Non-Detection in Trail-Camera Surveys: Scientific Perspectives on Avoidance-Intelligence Claims

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Abstract

A common explanation offered for the absence of trail-camera imagery of rare or hypothesized animals is "avoidance intelligence": the idea that such animals detect and evade cameras by seeing infrared illumination, smelling batteries or electronics, or detecting human presence associated with deployments. This paper reviews the scientific basis for these claims through the lens of camera-trap research, sensory biology, and ethological observations—particularly work documenting how mammals and primates respond to camera traps as novel objects. The camera-trap literature shows that (1) camera traps are probabilistic detectors with well-characterized false-negative processes; (2) some wildlife can detect camera traps via audible cues and sometimes visible illumination, and behavioral responses can bias detections; (3) novelty responses such as curiosity and neophobia occur across taxa and are shaped by habituation and experience;

and (4) olfactory cues can modify detection rates, though evidence for consistent long-term avoidance due to "electronics odor" is limited. Across these domains, non-detection is readily explained by detection constraints without requiring an inference of specialized camera-avoidance cognition.

1. Introduction: the claim and the scientific question

In discussions of anomalous or cryptozoological animals, it is frequently asserted that the absence of trail-camera imagery reflects intentional avoidance: that the animal detects cameras by visual, olfactory, or contextual cues and deliberately evades them. Treated as an explanatory hypothesis, this claim implies a consistent, learned behavioral strategy operating at the species level.

Camera-trap ecology approaches the problem differently. Trail cameras are **probabilistic detectors**, and non-detection is a routine outcome even for well-documented species. Detection depends on sensor physics, deployment geometry, environmental conditions, and animal behavior, and must be modeled explicitly rather than inferred from raw counts (Findlay et al., 2020; McIntyre et al., 2020; Kühl et al., 2023).

The scientific question is therefore not whether animals *can* notice cameras, but whether non-detection requires invoking a specialized avoidance intelligence—or whether known detection limits and ordinary ethology are sufficient.

2. Camera traps as probabilistic detectors

Most trail cameras rely on passive infrared (PIR) sensors that trigger when a moving thermal contrast crosses the detection zone. Trigger probability depends on multiple interacting variables, including animal size, surface temperature, speed, direction of travel, ambient temperature, vegetation movement, camera height, and angle (Jacobs & Ausband, 2018; McIntyre et al., 2020; Palencia et al., 2022).

Detection is best understood as a sequence of component processes—passage, triggering, framing, and image quality sufficient for identification—each of which can fail independently (Findlay et al., 2020). An animal may pass within the nominal field of view yet fail to trigger, trigger but be poorly framed, or be recorded but not identifiable due to blur, occlusion, or low resolution.

Crucially, PIR systems perform less reliably when ambient temperatures approach animal surface temperatures, a condition common in warm climates and during summer nights.

These effects alone can substantially depress detection rates without invoking behavioral avoidance (McIntyre et al., 2020).

3. Can animals detect camera traps by sight or sound?

3.1 Audible and visible cues

Empirical work demonstrates that camera traps can emit sounds within the hearing range of many mammals and, depending on design, may produce visible cues during triggering events (Meek et al., 2014). These cues establish a plausible mechanism for behavioral responses, including startle, inspection, or temporary avoidance.

Infrared illumination varies by flash type. White flash is visible to humans and many animals; low-glow infrared often emits a faint red component; no-glow infrared minimizes visible emissions. Field guidelines commonly recommend no-glow models to reduce disturbance, acknowledging that illumination can influence animal responses (Trolliet et al., 2014).

Importantly, the relevant biological question is not whether animals "see infrared" in an abstract sense, but whether they detect any perceptible cue associated with camera activation. Detection does not imply understanding or strategic avoidance.

3.2 Behavioral responses are mixed and context-dependent

Studies examining flash type and animal behavior show variable outcomes. Some species or individuals alter behavior in response to visible flash, while others show no consistent differences between infrared and white-flash deployments (Ladd et al., 2022; Daniel et al., n.d.). Reviews emphasize that responses vary across taxa, individuals, and contexts, and that camera-induced disturbance is best treated as a potential bias rather than as evidence of systematic avoidance (Caravaggi et al., 2020).

4. Novelty, neophobia, and habituation in mammals and primates

4.1 Novel objects in animal behavior

Many species exhibit **neophobia**, a cautious response to novel stimuli, or curiosity toward unfamiliar objects. These responses are well documented in ethology and are not specific

to cameras. Importantly, novelty responses are typically transient and shaped by experience and habituation.

4.2 Evidence from great apes

Because claims of avoidance intelligence often imply primate-like cognition, great apes provide a relevant comparison. Studies of wild African apes show measurable novelty responses to camera traps, including cautious approaches and altered behavior near devices (Kalan et al., 2019; Forss et al., 2019). However, responses vary by species, population, and degree of habituation to humans.

Crucially, these studies do not document a consistent, species-wide avoidance strategy. Instead, they show ordinary novelty responses that diminish or change with experience (Forss et al., 2021). Even among cognitively sophisticated primates, camera traps are not treated as a recognized category of object to be universally avoided.

5. Olfaction, human scent, and the "electronics odor" claim

Mammals possess acute olfactory capabilities, and camera-trap methodology explicitly considers scent as a potential confound. Studies testing scent lures demonstrate that odors can influence detection rates, often increasing detections for certain carnivores, with variable effects across species (Holinda et al., 2020; Randler et al., 2020).

Research on human scent masking shows mixed results. Some studies find little or no effect of scent-masking products on detection rates, while others note context-specific influences (Muñoz et al., 2014; Heinlein et al., n.d.). The strongest supported olfactory effects relate to **human presence and intentional lures**, not to a demonstrated long-term avoidance response to batteries or electronic components per se.

Thus, while olfaction plausibly contributes to short-term behavioral variation, current evidence does not support a generalized "electronics odor" avoidance hypothesis.

6. Trail-camera non-detection in context

Camera-trap ecology treats non-detection as an expected outcome under conditions of low abundance, restricted movement corridors, dense cover, or unfavorable sensor physics. Occupancy and density models explicitly account for imperfect detection because failing to do so biases inference (Findlay et al., 2020; Kühl et al., 2023).

To infer avoidance intelligence from non-detection, one must first exclude well-documented alternatives: PIR detection limits, environmental noise, placement bias, and ordinary animal movement patterns. The literature repeatedly demonstrates that these factors are sufficient to explain substantial under-detection (Jacobs & Ausband, 2018; McIntyre et al., 2020; Palencia et al., 2022).

7. Non-detection ≠ avoidance: three testable alternatives

Claims of camera avoidance are often framed as unfalsifiable. In fact, camera-trap science provides clear, testable alternatives.

7.1 Detection-physics limitation hypothesis

Prediction: Detection probability covaries with temperature contrast, speed, distance, and placement.
Test: Manipulate camera height, angle, and sensitivity; deploy during periods of high and low ambient temperature; compare detection rates under controlled conditions.

This pattern is well supported by experimental and modeling studies (McIntyre et al., 2020; DeWitt et al., 2023).

7.2 Behavioral ecology hypothesis

Prediction: Detection rates track known movement corridors, travel timing, and habitat use rather than camera presence.
Test: Compare detections on trails versus off-trail placements; assess diel patterns; replicate across microhabitats.

This explanation aligns with spatial ecology and movement studies across taxa (Jacobs & Ausband, 2018; Palencia et al., 2022).

7.3 Novelty-response hypothesis

Prediction: Initial responses to cameras include inspection or avoidance that diminish over time or vary by individual.
Test: Analyze detection rates as a function of deployment age; compare new versus long-established cameras; assess individual-level variation.

This pattern is consistent with ethological observations, including primate studies (Kalan et al., 2019; Caravaggi et al., 2020).

8. Conclusion

The scientific literature supports a restrained conclusion. Wildlife can sometimes detect camera traps via audible or visible cues, and behavioral responses may bias detections. At the same time, trail cameras are inherently imperfect detectors whose performance is shaped by sensor physics, environment, placement, and ordinary animal behavior.

Within this framework, non-detection does not require invoking avoidance intelligence. The absence of trail-camera imagery for rare or hypothesized animals is consistent with low encounter rates, imperfect detectability, and ordinary ethological responses to novelty. Where behavioral effects occur, they are better characterized as curiosity, neophobia, or habituation rather than as a generalized, strategic recognition of cameras as objects to evade.

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