RESEARCH / EMPATHY / INNOVATION

Empathy-Based Veterinary Engineering Framework

EBVEF · White Paper

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Empathy as method: connecting technology design, ethics, and policy in veterinary science.

This edition presents the author-supplied EBVEF paper in full, preceded by a visual overview of its four interdependent pillars. The framework is conceptual; its proposed metrics and applications require empirical development and evaluation.

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Framework and source text by Joie Lamar. Diagram adapted from the supplied paper.

EBVEF: four interdependent pillars

PILLAR I

Ethical Design Ontology

Make moral objectives explicit; evaluate technical soundness alongside animals' experiences.

PILLAR II

Multi-Species Participatory Design

Use behavioural signals of preference, comfort, and distress to inform design iterations.

Shared orientation: empathy as method

PILLAR III

Empathic Metrics and Evaluation

Consider affective, relational, and ecological dimensions of welfare.

PILLAR IV

Institutional Implementation and Policy Integration

Connect design ethics with education, impact assessment, committees, and governance.

Reading the diagram

The four pillars are interdependent, rather than sequential stages or a validated scoring instrument. The connections represent their shared orientation toward empathy-driven engineering. The foundations and pillar names follow the author's paper.

Empathy-Based Veterinary Engineering Framework (*EBVEF)*

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Systemic cruelty in veterinary science arises not from isolated moral lapses but from deeply embedded design logics that privilege efficiency, control, and anthropocentrism. The historical and institutional analyses reveal that veterinary practice, though born of medical compassion, operates within structures that often reproduce cruelty through technological and bureaucratic rationalization. The challenge of the twenty-first century, therefore, is not simply to reform veterinary ethics, but to re-engineer the moral architecture of veterinary science itself.

This writing presents the central contribution of my dissertation titled Engineering Empathy: A Critical Examination of Systemic Cruelty and Ethical Innovation in the Evolution of Veterinary Science and Technology:

Empathy-Based Veterinary Engineering Framework (EBVEF)—a cross-disciplinary model uniting technology design, ethics, and policy. Built upon the integration of post-humanist philosophy, systems ethics, and participatory design methodologies, *EBVEF* outlines how empathy can move from an aspirational concept to an actionable engineering principle.

The framework proposes new evaluative criteria for welfare technology, educational reform for veterinary professionals, and governance mechanisms that institutionalize compassion as a measurable value within technological innovation.

Foundations of the Empathy-Based Veterinary Engineering Framework

EBVEF builds conceptually upon three philosophical and methodological foundations:

1. Bioethical and Virtue Ethics Foundations Drawing on Aristotle's phronesis and Rollin's (2012) applied virtue ethics, the framework positions empathy not as mere emotion but as a cultivated moral skill—a disciplined sensitivity to the experience of the other. Veterinary engineers, like physicians, must internalize empathy as a professional habitus guiding both design and intervention.

2. Systems and Post humanist Ethics . Wolfe (2010) and Haraway (2008) redefine moral agency as distributed across human–animal–technological networks.

   The EBVEF applies this insight by conceptualizing veterinary systems as co-produced moral ecologies. Ethical responsibility, therefore, lies in the maintenance of relational integrity among all participants—human, animal, and machine.

3. Participatory Design and Slow Technology Building on Verbeek (2011) and Hallnäs and Redström (2001), the framework adopts "slow technology" principles—emphasizing reflection, transparency, and sustained interaction over speed and efficiency. Veterinary technologies, when developed under slow design ethics, encourage moral awareness rather than abstraction from empathy.

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The EBVEF Model: Structure and Principles

The EBVEF comprises four interdependent pillars, each corresponding to a dimension of empathy-driven engineering.

Pillar I: Ethical Design Ontology

This pillar addresses how values enter the design process. Ethical design ontology requires that all technological projects in veterinary contexts begin with explicit articulation of their moral objectives—for example, reducing suffering, enhancing communicative understanding, or promoting natural behaviours.

To operationalize this, engineers and veterinarians should employ value-sensitive design workshops (Friedman et al., 2013), where welfare scientists, ethicists, and stakeholders collaboratively identify embedded moral assumptions. Empathy serves as a design parameter, requiring that prototypes and algorithms be evaluated for both technical soundness and their impact on animals' experiences.

Pillar II: Multi-Species Participatory Design

Traditional engineering seldom involves direct representation of nonhuman stakeholders. *EBVEF* introduces multispecies participatory protocols, inspired by Meijer's (2019) advocacy for interspecies democracy.

In practice, this entails designing technologies that interpret animals' own signals of consent, comfort, or distress. For example, welfare-monitoring interfaces should integrate behavioural proxies for preference (tail position, ear posture, movement freedom) as functional design feedback. Design iterations then respond to those indicators as expressions of user experience—making animals co-authors of technological refinement.

This approach transforms care from unidirectional charity into cooperative ethical interaction.

Pillar III: Empathic Metrics and Evaluation

Quantifying empathy poses challenges, but ethics becomes actionable only through evaluation. *EBVEF* defines empathic metrics along three domains:

- Affective Metrics: incorporating veterinary and behavioural assessments of anxiety, trust responses, or affiliative behaviours to gauge emotional well-being (Boissy et al., 2007).
- Relational Metrics: measuring quality and reciprocity of human–animal interaction in clinical and industrial contexts.
- Ecological Metrics: evaluating environmental and social externalities—sustainability, biodiversity impact, and resource equity.

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By embedding such metrics into standards, accreditation bodies can hold technologies accountable for holistic welfare outcomes, transforming empathy from an abstract virtue to a measurable deliverable.

Pillar IV: Institutional Implementation and Policy Integration

Ethical engineering must ultimately influence governance. The EBVEF therefore emphasizes institutional embedding—aligning laws, education, and industry policy around empathy-based innovation.

Key recommendations include:

- Integrating Ethics of Design modules in veterinary and engineering curricula.
- Creating Empathy Impact Assessments (EIA) for new veterinary technologies, analogous to environmental impact assessments.
- Establishing multispecies ethics committees that consult animal behaviour data during policy review.

These structural reforms ensure that empathy remains institutionalized and cannot be marginalized under industrial or economic pressures.

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Case Application: Retrofitting the Welfare Monitoring Industry

To illustrate its practical relevance, the EBVEF is conceptually tested against the welfare-monitoring technologies.

Applying these insights to veterinary engineering suggests that machines, data systems, and biomedical devices do not merely serve ethical decisions—they participate in them. A welfare-monitoring algorithm, for instance, articulates a moral definition of stress when it quantifies animal discomfort into binary thresholds. A surgical robot embodies a conception of precision that may obscure the relational dimension of care between veterinarian and patient.

Under conventional design principles, camera-based and acoustic welfare systems optimize production efficiency while commodifying animal affect. Applying the EBVEF alters this trajectory:

- Design Ontology:
    - Engineers begin with a moral goal—facilitating animals' self-expression rather than maximizing yield.
- Participatory Design:
    - Prototypes integrate animal behaviour specialists who calibrate sensors to interpret individuality rather than conformity.
- Empathic Metrics:
    - Systems record play behaviour, curiosity, and social engagement—positive welfare indicators typically excluded from quantitative datasets.

- Institutional Integration:
    - Regulatory approval requires ethical certification demonstrating compliance with the principles of empathy-driven design.

This model demonstrates that empathy is not an obstacle to scientific rigour but rather an expansion of it, redirecting innovation toward genuine welfare promotion.

Discussion: Implications of EBVEF

The *Empathy-Based Veterinary Engineering Framework* redefines the purpose of technological progress.

Instead of equating success with efficiency or output, it ties innovation to ethical flourishing. It challenges three prevailing assumptions:

1. That animal suffering is a collateral necessity within science.
2. That technology and ethics exist in separate domains.
3. That empathy belongs to emotion rather than design.

By countering these assumptions, veterinary engineering can evolve into a discipline of moral design—a field measured by its capacity to sustain dignity, not just health. This

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redefinition has implications across education, regulation, and research funding, aligning veterinary practice with global agendas of ecological ethics and multispecies justice.

Limitations and Future Directions

While conceptually comprehensive, the EBVEF faces challenges in empirical implementation. Measuring empathy remains methodologically complex, and participatory design across species introduces epistemological uncertainty. Moreover, institutional inertia within industrial and academic systems can resist such reform.

Future research should examine pilot applications of EBVEF ethics in real-world contexts, such as smart dairying systems, animal shelters, or laboratory environments. Data from these studies could refine empathic metrics and develop standardized tools for ethical certification of veterinary technologies.

Ultimately, bridging theory and praxis will depend on interdisciplinary collaboration—uniting engineers, veterinarians, ethicists, and policymakers under a shared commitment to moral innovation.

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Conclusion

The Empathy-Based Veterinary Engineering Framework transforms the ideals of animal ethics into a systematic practice of moral design. By embedding empathy into ontological, participatory, evaluative, and institutional dimensions, it constructs a blueprint for re-engineering veterinary science as a technologically advanced yet ethically grounded discipline.

Empathy emerges here not as sentiment but as method—a guiding principle that ensures every machine, algorithm, and curriculum in veterinary engineering sustains the integrity and dignity of its nonhuman subjects. This represents a new paradigm: progress defined not by the domination of life, but by the ability to recognize and design for its flourishing.

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