic and fear protocols are not indicated
Instrumental / learned routine	Stereotyped, low-latency responding to increasingly distal stimuli	Reinforcement history	Ontogeny: reinforcement-maintained, decoupled from the original affect (no dedicated substrate)	Address the reinforcement contingency, not the affect

Note. Systems follow Moyer's (1968) typology and the affective-defense and predatory-attack distinction of Weinshenker and Siegel (2002). The first three systems are differentiated at the level of causation, the proximate motivational system that is active; the instrumental routine is differentiated at the level of ontogeny, since Moyer (1968) notes it has no dedicated neural substrate and is defined by reinforcement history. Step Two then applies all four of Tinbergen's (1963) questions to the individual case. Instruments: C-BARQ (Hsu & Serpell, 2003); Canine Frustration Questionnaire (McPeake et al., 2019, 2021); off-leash probe following Shnookal et al. (2025).

4.3 Step Two: Tinbergen's Four Questions in the Individual Case

With the motivational system provisionally identified, Tinbergen's four-question model structures the analysis of the individual within that system. At the level of causation, the assessment examines the proximate triggers, the systems activated, and whether the behavior is still driven by the identified system or has been substantially modified by reinforcement history. A behavior that began as fear-induced defense may, after months of negative reinforcement, become an instrumental avoidance routine in which the current stimuli differ from those that originally elicited fear. At the level of ontogeny, the assessment addresses socialization history, conditioning events, reinforcement history, and sensitization episodes, the level at which the reactive-to-proactive transition formalized by Dodge and Coie (1987) and confirmed meta-analytically by Card and Little (2006) becomes assessable in

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a given individual, and the answer determines whether intervention should target the affective state, the reinforcement contingency, or both. At the level of function, the assessment asks what the behavior currently achieves, whether distance regulation, stimulus acquisition, social communication, or avoidance, recognizing that current function may differ from original function as ontogenetic ritualization proceeds. At the level of phylogeny, the assessment situates the behavior within the species-typical and breed-typical repertoires, with attention to the morphological and selectional history of the lineage, since Goodwin et al. (1997) showed that paedomorphic selection limits the agonistic vocabulary available to many breeds and so constrains the interpretation of an apparent absence of de-escalation signals. Applied to a dog lunging and barking at a conspecific on a leash, these questions expose what the label leaves unasked, since the causal question alone branches into conspecific-responsive defensive activation, amygdala-based fear conditioning, dopaminergic approach motivation, or frustration-driven aggression from blocked approach, each with a distinct pharmacological profile and functional relationship to the stimulus. All four answers may differ across individuals whose surface behavior is indistinguishable.

5. Limitations

The framework is a proposal document intended to encourage the start of a necessary discussion, and several limitations constrain it. The internal observational record is illustrative, with the methodological constraints of practitioner-led notes noted above, and it does not support any of the framework's claims as empirical evidence. The framework itself requires validation along three lines. The first is concurrent validity, since the motivational categories it generates should reasonably agree with independent psychometric measures such as the Canine Frustration Questionnaire and C-BARQ subscales, and, where available, physiological markers. The second is predictive validity, since an intervention selected based on motivational identification should produce measurably different outcomes from an intervention selected from the label alone. The third is inter-rater reliability, since a framework requiring practitioner judgment at several decision points needs evidence that different assessors reach comparable conclusions for the same individual. None of this work has been conducted through research, and the framework's clinical claims presently rest on theoretical coherence and the limited illustrative observation described above. A multi-site study comparing motivationally differentiated assessment against label-based assessment, with blinded treatment assignment and standardized outcome measures, would supply the evidence the proposal currently lacks, and this is the most pressing research question the analysis generates. A staged agenda follows from this. The first stage is the development of an integrated motivational-assessment

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instrument. The second is inter-rater reliability testing using standardized video coding with blinded raters. The third is a multi-site study comparing motivationally differentiated assessment against label-based assessment and against existing clinical tools, with blinded treatment assignment and standardized outcome measures.

The framework also sets an assessment standard that most practitioners cannot meet without specialist ethological training, which is a legitimate objection. The response is not that every practitioner must conduct a full Tinbergen analysis before acting, but that the available instruments begin the motivational differentiation the label forecloses, with the complete analysis reserved for the referral and research end of practice. The professional-buffer account of the label's persistence is, as noted, a hypothesis rather than a finding, since no published study has examined whether practitioners select terminology with liability or reputational consequences in mind, and the behavioral-science distinction between reactivity and aggression could itself be raised in either direction within that debate. The empirical literature reviewed here originates predominantly from clinical referral populations, owner surveys, and standardized tests, designs that are rigorous within their constraints yet systematically exclude the naturalistic observation that the ethological tradition treats as foundational. Working practitioners who see presenting cases daily occupy an observational position that clinic- and survey-based research cannot easily replicate, and structured collaborations between researchers with validated measurement tools and practitioners with naturalistic longitudinal contact would help close the gap that the proposed framework cannot close on its own.

Conclusion

"Reactivity," as currently used in applied dog training and veterinary behavioral medicine, serves more as popular shorthand than as a scientific category. It has outlasted the clinical specificity from which it was drawn, circulated through popular and professional discourse, and re-entered the scientific literature without the definitional scrutiny a behavioral category requires before it can support research, guide intervention, or inform welfare assessment. Its central limitation is that it classifies behavior by intensity of response rather than by the motivational systems that produce it, leaving all four of Tinbergen's (1963) levels unaddressed. The behaviors it encompasses are driven by distinct fear circuits (Gross and Canteras, 2012), by agonistic configurations in which an individual whose options for flight and appeasement have been foreclosed produces aggression toward the eliciting conspecific or human, by frustrated approach motivation (Berkowitz, 1989; McPeake et al., 2019), by appetitive predatory sequences (Berridge, 2007; Weinshenker and Siegel, 2002), and by learned sequences motivationally

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emancipated from whatever affective state first generated them. Each operates through distinct substrates, neurochemical profiles, developmental histories, and functional logics.

The analysis stops short of recommending "aggression" as a substitute, since the ethological tradition established long ago that "aggression" is itself problematic without further specification. Scott and Fredericson (1951) introduced "agonistic behavior" because attack, threat, defense, appeasement, and submission function as interdependent components of one system, Hinde (1970, 1982) defined aggression by effects rather than causes and excluded predation, and Moyer's (1968) taxonomy, retained here as the starting point for motivational identification, applies the word across categories that classical ethology would place in different systems. Substituting one heterogeneous label for another would reproduce the same confusion. What is offered in place of the popular label is a method: the motivational identification of the system operating in the individual case and the application of Tinbergen's four questions within it, with terminology chosen at the end of the analysis to reflect what was found. Whether the existing category should be refined, replaced, or supplemented is a question the field will answer collectively, and the function of this paper is to open that question, with validation research, refinement against alternative proposals, and active participation from researchers, practitioners, and welfare professionals as the next steps. The practical next steps are instrument development, inter-rater reliability testing, predictive validity trials, and comparison with existing clinical assessment tools.

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