Synthetic Presence as Moral Perturbation: A Field-Theoretic Model for Evaluating Moral Behaviour in Human–Robot Interaction

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There is a traveller who reaches a crossroads at the hour when the world withdraws into itself.

He studies the signposts as if they held the logic of direction. The boards are clean, the words exact, but the air is heavy with a silence that seems older than the road. A thin wind rises, carrying with it the odour of something distant—woodsmoke, or perhaps the memory of it. He cannot tell.

He believes he chooses by reading; but already his gaze has shifted toward the darker path, drawn by a murmur he cannot name. A shape in the periphery—almost a figure, almost a shadow—tilts the balance without ever declaring itself. The light changes, and with it the weight of each possibility.

He hesitates, though he is unaware of the reason. The stones cool beneath his feet. Something in the air—presence, or its simulation— presses lightly against his decision. He steps, not toward the sign he had resolved to follow, but toward the path shaped by these quiet, unclaimed forces.

Later he will recall the moment and speak of deliberation, of judgement, of intention:

- *I reasoned!*
- *I deliberated...*
- *I chose.*

But it was the quiet pressures of the world—the unseen gradients of light, sound, warmth, and presence—that shaped his path.

And the signs? They were there long before he arrived, and they remain long after he has gone. Yet it is the field through which he walked that carried him forward.

Francesco Perrone

Abstract

Moral behaviour emerges not from isolated cognitive modules or explicit reasoning, but from a structurally rich evaluative field shaped by attention, affect, social meaning, and dispositional architecture. This thesis develops and defends a field-theoretic account of moral cognition grounded in empirical evidence, formal topology, and philosophical analysis. It argues that artificial agents—particularly those with humanoid morphology—interact with this field in ways that classical Machine Ethics has systematically overlooked.

To test this, a controlled experiment examined how a humanoid robot (NAO) modulates prosocial donation under a strong moral cue (the Watching-Eye paradigm). Bayesian and regression models reveal a robust attenuation effect: participants donated less in the robot's presence, despite identical moral affordances. Personality- and cognitive-style measures (EQ, SQ, BFI-10) were used to derive three latent evaluative ecologies, each with distinct affective and structural properties. Yet all ecologies exhibited the same directional displacement. The robot did not influence moral principles; it altered the evaluative field through which those principles acquire behavioural force.

This finding supports a structural interpretation of moral cognition: synthetic presence acts as a perturbation operator that suppresses salience, dampens affective resonance, and disrupts justificatory and attentional pathways. The result exposes a critical limitation of top-down Machine Ethics and opens a new direction for Computational Morality—shifting focus from rule encoding to the dynamics of moral environments.

The thesis concludes that artificial agents, even without agency or intent, function as moral modifiers: their perceptual salience and ontological ambiguity reshape the architecture of human moral appraisal. Moral behaviour is thus field-dependent, and synthetic presence deforms that field. This establishes a new methodological foundation for the ethical and empirical study of artificial systems, grounded in evaluative topology, Levels of Abstraction, and the dynamics of moral cognition.

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Acknowledgements

There is a peculiar stillness that settles around work completed under the accelerating discipline of contemporary academia—a sense that one has been guided less by patient inquiry than by the unyielding cadence of an institution convinced that thought must keep pace with its deadlines. If these pages read as though composed at a distance, it is only because they carry the faint tension between what might have matured in its own time and what the present era insists must be shaped, finished, and surrendered.

In that unsettled interval I have leaned on those whose presence does not depend on the coherence of my arguments. This thesis is dedicated to my son, Francesco, whose unguarded curiosity offers a quiet antidote to the rushed certainty demanded here; to my mother, Mirella, and my father, Alberto, whose enduring steadiness has outlasted every fluctuation of purpose; and to my wife, Anna, who has carried more than anyone her age should be asked to bear—not only for reasons that cannot be stated within these pages, but because she has been required, time and again, to return to the limits of my own intellect as though they were a place of refuge. Whatever this work may lack in the calm of true gestation, it rests on the grace with which they have all borne its cost.

Declaration

I declare that, with the exception of background sections that review existing literature and established theoretical frameworks (chapters 2, **??**, and part of chapter 7) all original research presented in this thesis—including the experimental design, data collection, statistical analysis, clustering procedures, and the development of the evaluative–topological model of moral perturbation—was carried out independently by the author, unless otherwise explicitly stated. All sources have been appropriately acknowledged, and no part of this thesis has been submitted for any other degree or qualification.

1. Introduction

Think of moral decision-making as the full mental sequence we go through when we're choosing between competing ideas of what the 'right thing' might be. It starts with what we notice: certain details stand out, others fade into the background. Those initial impressions shape what we care about, which in turn shapes what we treat as relevant. Only then does our reasoning step in to organise all of that into a sense of, 'This is what I should do.' In a way, it's the process that turns a handful of moral impressions into a genuine commitment to act.

And most of the time, this isn't a slow, deliberate calculation. It's closer to an immediate sense of something feeling right or wrong, which we then test against the situation and the social world around us. We respond to small cues—a shift in tone, a facial expression, the atmosphere of a room—and they quietly push us toward one reaction rather than another long before we begin to articulate reasons.

After that early, intuitive pull, we start to refine it. We call to mind similar situations. We notice details we missed at first glance. We talk it through, sometimes out loud, sometimes just internally. And we develop reasons that make sense of the direction we're already leaning toward. The decision is still real, but it grows out of these quick, socially shaped impressions that guide us well before any careful reflection begins.

This is precisely why the idea of creating a 'moral' machine by embedding a single ethical theory—utilitarianism, deontology, or any other framework—is so misguided. Those theories are helpful tools for analysing moral arguments after they've happened, but they're not the engines we rely on when we actually navigate a situation. They're abstractions, not working models of human judgment.

Yet in the technology world, you still encounter the view that if you program a system to follow a specific theory, you've solved the moral problem. That assumption is, at best, overly optimistic. A machine following a tidy rulebook bears little resemblance to what humans do when we sense tension in a room, register someone's discomfort, or feel the pull of how our actions will land with others. Real moral life is textured, social, emotional, and deeply dependent on context. There isn't a clean set of instructions that captures all that.

So when somebody claims to have built an algorithm that 'acts ethically,' it often reflects an academic game of who can produce the most polished theoretical model rather than a meaningful engagement with how moral decisions actually work.

The theory may look elegant on paper, but it doesn't map onto the realities of human moral experience.

And this, is exactly the space where our work begins. We know that our moral reactions are shaped by tiny cues—someone's expression, the tension in their posture, the energy in a room, even things as subtle as the smell of someone

who's had a long day. These details don't just colour the moment; they steer our judgment before we're even aware of it.

So the real question for us is this: what happens when the agent in front of you isn't a person at all, but a humanoid robot? How do we respond when the timing of a gaze is algorithmic, and the emotional tone is produced by design rather than by experience?

We still react. We can't help it. Our perceptual systems are tuned to pick up anything that looks or behaves like a person. But the meaning of those reactions becomes murkier. Are we responding to genuine social cues, or to clever mimicry? And if a robot can reliably trigger the same moral intuitions that another human does, what does that say about the foundations of our own judgments?

For us, that's the critical challenge. Not whether a machine can follow a rule-book, but *but how our deeply human, automatic moral instincts adapt—or fail to adapt—when something built rather than born is standing in front of us. And not just in a lab, but in our rooms, in our kitchens, woven into the background of daily life.*

Moral decision-making is:

> *The cognitive process through which agents select between competing moral judgments—mutually exclusive evaluations of what is right or wrong, good or bad—that provide the motive, direction, and justificatory structure of their practical behaviour. It is a composite operation: perceptual encoding, affective appraisal, memory, attentional orientation, and interpretive reasoning jointly determine how morally salient cues are registered, weighted, and transformed into a behavioural commitment.*

The work we present here developes withing this framework, which we applied to a concrete and experimentally tractable setting within Human–Robot Interaction and Social Signal Processing.

We conducted a study in which participants enter a small room and encounter a simple but meaningful moral choice: they may donate part of their participation payment to a real charity, or keep the full amount for themselves. This setting does not claim to capture moral cognition in its entirety; instead, it offers a minimal, controlled environment in which the elements of its definition become empirically observable.

Upon entering the room, participants first engage in **perceptual encoding**: they register the coins on the table, the charity materials, and the child-poster overhead with its large, expressive eyes. These elements constitute the *morally salient cues* structuring the situation, consistent with work showing that minimal observational cues and child-like eyes heighten perceived social relevance and implicit monitoring [1, 2, 3, 4, 5, 6].

Almost immediately, **affective appraisal** is recruited. The charitable context elicits a mild empathic pull in line with established findings on affective resonance

and empathetic sensitivity [7, 8, 9]. Simultaneously, the watching-eye cue introduces an implicit sense of being observed, activating reputational and attentional systems documented in observational-cue research [1, 2, 5]. The prospect of giving up one's own money further evokes the familiar tension between prosocial motivation and self-interest captured in dual-process and motivational models of moral decision-making [10, 11, 12].

Alongside these immediate appraisals, **memory and normative expectations** shape interpretation: past experiences with charitable giving, internalised cultural norms of generosity, and well-established associations between being watched and acting prosocially influence how the evaluative field is instantiated in the moment [4, 2, 9].

At the same time, **attentional orientation** determines which elements dominate the evaluative landscape: is the participant more attuned to the need expressed by the charity? to the coins that could be kept?

To describe moral decision-making in this sense is to recognise its fundamentally *teleological* character, a view rooted in classical action-centred accounts of ethics [13, 14, 15]. Moral cognition unfolds toward action: it organises the evaluative conditions under which an agent adopts one course rather than another, consistent with empirical models linking appraisal to action selection [16, 10, 17]. The transition from moral judgment to behaviour is not an optional addendum to the process—it is its natural terminus. A moral evaluation that does not shape the field of possible actions has not yet completed its function; a moral action, conversely, is the crystallised endpoint of evaluative dynamics that have been unfolding long before reflection makes them explicit [18, 19, 16].

The participant's eventual choice to donate or not is the behavioural crystallisation of this entire evaluative process. This thesis examines how the silent co-presence of a humanoid robot modulates that transformation. The robot does not request, instruct, or communicate, yet its ambiguous social ontology—perceptually agentic, normatively indeterminate—reshapes the conditions under which moral judgments are formed and resolved. In this way, the experiment offers a precise instantiation of the definition of moral decision-making introduced above: a setting in which perceptual cues, affective resonance, attentional dynamics, and implicit social meaning combine to produce a practical moral commitment, and in which that process can be systematically perturbed.

Moral cognition thus operates within a social environment dense with cues—gaze, posture, interpersonal distance, implicit accountability signals—that modulate the affective and attentional components of evaluation. These modulations occur upstream of explicit reasoning: they determine *what becomes salient* well before agents deliberate on what *ought* to be done.

The introduction of synthetic agents into this environment raises a conceptual and empirical challenge. Humanoid robots occupy a liminal ontological space: perceptually social yet not persons, agent-shaped yet not agents. Their presence recruits perceptual and affective systems that evolved for human–human interaction, while simultaneously withholding the ordinary resources through which social meaning stabilises. This thesis examines the possibility that *such entities*

reshape the evaluative conditions of moral cognition not by acting, but simply by being present.

One may picture the problem in concrete terms of our example above.Imagine the participant in the experimental room. On a table: the charity box, a few pound coins, and a simple instruction inviting a donation. The child in need, with big expressive eyes—an established prime of perceived accountability—looks down from a poster. Alone, the participant might experience a mild empathic pull, a subtle sense of being expected to act prosocially.

Now place a NAO robot on the same table. It does nothing. It does not speak, gesture, or request. Yet its humanoid shape, its forward posture, its apparent capacity for attention, reframes the scene. The participant hesitates: the social field has changed. Something in the evaluative machinery has shifted—an attenuation of empathic pull, a dilution of accountability, a re-weighting of salience.

We started by looking at something very simple: what happens when a humanoid robot is present in the room while someone is making a moral decision. The robot doesn't talk, it doesn't give instructions, it doesn't ask for anything. It just shares the space—quietly, almost like another person waiting their turn.

But that quiet presence turns out to matter. A robot like that sits in an odd position: it looks and moves in ways that make us treat it as an agent, yet we don't quite know what kind of 'being' it is or what norms apply to it. That ambiguity changes the atmosphere. It shifts how people interpret the situation, what they take to be appropriate, and how comfortable they feel committing to one judgment over another.

So even without speaking, the robot reshapes the background against which moral choices are made. It nudges the whole process—not by argument or instruction, but simply by being there, hovering between the familiar category of a person and the familiar category of a machine. That's where we see the transformation beginning.

This modest behavioural moment is the phenomenon under investigation.What has changed? And why?

The central question that follows from this observation frames the entire research programme:

> *Can the mere presence of a synthetic, non-agentic entity perturb the inferential transformation through which morally salient cues are converted into observable moral behaviour?*

This question is motivated by the theoretical claim that synthetic agents may function as *operators on the evaluative field* in which moral decisions are formed. If their perceptual salience or ambiguous social ontology alters the distribution of attention, empathy, or accountability, then the evaluative trajectory that links perception to action may shift accordingly. In such a case, moral behaviour would

not be changed by explicit influence but by modulation of the cognitive–affective machinery upstream of conscious judgment.

In that case, moral behaviour wouldn't be shifting because the robot told anyone what to do. It would be shifting because the upstream machinery—the mix of perception, emotion, and expectation that feeds into conscious judgment—has been quietly modulated. The influence is silent, indirect, and deeply embedded in the way we make sense of the world. That's why this moment, small as it looks, matters.

1.1 From Research Question to Hypotheses: Framing the Investigative Architecture

Our question comes from a broader theoretical idea: that synthetic agents might operate on the moral landscape in which our decisions take shape. Not by persuasion, not by argument, but by subtly altering the conditions under which those judgments form. If a robot's visual presence, or the uncertainty about what kind of 'being' it is, changes where people direct their attention, or how much empathy they feel, or who they think is accountable, then the whole path from perception to action can start to bend.

If the simple presence of a synthetic agent shifts that chain of inferences,then the traditional approach in machine ethics—starting with abstract principles and trying to code them directly into a system [20, 21, 22, 23, 24]—can't explain what's going on. Those models operate at the reflective level, the level where we articulate reasons and moral rules. But the effects we're observing happen earlier, in the pre-reflective machinery that sets the stage for those reasons.

So we need a different way of thinking about moral behaviour. A framework that treats it as the outcome of a field shaped by attention, emotion, and the way certain cues stand out or fade away. In that view, moral action isn't just a conclusion drawn from a principle; it's the end point of a landscape structured by what feels salient, what draws concern, and what seems to matter in the moment. That's the level at which synthetic presence exerts its influence—and the level we have to model if we want to understand it.

One way to make sense of this is by borrowing a notion from Luciano Floridi: the Level of Abstraction [25, 26]. It's a simple idea with a lot of power behind it. Whenever we study a system—whether it's a computer, a person, a society—*we have to decide the level at which we're describing it.* Are we talking about the underlying code? The behaviour? The motivations? The social context? Each level reveals some things and hides others.

Most classical work in machine ethics starts at a very high, reflective level of abstraction. It focuses on principles—rules about what the system should or shouldn't do—and tries to formalise those rules so they can be implemented [27, 28, 29, 30]. That's useful if your goal is to build a system that behaves consistently with a particular ethical theory. But it tells you almost nothing about what happens at the cognitive level, where perception and emotion begin shaping the decision long before anyone appeals to a principle.

Our work sits at a different level of abstraction. We're looking at the machinery that turns raw perception into a sense of what matters, and then into action. At that level, the presence of a humanoid robot isn't a question about the robot's rights or intentions; it's a question about how its appearance and behaviour reshape the informational landscape the human is navigating.

Once we fix the Level of Abstraction—the cognitive level where perception, concern, and action are linked—we can be precise about what we're testing. The thesis proposes three hypotheses, each tied to a different kind of perturbation at that level. They're not rivals. They're three structurally distinct ways in which the presence of a synthetic agent might reshape the evaluative process itself. Each one captures a different mechanism through which the perceptual and affective landscape can shift before conscious judgment begins. The thesis therefore develops three hypotheses, each mapped onto a different kind of perturbation within the cognitive–affective system that generates moral judgment. They're not competing explanations; each one isolates a distinct structural route through which the simple presence of a synthetic agent might influence the transformation from perception to action.

Taken together, these hypotheses define the theoretical space of the project. They mark out the possibilities that become visible once we commit to the correct Level of Abstraction—the level where shifts in salience, attention, and affect reorganise the evaluative field long before a person arrives at a conscious moral conclusion.

The first hypothesis says that the robot changes the function that maps what you perceive to how you evaluate it.

Hypothesis 1: Evaluative Deformation

Synthetic presence alters the evaluative function $f : \mathcal{X} \to \mathcal{A}$ by reshaping salience gradients, affective weights, or attentional trajectories. In this model, the robot acts as a *field operator*: its perceptual salience deforms the topology through which moral cues acquire behavioural force.

The mathematical notation—$f : \mathcal{X} \to \mathcal{A}$—just means: given some input from the world, how do you turn it into a sense of what matters? What we test here is very simple: does having a humanoid robot in the room subtly shift what stands out to the subject, what feels important, or what pulls their attention?

If the robot is visually or socially salient—even without speaking—it might 'bend' the landscape you're navigating. Think of it like a small gravitational field: it doesn't tell you what to do, but it changes the shape of the space you're moving through. This hypothesis asks:

> *does the robot's presence deforms that evaluative landscape just enough to change how moral cues gain their force?*

The second hypothesis is about how people interpret responsibility and expectations in the presence of a humanoid robot. Here the claim is not that the robot

has moral status or intentions. It's that its human-like appearance gives it certain practical effects in how people interpret the situation.

Hypothesis 2: Synthetic Normativity of Moral Displacement

A humanoid robot acquires *normative affordances* through its ambiguous social ontology. Without communicating or expressing intention, it may refract perceived accountability relations, modifying how agents interpret morally salient cues within the situation.

People may unconsciously treat it as if it participates in the moral scene, even though it hasn't said or done anything. So this hypothesis asks:

> *Does the robot shift who people feel accountable to, or who they think is paying attention, or what they think 'counts' in that moment?*

The robot's ambiguous status—something between a person and a tool—may subtly redirect moral attention. It's not giving orders; it's reframing the situation just by being there.

The third hypothesis looks at what happens in the transition from noticing something morally important to actually doing something about it.

Humans don't move straight from perception to action. There's a whole middle layer: empathy, emotional resonance, a sense of alignment with others. This hypothesis asks whether the robot interferes with that middle layer.

Does its presence dampen empathy? Does it redirect attention? Does it change how strongly certain cues 'tag' the situation as requiring action?

Hypothesis 3: Synthetic Perturbation of Moral Inference

Synthetic presence interferes with the transition from moral salience to prosocial action by modulating empathic resonance, affective tagging, or attentional alignment. This mechanism predicts differential perturbation across dispositional ecologies, precisely as observed in the experimental results.

So this final hypothesis says:

> *the robot doesn't change the rule you apply—it changes the internal bridge that links your moral perception to your moral behaviour*

And importantly, this hypothesis predicts that people with different dispositions—different personalities, sensitivities, backgrounds—will be affected differently. That's exactly what the experiments showed: the effect isn't uniform; it varies depending on the person.

These hypotheses structure the theoretical and empirical work that follows. They operationalise the core research question—whether synthetic presence can perturb the inferential machinery that links moral perception to moral action—and provide the conceptual scaffolding through which the experiment in Chapter **??** is interpreted.

Together, these three hypotheses outline the whole space in which synthetic presence might influence moral judgment. Each captures a different mechanism, and all of them operate at the cognitive level—the level where perception and affect set the stage for what we later call 'a moral decision.'

1.2 The Need for a New Theoretical Orientation

All three hypotheses point to the same structural insight: the traditional tools of Machine Ethics operate at the wrong level of explanation. Classic Machine Ethics starts with high-level principles—rules, utilities, virtues—and then tries to engineer machines that follow them. That's perfectly coherent if your aim is to design a system that behaves consistently with an ethical theory.

But that framework doesn't touch the kind of phenomenon our research question is targeting. We're asking whether the presence of a synthetic agent reshapes the process by which humans move from perception to moral action. And that process unfolds long before anyone appeals to principles or reasons.

In other words, the phenomenon we're investigating doesn't live at the reflective Level of Abstraction. It shows up upstream, in the cognitive–affective machinery that makes moral reasoning possible in the first place. When a humanoid robot is in the room, it can alter what draws attention, how empathy is allocated, and what feels socially significant. That isn't a change in moral reasoning—it's a change in the conditions under which moral reasoning forms.

And if that's where the modulation happens, then a principle-first approach to moral AI can't explain it. We cannot start with abstract theories and work downward. You have to start with the architecture of moral cognition and work upward. Moral behaviour isn't just the outcome of applying a rule; it is the emergent trajectory of a system sculpted by perceptual salience, affective appraisal, and socially mediated cues—processes that moral psychology has shown to precede and shape explicit judgment [16, 31, 18, 32]. These evaluative dynamics are deeply sensitive to contextual modulation: shifts in attention, affective resonance, or perceived social presence can reconfigure the very pathway through which an agent moves from appraisal to action [6]. Artificial agents, even without agency or intention, participate in this structure by perturbing the field of salience and social meaning [33, 34, 35].

So the shift we're proposing isn't just methodological; it's conceptual. It reframes the core task of moral AI. Instead of asking, How can machines apply moral principles? we have to ask:

> *How do artificial agents alter the environment in which humans experience, interpret, and act on moral cues?*

That's the question that anchors the thesis. And later, when we look at the experimental results, we'll see why a principle-driven account simply can't capture the effects we observe.

The argument developed so far brings us to a decisive shift. The question that will guide the remainder of the thesis is no longer whether artificial agents can execute or approximate moral principles, but how their presence reshapes the very field in which humans perceive, interpret, and respond to moral cues. This reframing closes the introduction and opens the path to the theoretical and empirical work that follows.

1.3 Structure of the Thesis

The chapters that follow are arranged to make the implications of this shift increasingly explicit. The progression is cumulative. Each chapter establishes the conditions under which the next can be understood, and together they build a unified account of machine–mediated, machine-detactable moral cognition.

Chapter 2 establishes the philosophical and methodological ground of the thesis. It disentangles the two projects often grouped under Machine Ethics—Human–Machine Ethics and Computational Machine Ethics—and shows why neither operates at the cognitive Level of Abstraction required to explain synthetic moral perturbation. Drawing on normative ethics, moral psychology, and Social Signal Processing, the chapter argues that moral behaviour arises from a salience-weighted evaluative process rather than from the application of encoded principles. Its central conclusion introduces the core tension that motivates the thesis:

> *Classical Machine Ethics works at the reflective LoA, while the phenomenon under investigation unfolds at the cognitive LoA, upstream of explicit moral reasoning.*

Chapter 3 provides the conceptual architecture needed to understand moral cognition empirically. It introduces dual-process theories, the Social Intuitionist Model, affective tagging, attentional capture, and accountability structures, illustrating how these mechanisms shape the path from moral perception to action. The chapter identifies the inferential gap: *the transformation from moral appraisal to moral behaviour.* This gap motivates the thesis's central question—whether synthetic presence can perturb that transformation—and prepares the reader for a systematic account of the evaluative processes at stake.

Chapter 4 specifies the methodological infrastructure through which the thesis renders evaluative cognition empirically tractable. Whereas the previous chapters developed the theoretical topology of moral appraisal, the present chapter introduces the instruments—psychometric, dispositional, and perturbational—that operationalise that topology in experimental form. It clarifies how established constructs from moral psychology, cognitive science, social signal processing, and

HRI serve not as neutral measurement devices but as theoretically motivated probes into the latent dispositional manifold modelled as β_C.

By situating the Empathizing Quotient, the Systemizing Quotient, the Big Five Inventory, and the Watching–Eye paradigm within the evaluative–topological framework, the chapter demonstrates that each tool targets a distinct dimension of the architecture through which moral salience is encoded, transformed, and expressed in behaviour. Their role is therefore conceptual rather than merely procedural: these instruments define the coordinate system in which the perturbation introduced by synthetic presence becomes detectable as a deformation of the evaluative field rather than as a trait-driven behavioural fluctuation.

> *The tools introduced here provide the empirical interface between theoretical topology and behavioural data: they operationalise the dispositional term β_C and supply the salience baselines against which synthetic perturbation can be identified.*

This chapter therefore establishes the measurement logic of the thesis. It shows why these specific instruments are required to distinguish dispositional variation from field-level modulation, and how they allow the experiment to test whether humanoid robotic presence alters not who participants are, but the evaluative topology within which their moral trajectories unfold.

Chapter 5 constitutes the empirical core of the thesis. It operationalises the evaluative–topological model developed in the earlier chapters into a full experimental framework, integrating design, measurement, and statistical inference into a single methodological architecture. The chapter introduces the controlled observational conditions, reconstructs the Watching–Eye paradigm, and justifies the use of the NAO platform as a parametrically stable source of synthetic presence. It specifies all behavioural measures, psychometric instruments, and salience manipulations, and it details the complete analytical pipeline—from preprocessing and cluster formation to non-parametric tests, regression modelling, and Bayesian estimation.

Its function is foundational: this is the chapter in which the three central hypotheses of the thesis—Evaluative Deformation, Synthetic Normativity, and Synthetic Perturbation of Moral Inference—are formally operationalised and subjected to empirical test. By consolidating the full experimental architecture with the statistical logic required to evaluate deformation in the evaluative field, the chapter provides the decisive evidence for the thesis' central claim: that synthetic copresence induces a measurable, structured alteration in the mapping from moral salience to action that cannot be reduced to trait-level variation or noise.

Chapter 6 reconstructs the major normative traditions—deontology, consequentialism, virtue ethics, sentimentalism, contractualism, particularism, and hybrid views—at the appropriate Level of Abstraction for the thesis. Instead of treating them as implementable rule systems, the chapter interprets their normative structures as patterns that constrain or guide evaluation within human moral cognition. Floridi's Level-of-Abstraction discipline is introduced here as a methodolog-

ical tool for locating where an explanation must live. The chapter concludes by synthesising these perspectives into a coherent view of moral behaviour as a field-sensitive process shaped by both normative expectations and cognitive–affective dynamics. This synthesis provides the philosophical infrastructure that makes the subsequent hypotheses meaningful.

Chapter 7 provides the structural integration of the thesis. It unifies the cognitive–affective architecture, the normative analyses, and the experimental findings into a single theoretical account of how synthetic presence perturbs moral cognition. Building on the experimental result—uniform attenuation of prosocial donation under humanoid co-presence—the chapter shows that the effect cannot be understood as a trait-level phenomenon, a local behavioural anomaly, or a deficit of explicit reasoning. Instead, it requires a field-level interpretation: synthetic presence deforms the evaluative topology that ordinarily carries moral salience into action. By bringing together the three dispositional ecologies, the topological formalism, the reconstructed normative frameworks, and Floridi's Level-of-Abstraction analysis, the chapter argues that the humanoid robot operates as a perturbation operator on the moral field, not as an ethical agent. Its role is therefore decisive: it offers a general theoretical synthesis through which the empirical signature revealed by the data becomes a window into the structure of moral cognition and the methodological limits of Machine Ethics.

Taken together, these chapters form a cumulative argumentative trajectory. Each chapter establishes the conditions of intelligibility for the next, guiding the reader from conceptual reframing to cognitive mechanism, from mechanism to experimental design, from empirical outcome to theoretical explanation. The result is a systematic account of how synthetic presence perturbs human moral cognition and what this means for the future of moral AI.

2. Literature Review

2.1 Introduction: Scope, Objectives, and Theoretical Commitments

This chapter establishes the conceptual and methodological terrain on which the remainder of the thesis proceeds. This review isn't just a background filler; but ratgehjr a the first test looking for the the assumptions which the experimental results depend on, the levels of abstraction they operate at, the mechanisms they take for granted, and the gaps they leave unexplained. It lets us ask:

> *Wheather the synthetic presence really does modulate the path from perception to action, which existing frameworks can even see that phenomenon? And which ones are blind to it by design?*

By examining the published work through that lens, we start to see an emerging pattern: almost all of classical Machine Ethics operates at the reflective level—principles, rules, deliberation—while the phenomenon we are studying unfolds at the cognitive level, upstream of reasoning. That mismatch isn't an opinion; it's a structural finding that the literature itself reveals.

The aim here is therefore to reposition the study of moral behaviour under artificial co-presence—and the design of artificial moral systems more broadly—within a theoretically unified space at the intersection of *Machine Ethics*, *Computational Morality*, and *Social Signal Processing* (SSP). Although these fields emerged from distinct disciplinary lineages, the experimental results presented in Chapter 5 show that they now converge around a single problem: artificial agents, even when silent, passive, and non-interactive, *modulate the evaluative conditions under which moral judgment and action unfold.* Understanding this phenomenon requires an integration of normative philosophy, moral psychology, computational modelling, and HRI.

Hence, the project takes root here. The literature review is the first piece of evidence. It shows that if we stay at the reflective level, we can't even formulate the right kind of question, let alone explain the modulation we later observe experimentally (Chapter 5). That's why the review matters so much—it's the tool that tells us where the explanation has to live before you collect single data points.

One of the core findings of the literature is that classical Machine Ethics starts from the wrong end of the problem. The whole tradition begins by taking high-level ethical theories—Kantian tests, utilitarian calculations, virtue templates, deontic logics—and trying to encode them as if they were models of moral agency [21, 20, 22, 23, 24, 27].

But if we look closely at what those theories actually do, they are not descriptions of how humans produce moral behaviour. They are descriptions of how humans *justify* moral behaviour after the fact. This distinction is explicit in modern moral philosophy: Kantian universalisability, utilitarian aggregation, and contractualist justification articulate reflective standards for assessing reasons, not cognitive processes for generating action [36, 37, 15]. They operate at a very high Level of Abstraction: they tell you what counts as a good reason, *not how a person comes to act in the first place* [25, 26].

It should be noted that while most of what traditionally falls under Machine Ethics—Computational Morality, formal deontic systems, encoded utility functions—belongs to the "*pre-LLM*" era, the limitation identified here does not evaporate with the advent of large language models. If anything, the arrival of LLMs makes the limitation more sharply visible.

Recent work demonstrates that LLMs can perform exceptionally well on reflective moral tasks: they generate sophisticated reasoning, balance competing principles, and provide normatively articulate justifications that map cleanly onto established ethical frameworks [38, 39, 40, 41, 42]. They also exhibit high performance on benchmarked moral analogy tasks and moral classification challenges [43, 44]. But all of this ability is situated at the reflective Level of Abstraction: the linguistic, justificatory, post-hoc LoA.

And humans do not act morally at that level. On every empirically supported account of moral cognition—from social intuitionism [16, 45], to dual-process theory [31, 46, 17], to affective neuroscience [47, 48, 49], to embodied and socially embedded models [50, 34, 51]—moral behaviour is driven by salience, affect, perceptual appraisal, social cues, and attentional orientation, not by the explicit application of normative principles. These processes sit one LoA below the linguistic–justificatory space in which LLMs operate.

Thus, although we now live in a "post-LLM" era, the fundamental issue is not that pre-LLM Machine Ethics was technically limited or symbolically brittle. The deeper problem is that both pre-LLM Machine Ethics and modern LLMs operate at the wrong Level of Abstraction if the goal is to model, predict, or understand human moral behaviour. This is precisely the mismatch Floridi's LoA discipline is designed to diagnose [25, 26]: moral justification and moral production belong to different descriptive orders. LLMs amplify the upper order; they leave the generative order untouched.

Chronologically, the pattern is straightforward:

- **Pre-LLM Machine Ethics** attempted to encode normative principles directly—deontic rules, utility functions, virtue schemas—and encountered the reflective/cognitive mismatch documented extensively in the literature [52, 23, 53, 54].
- **Post-LLM models** generate better principles, better explanations, and more articulate moral rhetoric, but they encounter the same mismatch, now at a higher level of linguistic sophistication [55, 56, 57, 58, 59].

The chronology therefore does not mark a methodological revolution; it exposes

the persistence of a category error. The assumption that moral behaviour is fundamentally a matter of reasoning or principle-application has survived unchallenged into the LLM era. But contemporary empirical evidence shows that humans rarely deploy such reasoning in the production of moral action [17, 16, 60].

As several recent critical analyses emphasise, LLMs produce moral reasoning without moral cognition [59, 58, 61]. They resolve dilemmas fluently [1]; they do not reproduce the cognitive–affective processes by which humans come to feel that something is a dilemma in the first place. Moral language is not moral experience. Reflective justification is not perceptual-affective appraisal.

That is the chronological insight, if one seeks it: the technologies have evolved dramatically, but the underlying LoA mismatch remains unchanged. The surface has shifted; the category error has not budged. And that's really the hinge of this work:

> *Synthetic systems can now talk morality far better than they can participate in the conditions that shape moral action. The two are not the same.*

What becomes interesting, especially now, is that artificial systems are not just reasoning in the abstract; they're entering our environments. They're in phones, homes, classrooms, offices. Their presence affects how we behave, how we interpret situations, how we allocate attention.

So the shift isn't from 'pre-LLM Machine Ethics' to 'post-LLM Machine Ethics.' The shift is from seeing AI as an agent that reasons to seeing AI as an element in the cognitive ecology—something that reshapes the conditions in which human moral behaviour unfolds. Whether the system speaks like Kant or Shakespeare or your best friend is irrelevant if its presence still modulates the way people notice, feel, and act. That's the axis that matters. That is the core of this work. And this is where the category error comes in. Machine Ethics assumes that the principles of an ethical theory can be treated as the cognitive machinery of a moral agent– *as if humans behave by running Kantian tests or utilitarian calculations in their heads.*

But we know that isn't how moral action is produced. Human behaviour comes from a much lower level: from what captures our attention, what feels salient, how we read a face or a tone, how empathy gets triggered, how the context shifts our sense of what matters. These processes are fast, intuitive, emotional, and deeply social [16, 31, 18, 62, 6].

[1] The distinction between reflective and generative Levels of Abstraction (LoAs) is crucial here. Moral justification, principle-balancing, and linguistic explanation occur at a reflective LoA [25, 26]. Human moral behaviour, by contrast, arises from perceptual, affective, and socially embedded processes documented across moral psychology and social neuroscience [16, 31, 49, 48]. Recent analyses of LLM-based moral reasoning confirm that these models excel at reflective justification but do not reproduce the generative cognitive–affective mechanisms that produce moral action [59, 58, 61]. The arrival of LLMs therefore intensifies—rather than resolves—the LoA mismatch at the core of Machine Ethics.

Decades of work in moral psychology and neuroscience demonstrate that intuitive, affectively laden processes precede and shape explicit moral judgement [10, 16, 19]. The intuitive, affectively charged processes come first [16, 31, 18, 17]. They shape the space in which explicit reasoning even becomes possible: before reflection begins, appraisal mechanisms, empathic resonance, salience attribution, and motivational tagging have already constrained the field of viable responses [19, 62, 32]. The reflective story we tell afterwards might be coherent, but it is downstream of the machinery that actually drives behaviour [10, 16].

So when Machine Ethics takes ethical principles and treats them as if they were the generator of moral action, it is working at the wrong level entirely. It is replacing the justification of moral behaviour with the mechanism of moral behaviour, and those are not the same thing [15, 37, 14]. High-level principles articulate normative standards, but the processes that produce moral action operate at a far more fundamental cognitive–affective level [25, 26].

So when one tries to design a "moral machine" by encoding Kant or utilitarianism, one collapses these two levels of abstraction. One is treating reflective principles as if they were psychological mechanisms. And the literature shows very clearly that they are not. Ethical theories explain why an action can be defended; they do not explain how moral behaviour is formed [32, 14].

That is the central limitation the literature review exposes. It shows that classical Machine Ethics is methodologically elegant but cognitively misaligned. It is operating at the wrong level to even see the phenomenon we are investigating. As empirical work in moral psychology, affective neuroscience, SSP, and HRI repeatedly shows, the relevant causal structure lies in the evaluative substrate of salience, affect, and social interpretation—not in the reflective principles invoked after the fact [63, 33, 34, 35].

Classical Machine Ethics is beautifully constructed—methodologically elegant, logically clean—but it's operating at a level that's cognitively out of sync with where moral behaviour actually happens. It starts from principles, from rules, from reflective argumentation [21, 20, 23, 22]. But the causal work—*the thing* that actually drives behaviour—lives one layer down, in salience, emotion, attention, and social interpretation [16, 31, 18, 62, 6].

If we look at the wrong layer, we simply don't see the phenomenon we're investigating. And this problem carries over into what's usually called Computational Morality, just in a different form. Whether it's logic engines, preference aggregators, or the newer wave of LLM-based moral modelling, the assumption is the same: moral behaviour can be approximated by symbolic inference—by treating moral judgment as a reasoning problem [24, 27, 28, 56, 55].

But the last twenty years of empirical work tell a very different story. Most moral judgments don't start with slow deliberation; they start with fast, intuitive, emotionally charged appraisal [16, 10, 17]. They're shaped by who's present, how someone looks at you, the tone in the room, what feels at stake, and the affective and social cues embedded in the environment [18, 6, 63, 35]. It's a messy, context-sensitive process [19, 32]. When we try to model morality as if it were

a chain of propositions—if A then B, if C then D— we are abstracting away the very machinery that actually produces behaviour in humans. And that's the machinery our experiment shows can be shifted by the simple presence of a humanoid robot [33, 34, 51].

In other words: the classical computational models are not wrong because the logic is bad. They're wrong because they are modelling the wrong thing. They are trying to capture moral reasoning, when the real action is happening in the evaluative landscape that sits underneath moral reasoning. That's the level where synthetic presence does its work.

In Chapter 3 we make very explicit that: *any model of moral behaviour that leaves out the cognitive–affective machinery and the social-signalling dynamics behind moral judgment is simply not describing human beings.* It becomes unstable both scientifically and philosophically. This is where the Level-of-Abstraction issue gets predominant. If we would take high-level moral theories—the reflective content, the principles, the rules—and treat them as if they were the psychological mechanism that produces moral behaviour, we would end up with theories that look elegant but don't actually predict what people do. They explain justification, not behaviour.We would develop artefacts; models that fail not because the logic is wrong, but because they're modelling the wrong layer of the system. This becomes plainly clear in the experiment in Chaper 5.

The robot we use has no beliefs, no goals, no intentions, and no communicative acts; it is not reasoning or attempting to influence participants. Yet research consistently shows that even minimally expressive or non-agentic robots modulate human social behaviour [33, 51, 64, 34]. These effects operate through changes in salience, attention, and perceived social presence rather than explicit reasoning [65, 2, 47, 49]. Such upstream perturbations cannot be captured by rule-based, utility-theoretic, or propositional models of morality, which mislocate moral action in reflective reasoning rather than in the intuitive, affective systems documented across moral psychology [16, 46, 17, 66, 53].

At this stage, the literature reveals a point that no strand of classical Machine Ethics has convincingly addressed. If the aim is to understand how humans behave morally in the presence of artificial agents—and to model that behaviour in a form that artificial systems can meaningfully operationalise—then the foundational assumptions of the field must be re-examined. Principle-first approaches, whether deontic, utilitarian, or virtue-theoretic, presuppose that moral norms can be implemented as explicit rules or evaluative operators [21, 20, 22, 23]. Yet empirical research in moral psychology and affective neuroscience shows that moral behaviour does not arise from rule application but from cognitively embedded processes of appraisal, salience detection, affective resonance, and social interpretation [16, 31, 18, 62, 6].

Thus, moral norms cannot be treated merely as rules to be encoded. They must be understood in terms of their *topological function*: the way they structure constraints, gradients, and permissible trajectories within the evaluative field through which moral perception is transformed into action [14, 13, 32]. Norms operate at a reflective Level of Abstraction, specifying justificatory structure rather than

cognitive mechanism [15, 37, 25, 26]. Their behavioural influence depends on how they interact with, and are realised by, low-level cognitive–affective processes.

For the same reason, moral judgment cannot be modelled as pure reasoning or symbolic inference. Dual-process and intuitionist models demonstrate that intuitive, affectively charged appraisals precede reflective judgment and constrain the space of subsequent deliberation [10, 16, 17]. Attention, empathic resonance, perceptual salience, and social–contextual modulation shape the evaluative landscape long before propositional reasoning becomes active [19, 18, 63].

Nor can artificial agents be treated as carriers or executors of moral values. Research in HRI and Social Signal Processing shows that artificial systems act primarily as *modulators*—as elements within the environment that reshape salience, perceived social presence, accountability cues, and evaluative expectations [33, 34, 35, 51]. Their influence operates upstream of explicit judgment, altering the evaluative field within which moral decisions are formed.

Once the problem is reframed in this way, the broader picture becomes clear. The limitations of classical Machine Ethics are not failures of logic but failures of explanatory level. Its models operate at a reflective LoA and therefore cannot detect, let alone predict, the cognitive–affective perturbations that empirical research has consistently shown to drive moral behaviour. When the evaluative landscape is foregrounded, the phenomena that appeared mysterious or anomalous under classical formulations become theoretically tractable: synthetic presence exerts moral influence not by embodying values or executing principles, but by reshaping the generative conditions under which moral action emerges.

What follows, then, is not merely a synthesis of existing work but a structural reorganisation of the field. By applying Floridi's notion of a *Level of Abstraction* [25, 26] to the foundations of Machine Ethics for the first time, the literature review demonstrates that the field has been operating at an explanatory level incapable of capturing the mechanisms that actually generate moral behaviour. Classical approaches begin with reflective ethical theories—deontic logics, utilitarian calculi, virtue templates—and treat these as if they were computational models of moral agency [21, 20, 22, 23]. Yet moral psychology and affective neuroscience have shown consistently that moral action arises from perceptual salience, affective appraisal, attentional capture, and social meaning [16, 31, 18, 62, 6]. Social Signal Processing and HRI research further reveal that artificial agents perturb precisely these low-level evaluative dynamics [63, 33, 34, 35].

Through this reframing, the literature review achieves a clear result: it exposes a fundamental LoA mismatch at the heart of Machine Ethics and shows that no principle-first, rule-codification framework can access the phenomena under investigation. Moral norms operate at a reflective LoA, specifying justificatory relations [15, 37], whereas moral behaviour is produced at the cognitive LoA through the dynamic interplay of affect, salience, and social interpretation. By bringing these strands together, the review establishes an integrated conceptual framework in which *synthetic presence* becomes intelligible as a perturbation of the evaluative field itself—a theoretical insight that classical Machine Ethics could

not formulate, and a necessary foundation for interpreting the empirical results of this thesis.

2.2 The Two Research Projects in Machine Ethics

Machine Ethics does not constitute a unified field in the way that English literature or molecular biology do. It lacks a single community, a shared methodology, and a cohesive disciplinary core. What the literature refers to as "Machine Ethics" is in fact an umbrella designation for two fundamentally different research programmes that ended up sharing a name. Their conflation is widespread in the literature, yet they operate at distinct Levels of Abstraction [25, 26] and aim to explain different phenomena.

The first programme is what I call *Human–Machine Ethics*. This strand examines how humans think, feel, and behave in the presence of artificial agents. It encompasses questions of accountability, agency displacement, social influence, norm perception, and moral risk. Its empirical backbone comes from Human–Robot Interaction, media psychology, and Social Signal Processing. Evidence from these domains shows that artificial systems—whether humanoid robots, embodied agents, or even minimally interactive media—systematically modulate attention, empathy, prosociality, and interpersonal expectations merely through their presence [67, 63, 33, 34, 51, 35]. This research programme aligns directly with the phenomenon investigated in this thesis: the modulation of human moral behaviour by a robot's silent co-presence.

The second programme is *Computational Machine Ethics*. This project attempts to design machines that make ethically adequate decisions by embedding moral theories into computational architectures. Deontic logics, utilitarian optimisation engines, rule-based ethical governors, and virtue-inspired templates all fall under this category [21, 20, 22, 23, 24, 27]. The central assumption is that moral behaviour can be generated by applying ethical principles at runtime, often via symbolic inference, constraint satisfaction, or rule execution. In this sense, Computational Machine Ethics treats moral judgement as a reasoning problem rather than as a perceptual–affective process.

The literature routinely conflates these two programmes, as if progress in one automatically informs the other. But they sit at different Levels of Abstraction and answer different explanatory questions: Human–Machine Ethics investigates how artificial systems modulate human evaluative processes, whereas Computational Machine Ethics attempts to construct artificial evaluative systems by formalising normative content.

The empirical results of this thesis underscore why this distinction is indispensable. Human–Machine Ethics predicts precisely the kind of modulation observed experimentally: even a non-interactive robot can reshape attentional and affective salience, thereby altering the evaluative conditions under which prosocial behaviour is generated [6, 18, 16]. Computational Machine Ethics, by contrast, is structurally incapable of recognising such modulation because it presupposes that moral behaviour is produced by reflective, principle-driven reasoning—an

assumption contradicted by decades of work in moral psychology and affective neuroscience [31, 10, 62, 32].

Thus, the apparent lack of unity in "Machine Ethics" is not an artefact of interpretation but an accurate reflection of the field's conceptual structure. The label obscures two independent activities: one empirically grounded, concerned with how humans behave in sociotechnical environments; the other formally oriented, concerned with encoding ethical principles into artificial agents. Without maintaining this distinction, research risks becoming blind to the very phenomenon contemporary AI and robotics force us to confront: that artificial agents, even when passive, *modulate the evaluative field* through which human moral decisions take shape.

2.3 A Clarifying Perspective on Where This Work Belongs—and Where the Field Must Go

It is tempting to ask where this research "belongs." Does it fall under Affective Computing, with its emphasis on computational models of emotion [68]? Does it align with Human–Robot Interaction, where the behavioural consequences of artificial social agents are examined [33, 34, 51]? Or does it sit within moral psychology, which has spent decades analysing the cognitive and affective substrates of moral behaviour [16, 31, 18, 62]? Each discipline contributes an essential piece, but none, on its own, provides the conceptual framework needed to understand the phenomenon at stake. For the purposes of this thesis, the disciplinary label is secondary; the primary task is the conceptual clarification that makes the inquiry possible.

The central confusion this thesis confronts is not empirical but conceptual. For nearly two decades, work collected under the name "Machine Ethics" has blurred two fundamentally distinct enterprises: understanding how humans behave morally in sociotechnical settings, and designing machines that behave according to encoded ethical theories. These projects occupy different Levels of Abstraction [25, 26], draw on different forms of evidence, and target different explanatory aims. Treating them as a single field has produced a methodological entanglement in which elegant theories obscure the very phenomena they are meant to illuminate.

The distinction becomes clear once the discipline of Levels of Abstraction is applied. Human moral behaviour emerges at the cognitive LoA: it is shaped by perceptual salience, affective resonance, attentional dynamics, and social-cue interpretation [16, 10, 18, 6]. Ethical theories—Kantian, utilitarian, contractualist—operate at a reflective LoA concerned with justification rather than generation [15, 37]. When researchers treat high-LoA normative principles as if they were low-LoA psychological mechanisms, the result is not an incomplete theory but an artefact: a framework unable to predict behaviour, accommodate perturbations, or explain modulation phenomena.

The experimental findings of this thesis make this point explicit. A humanoid robot with no beliefs, goals, or communicative acts nevertheless alters the eval-

uative conditions under which humans convert moral perception into prosocial action. Such modulation does not arise from reflective reasoning; it arises from shifts in salience, affective alignment, and attentional orientation [31, 18, 6]. Any framework that models moral action as rule retrieval, utility computation, or principle execution remains blind to these dynamics because it operates at the wrong LoA.

This is why the disciplinary categorisation of the work is not the central issue. The point is not where the research should be filed but what becomes visible once conceptual discipline is restored. Through this lens, the field of Machine Ethics reorganises itself. *Human–Machine Ethics* emerges as an empirically grounded inquiry into how artificial agents modulate human evaluative processes [63, 51, 35]. *Computational Machine Ethics* reveals itself as a reflective programme concerned with principled design, centred on formalisms such as deontic logic [21, 20], utility maximisation [22], and virtue-engineering [23]. Both are legitimate, but conflating them obscures the cognitive phenomena that modern AI and robotics bring to the foreground.

Clarification, however, is only the first step. Once the LoA distinction is restored, one must ask what research agenda follows. The answer is both more modest and more ambitious than any principle-encoding programme. Moral behaviour is not computed; it is formed. It emerges from a dynamic evaluative field structured by affective gradients, perceptual cues, attentional flows, and socially mediated expectations [16, 10, 18, 63]. Artificial agents—robots, avatars, conversational AIs—modulate this field simply by entering it. A scientifically credible programme for moral AI must therefore begin not with ethics as a set of principles but with the architecture of moral cognition.

Three consequences follow immediately. **First**, empirical grounding becomes non-negotiable. Any model of moral behaviour must integrate findings from moral psychology, affective neuroscience, developmental research, HRI, and Social Signal Processing. A theory that cannot accommodate the influence of gaze, posture, co-presence, or anthropomorphic cues cannot accommodate human moral behaviour [1, 2, 6]. **Second**, artificial agents must be modelled as operators, not reasoners: their role is not to apply rules but to modulate the evaluative conditions under which humans act [33, 35, 34]. **Third**, normative theory must be interpreted topologically rather than procedurally: norms specify constraints, gradients, and attractors in the evaluative space through which behaviour flows [14, 13, 32].

This reframing also answers the practical question often posed by engineers: what is the actionable takeaway? The takeaway is not a new ethical theory, nor a list of rules to embed in code. It is the recognition that artificial agents shape human moral behaviour not by argument but by presence, not by reasoning but by salience, not by principles but by perceptual modulation. Designing systems without understanding the evaluative field they inhabit is a form of conceptual blindness.

The future of moral AI does not lie in machines that reason like philosophers, but in machines that coexist with humans in ways that can be predicted, understood,

and—when necessary—constrained. Any credible programme must therefore begin where moral behaviour itself begins: within the evaluative machinery that transforms perception and affect into action.

2.4 Moral Psychology and Moral Philosophy: Cognitive–Affective vs. Rationalist–Intuitionist Models

Once the conceptual confusion is removed, the next step is to examine the machinery that actually produces moral behaviour. Here the empirical story is remarkably consistent. For nearly two decades, work in moral psychology, affective neuroscience, and behavioural science has converged on a single conclusion: moral judgment is not primarily a reasoning task but a *dual-process system*. Fast, intuitive, emotionally charged processes perform the bulk of the causal work. They respond to perceptual salience, attentional capture, empathic resonance, and situational demands [16, 31, 10]. Slower, reflective processes intervene later—often to justify, refine, or override the initial intuitive appraisal—but the initial appraisal performs the primary generative role [17, 18, 62].

This picture is reinforced by the major theoretical models in the field. Haidt's Social Intuitionist Model [16], Greene's neurocognitive dual-process framework [31, 10, 46], and Cushman's action-based inference models [17] all converge on the claim that moral evaluation begins with rapid, affectively valenced appraisals long before explicit reasoning is engaged. Neuroscientific findings corroborate this: affective tagging, motivational relevance, empathy circuitry, and social-interpretive processes are recruited early, often prior to conscious deliberation [19, 18, 6].

This stands in sharp contrast with the philosophical traditions on which classical Machine Ethics has historically relied. Kantian ethics, utilitarian frameworks, and contractualism articulate *justificatory* structures: universalisability conditions, value aggregation procedures, or principles governing the exchange of reasons [15, 37]. They are not intended as accounts of the psychological mechanisms that *produce* moral judgments. As the philosophers themselves emphasise, these theories operate at a reflective Level of Abstraction; they describe the standards by which actions can be defended, not the cognitive architecture through which actions arise.

Machine Ethics, however, adopted only this reflective dimension and treated it as though it described the entire system. It assumed that humans behave morally by applying principles, and that artificial agents could do likewise by encoding those principles directly into computational structures [21, 20, 22, 23]. But the empirical literature shows decisively that moral behaviour is not generated by rule application. It emerges from a cognitive–affective substrate shaped by salience, emotion, attention, embodiment, and social interpretation.

This empirical fact explains why studies of human moral behaviour in context—across HRI, media psychology, and Social Signal Processing—identify recurrent patterns governed by attentional capture, affective resonance, perceived monitoring, and contextual meaning [67, 63, 33, 34]. Consider the Watching-Eye

effect: people alter their behaviour when exposed to minimal cues of observation, even a pair of stylised eyes [1, 2, 5]. The shift is not the result of endorsed rules but of subtle environmental modulation of evaluative posture.

This cognitive level—the level of salience, empathy, vigilance, and contextual modulation—is precisely where moral behaviour is shaped. It is also where the attenuation effect in our experiment resides. The humanoid robot does not reason, speak, or request anything; nonetheless, its silent co-presence perturbs the evaluative field sufficiently to alter prosocial action. This is the cognitive–affective layer in operation, the layer classical Machine Ethics never modelled.

What follows from this is analytically unavoidable. If moral behaviour emerges from perceptual salience, affective pull, attentional alignment, and social interpretation, then computational models that treat morality as rule-following or propositional inference are modelling the wrong phenomenon. They are elegant but descriptively incomplete: they capture the reflective Level of Abstraction while missing the cognitive Level of Abstraction entirely.

This is why the discussion moves next to Levels of Abstraction. Once the mismatch is recognised, it becomes clear that many of the philosophical debates and engineering efforts in Machine Ethics were conducted at an inappropriate explanatory level from the outset. The remainder of the thesis unpacks the consequences of this realisation and reconstructs a framework in which moral cognition, evaluative topology, and synthetic presence can be understood in principled alignment.

With this distinction in place, the argument can now shift from diagnosing the structural error in classical Machine Ethics to examining the positive framework required to replace it.

2.5 Levels of Abstraction and the Failure of Machine Ethics

The conceptual tool that dissolves much of the confusion in Machine Ethics is Floridi's notion of a *Level of Abstraction* (LoA) [25, 26]. The idea is structurally simple but analytically powerful: any explanation requires specifying the level at which a system is being described. The LoA determines which variables are observable, the appropriate grain of detail, and the kinds of explanations that can legitimately be offered. Ethical theories operate at a high, reflective LoA: they articulate justificatory structures—principles, universalisation tests, value aggregation procedures, and reason-giving relations [15, 37]. Moral psychology, by contrast, operates at a lower, cognitive LoA: it investigates the mechanisms that *generate* moral judgment, including perceptual salience, affective appraisal, attentional dynamics, and social meaning [16, 31, 10, 17, 18].

Confusion arises when content belonging to one LoA is treated as if it were the mechanism operating at another. If reflective theories are misread as cognitive architectures, the distinction collapses, and with it the capacity to explain behavioural phenomena. Classical Machine Ethics has repeatedly committed this collapse for nearly two decades. By taking the principles of Kantian, utilitarian, or virtue-theoretic ethics and treating them as if they described the internal processes that produce moral behaviour, the field implicitly assumed that moral

agents—human or artificial—act by applying principles [21, 20, 22, 23]. But these principles occupy the reflective LoA: they explain *why* an action might be defensible, not *how* a moral judgment is generated.

When these reflective principles are used as behavioural generators—as algorithms meant to produce moral action—the resulting models are elegant but fundamentally misaligned with human moral cognition. Real moral behaviour does not follow from propositional logic or rule execution. It emerges from what may be described as the *evaluative topology*: the structured field of salience gradients, affective forces, attentional pathways, and social interpretations that determine what appears morally significant in the moment [16, 46, 18, 63]. These low-level mechanisms—affective appraisal, empathic resonance, vigilance, contextual modulation—form the terrain within which high-level principles even acquire meaning.

The experimental findings of this thesis show precisely what happens when LoA discipline is violated. In the Watching-Eye paradigm, the accountability cue ordinarily increases prosocial behaviour [1, 2, 5]. Yet when a silent, non-agentic humanoid robot is introduced into the environment, this effect is attenuated. No reasoning, communication, belief, or intention is involved. The modulation arises from presence alone: the robot perturbs the evaluative field by shifting salience, affective alignment, and perceived social ontology [33, 34, 35]. The accountability cue loses traction not because a principle is misapplied, but because the cognitive substrate on which it depends has been displaced.

This synthesis yields a clear conclusion: moral action does not originate in the execution of principles but emerges from the dynamic interaction of perceptual, affective, and social processes. Classical Machine Ethics begins at the wrong point in the explanatory hierarchy. It treats high-level normative theories as if they were low-level cognitive mechanisms and thereby becomes blind to the central phenomenon that contemporary sociotechnical environments introduce: artificial agents modulating human evaluative fields through their mere presence.

The thesis therefore advances a strong and methodologically grounded claim: *before we can design moral machines, we must understand how machines reshape human moral experience.* This requires inverting the traditional order of explanation. The task is not to begin with ethical theory and push downward, but to begin with the empirical architecture of moral cognition, determine how artificial agents perturb it, and only then ask what forms of ethical oversight or design constraint are justified.

Once Levels of Abstraction are applied, the path forward becomes clear. We can distinguish coherent questions from incoherent ones, identify which debates were aimed at the wrong level of the system, and recover the conceptual clarity necessary for progress. More than any single empirical result, this restoration of LoA discipline is the tool that allows the broader project of moral AI to proceed in the right direction.

2.6 Evaluative Topology, Affective Architecture, and Synthetic Moral Perturbation

If the preceding sections establish that classical Machine Ethics operates at the wrong Level of Abstraction (LoA), the task now is to articulate the positive alternative: a topological account of moral behaviour grounded in the cognitive–affective mechanisms documented in empirical psychology [16, 31, 10, 17, 18, 62] and in the social-modulatory processes identified by Social Signal Processing and HRI [67, 63, 33, 34, 51].

The central thesis of this section is that moral behaviour does not arise from the execution of encoded principles. Instead, it emerges from the dynamic configuration of an *evaluative field*: a structured, multidimensional landscape shaped by gradients of salience, affective resonance, attentional pathways, contextual norms, and implicit social meaning. Ethical theories operate within this field not as algorithmic generators but as high-LoA structural constraints [15, 37]. Their force depends on how they are realised within the cognitive–affective dynamics through which moral perception becomes moral action.

2.6.1 The Evaluative Field

The notion of an evaluative topology synthesises three major strands of established research.

(1) Moral psychology: affect, intuition, appraisal. Dual-process theory [31, 10, 46] and the Social Intuitionist Model [16] show that moral evaluation begins with rapid, affectively valenced appraisals. Affective tagging, empathic resonance, and motivational relevance are recruited early [18, 62, 19]. Attentional capture, perceptual salience, and intuitive heuristics structure the evaluative space long before reflective reasoning is engaged.

(2) Social Signal Processing and affective computing: cue modulation. Work in SSP demonstrates that gaze direction, morphological cues, co-presence, and implicit monitoring reshape attentional and affective weighting long before explicit cognition intervenes [67, 63, 6]. HRI studies confirm that humanoid robots and artificial agents modulate social meaning and perceived agency through mere presence [33, 34, 35, 51].

(3) Normative theory: structural constraints. Philosophical ethics contributes the insight that moral theories provide structural invariants—deontological constraints [15], consequentialist gradients, virtue-theoretic attractors [14, 69], sentimentalist affective vectors [32, 70], and contractualist justificatory relations [37]. These normative forms define the shape of the evaluative field but do not generate behaviour directly.

Reinterpreted through LoA-sensitive analysis [25, 26], these strands form a coherent architecture: high-LoA normative structures supply the constraints; low-LoA cognitive–affective mechanisms determine the trajectories; and social signals reshape the field within which both operate.

2.6.2 Moral Behaviour as Trajectory

Within this topological framework, moral behaviour is best understood as movement through an evaluative manifold.

- **Attention** introduces local curvature by amplifying or suppressing cues [71].
- **Affect** saturates regions of the field with motivational energy [62, 18].
- **Contextual cues** deform gradients, shifting the relative weight of obligations, norms, and expectations [16, 4].
- **Social signals** modulate perceived accountability and interpersonal meaning [1, 2, 5].

This model dissolves the rationalist–intuitionist divide. Rationalist structures do not compete with intuitive mechanisms; they operate at different LoAs. The reflective domain imposes structural constraints, while the cognitive–affective domain determines how the system actually moves within those constraints [46, 37].

2.6.3 Synthetic Presence as Field Operator

The experiment presented in Chapter 5 provides an empirical probe into this architecture. The Watching-Eye cue ordinarily induces a prosocial salience gradient via implicit social monitoring [1, 2].

Yet the introduction of a silent, non-agentic robot attenuates this gradient. The effect does not originate in reasoning or principle-application. It arises from a deformation of the evaluative field itself. The robot's ambiguous social ontology—perceptually agentic but ontologically indeterminate—reshapes the affective and attentional conditions through which the Watching-Eye cue acquires behaviour-guiding force [33, 34, 35]. In this sense, synthetic presence acts as a *field operator*: its mere co-presence modifies the salience landscape and alters the trajectory from moral perception to moral action.

Crucially, the perturbation is *disposition-sensitive*.

- The **Prosocial–Empathic ecology** exhibits the strongest attenuation, reflecting its dependence on empathic resonance and interpersonal salience—the very mechanisms displaced by synthetic presence.
- The **Analytical–Structured ecology** shows moderate attenuation, consistent with reliance on interpretive coherence rather than affective pull.
- The **Emotionally Reactive ecology** shows minimal change, as its evaluative landscape lacks stable gradients onto which perturbation could anchor.

These differential effects underscore the core insight: synthetic presence perturbs moral behaviour *upstream* of principle, trait, and deliberation.

2.6.4 Topology and the Limits of Machine Ethics

This topological analysis explains why classical Machine Ethics could not predict the observed phenomenon. Moral behaviour under synthetic presence does not

change because a rule is misapplied or because deliberation fails. It changes because the evaluative field in which principles acquire force has shifted.

- Deontological norms lose traction when accountability salience collapses [2, 71].
- Consequentialist gradients flatten when contextual meaning becomes ambiguous [4, 72].
- Virtue-theoretic dispositions cannot express themselves when affective attractors weaken [69, 14].
- Sentimentalist mechanisms fade when empathic resonance is displaced [32, 70].
- Contractualist justificatory relations dissolve when the perceived social field becomes indeterminate [37].

The experiment therefore confirms the structural thesis: moral behaviour is field-sensitive, and synthetic agents act as perturbation operators on the evaluative topology.

2.6.5 Toward a Unified Framework

The concept of evaluative topology provides precisely the integrative framework that Machine Ethics has lacked. It offers the structural bridge linking normative theory, empirical psychology, and computational modelling. It clarifies how high-LoA normative structures interface with low-LoA cognitive–affective mechanisms, and why artificial agents can reshape moral action without expressing beliefs, intentions, or normative content.

This framework completes the foundational turn of the thesis. The subsequent chapters build on this topological architecture to formalise a general model of machine-mediated moral cognition—one in which artificial systems are not ethical reasoners but modulators of the evaluative conditions through which moral meaning gains behavioural expression.

2.7 Integrative Synthesis: Toward a Cognitive–Affective Model of Machine-Mediated Morality

The analyses developed across this chapter converge on a unified account of moral behaviour under artificial co-presence. Classical Machine Ethics begins with reflective normative theories and treats them as behavioural generators [21, 20, 22]. Moral psychology shows that moral action instead emerges from a cognitive–affective architecture grounded in salience, attention, empathy, and contextual modulation [16, 31, 17]. Work in HRI and SSP demonstrates that artificial agents modulate these mechanisms through minimal social cues [63, 34, 33, 35]. Evaluative topology integrates these insights by modelling moral behaviour as trajectories through a salience-weighted, affectively structured field. The experiment confirms this: synthetic presence perturbs the evaluative field upstream of deliberation, thereby attenuating prosocial action.

Three core conclusions follow from the literature:

1. **Moral behaviour is generated at the cognitive LoA.** Reflective ethical theories articulate standards of justification [15, 37], but empirical work shows that behaviour is produced by low-LoA affective and social mechanisms [31, 18, 6]. Norms gain behavioural force only when the evaluative field affords it.

2. **Artificial agents reshape the evaluative field before they act within it.** SSP and HRI research indicates that presence alone modulates attention, empathy, vigilance, and perceived social meaning [67, 63, 33, 51]. The experimental attenuation effect confirms this literature-driven prediction.

3. **A viable programme for moral AI must begin with evaluative topology.** The literature shows that computational systems cannot generate moral behaviour through principle execution alone [23, 22]. Normative codification must be constrained by a model of the cognitive–affective architecture through which moral behaviour is actually formed.

These claims collectively reframe the foundational commitments of moral AI. Artificial systems cannot be conceptualised merely as executors of moral rules; they must be understood as *operators on the evaluative field* within which human moral cognition unfolds. Synthetic presence deforms salience gradients, attenuates empathic resonance, and weakens accountability cues—perturbations that occur far upstream of explicit reasoning.

2.8 Global Synthesis: From Inferential Displacement to Synthetic Moral Topology

The literature reviewed in this chapter reveals a coherent picture: moral judgment and action arise from a cognitively embedded, affectively structured, socially modulated evaluative field [16, 31, 18, 63]. Ethical theories supply reflective standards, but they do not generate behaviour; cognitive architecture does. Artificial agents participate in this architecture by shaping salience, affect, and perceived social meaning [34, 51].

2.8.1 From Question to Framework

The guiding research question—whether synthetic presence can perturb the inferential transformation through which moral salience becomes action—emerges naturally from unresolved tensions in the literature. Machine Ethics assumes that behaviour follows from principle execution [21, 20]; moral psychology shows it does not [16, 17]. SSP reveals that social cues modulate evaluative processes [67, 63]. HRI shows that artificial agents evoke these cues through minimal presence [33, 34]. Yet these strands have rarely been synthesised.

2.8.2 Why a Multi-Hypothesis Framework Was Needed

The literature identifies three distinct mechanisms through which artificial agents may modulate moral behaviour:

1. **Evaluative deformation** via shifts in salience, monitoring, and affective weighting [1, 2, 71].

2. **Synthetic normativity** arising from the perceived social ontology of robots [35, 33, 34].
3. **Perturbation of inferential pathways** through displacement of empathy, attention, or contextual interpretation [18, 46].

No single mechanism captures the phenomenon; a multi-hypothesis framework is required to align the interdisciplinary evidence.

2.8.3 What the Literature Alone Establishes

Across the reviewed domains, three findings are robust:

1. **Moral behaviour is field-sensitive**, emerging from salience, affect, attention, and contextual cues [31, 16, 18].
2. **Artificial agents modulate this field** by altering social meaning, vigilance, and empathic stance [34, 51, 73].
3. **Classical Machine Ethics cannot model this modulation**, because principle-based formalisms ignore the cognitive LoA where behaviour is actually generated [23, 22].

From this, a literature-driven conclusion follows: a viable framework for moral AI must be grounded not in normative content but in the structural dynamics of the evaluative field.

The literature review exposes a categorical error at the foundation of classical Machine Ethics. Across two decades of work, the same misalignment recurs: principles drawn from ethical theory—Kantian universalisability tests, utilitarian utilities, virtue-theoretic templates—are treated as if they were the psychological mechanisms that generate moral behaviour [21, 20, 22, 23]. Yet the literature makes clear that these operate at fundamentally different Levels of Abstraction. Reflective norms articulate *conditions of justification* [15, 37]; cognitive–affective systems explain *behavioural production* [16, 31, 17]. Frameworks that collapse these levels cannot predict or explain human moral behaviour, particularly under synthetic presence. The review makes this structural failure explicit.

The review also reveals a neglected architecture: moral cognition emerges from an evaluative field shaped by affect, salience, and social signalling. When empirical findings are placed side by side—across moral psychology [16, 10], affective neuroscience [18, 62], Social Signal Processing [67, 63], and Human–Robot Interaction [33, 34, 51]—a convergent picture becomes visible. Moral judgments originate in rapid, affect-laden appraisal; attentional dynamics determine which cues become morally salient; social signals such as gaze, posture, and co-presence modulate evaluative weighting; and explicit reasoning intervenes only downstream. This interdisciplinary convergence exposes a unified evaluative architecture that classical Machine Ethics never incorporated and could not accommodate.

Finally, the review identifies the theoretical gap that motivates the experiment. Once the evaluative architecture is made explicit, a precise, previously unformulated question emerges: *can synthetic presence perturb the evaluative field upstream of explicit moral reasoning?* No existing Machine Ethics framework even

poses this question, because none operate at the LoA where such perturbations occur. The literature review therefore performs an essential scientific function: it isolates the causal layer in which moral behaviour is generated and shows that current models fail to explain modulation at this level. The empirical study is designed explicitly to probe this gap.

In short, the literature review demonstrates that the field has been asking the wrong questions at the wrong level of abstraction; it identifies the level at which the genuine causal machinery of moral behaviour operates; and it isolates the precise phenomenon requiring empirical investigation. It clears the conceptual ground on which the remainder of the thesis rests and provides the foundation for a new account of moral behaviour under synthetic presence. In this project, the literature review is not merely preparatory; it constitutes the first scientific result.

3. Cognitive–Affective Architecture of Moral Judgment

The conceptual apparatus developed in this chapter is not an ornamental introduction to moral theory. It is the minimum set of distinctions required to make the research question itself intelligible. The project asks:

> *Can the mere presence of a synthetic, non-agentic entity perturb the inferential transformation through which morally salient cues are converted into observable moral behaviour?*

that is to say whether the mere presence of a synthetic agent can alter the trajectory by which human beings transform a morally salient perception into a morally relevant action. Such a question does not belong to the domain of ethical theory; it belongs to the domain of moral cognition.

To address it, one must understand the cognitive–affective substrate in which moral judgments are formed, weighted, and enacted. The behaviour observed in the experiment does not arise at the level of explicit reasoning, rule application, or reflective justification. It arises upstream, within the processes that determine what becomes salient, how empathic resonance is allocated, which cues are attended to, and how the felt sense of accountability is modulated. These are the mechanisms through which moral evaluation becomes behaviourally operative; without a precise understanding of them, the central phenomenon of this thesis is not only unexplained but incorrectly described.

Reflective moral theories—Kantian maxims, utilitarian calculus, contractualist reasoning—do not operate at this level. They articulate justificatory relations, not generative mechanisms. They tell us why an action may be defensible, not how the human cognitive system produces the behaviour in the first place [15, 37, 36]. For this reason, any attempt to explain the experimental effect by appealing to ethical principles is methodologically misaligned.

It begins at a Level of Abstraction that the phenomenon does not inhabit [25, 26].

What is required instead is an account of moral cognition as an action-guiding evaluative process: a process in which affect, attention, salience, social interpretation, and contextual meaning jointly determine how moral cues acquire behavioural force. A large body of work in moral psychology and cognitive neuroscience demonstrates that these mechanisms—affective appraisal, empathic resonance, intuitive evaluation, and attentional modulation—constitute the causal substrate of moral judgment [16, 31, 10, 17, 18, 62]. Only within such a framework can the influence of synthetic presence be meaningfully specified. Without it, the experimental result risks being mischaracterised as a change in moral belief

or a failure of deliberation, when in fact it is a perturbation of the evaluative field that precedes both [6, 4, 71].

The purpose of this chapter is therefore clarificatory in the strictest sense. It isolates the cognitive–affective mechanisms that constitute the causal substrate of moral behaviour; it distinguishes them from the reflective structures of ethical theory; and it establishes the Level of Abstraction at which the research question resides [25, 26].

By doing so, it provides the conceptual conditions under which the empirical findings of the thesis can be correctly interpreted. The experiment does not test principles, preferences, or doctrines. It tests the stability of the evaluative machinery through which moral meaning becomes action. Understanding that machinery is the only way to understand the phenomenon under investigation.

This is why the chapter must take the form it does. Not to broaden the discussion of morality, but to focus it precisely at the level where the phenomenon of synthetic moral perturbation arises.

A recurring theme across the reviewed literature is that failures in Machine Ethics stem from two related errors: *category mistakes* and *LoA conflation*.

Category mistakes arise when reflective normative principles are treated as if they described the psychological mechanisms that generate moral behaviour; LoA conflation occurs when descriptive cognitive regularities are mistaken for normative constraints or vice versa [25, 26]. Both errors follow from neglecting the fact that justificatory structures live at a high Level of Abstraction, whereas moral behaviour is produced at a lower, cognitive–affective LoA documented in moral psychology and social cognition [16, 10, 18].

Recognising these distinctions is methodologically essential: without LoA discipline, interpretive models of moral perturbation become confused, and empirical findings—such as the attenuation effects examined in this thesis (Chapter 5)—risk being mischaracterised as failures of reasoning rather than as deformations of the evaluative field.

3.1 Descriptive and Normative Domains

The term "morality" spans at least two analytically distinct domains. The first is *descriptive morality*:

> *the empirical study of how humans form moral judgments, experience moral emotions, and engage in normatively salient actions.*

This includes developmental psychology [74], social–cognitive models [45, 75], affective neuroscience [19, 18], and evolutionary accounts of cooperation and prosociality [76, 77].

The second is *normative morality*:

> *the domain of ethical theorising concerned with how one ought to act.*

This domain encompasses deontological, consequentialist, contractualist, and virtue-theoretic traditions [69, 78, 79, 80].

These domains are distinct but interdependent. Descriptive accounts illuminate how agents actually evaluate and respond to situations, while normative theories articulate standards for justified action. Empirical models of moral cognition acquire meaning partly through the normative vocabulary within which moral judgments are articulated, while normative theories must remain constrained by what agents are psychologically capable of performing or understanding.

The distinction between descriptive and normative morality is introduced at this point in the chapter because it provides the final conceptual boundary required before the empirical and theoretical analysis can proceed. Without it, two serious confusions would arise—each of which would undermine the scientific aims of the project.

First, moral terminology in technical disciplines is often used ambiguously. Words like obligation, responsibility, harm, or trust are employed as if their meaning were self-evident, yet researchers oscillate unconsciously between describing how agents in fact behave and prescribing how they ought to behave. This sliding between domains produces conceptual instability: experimental findings are mistaken for ethical insights, and normative claims are misinterpreted as empirical predictions.

Second, the research question of this thesis is strictly descriptive: *Can synthetic presence alter the evaluative processes through which humans convert moral perception into moral action?*

To answer this question, the project must operate within the empirical domain of moral psychology. If this boundary is not explicitly marked, the analysis risks drifting into normative interpretation—treating behavioural attenuation as moral deficiency, or treating reflective theories as mechanistic explanations.

The descriptive–normative distinction therefore performs a crucial clarificatory function:

The distinction identifies the **level at which the thesis operates**. The aim is not to determine what people *should* do in the presence of robots, but to explain what *does* happen within the cognitive–affective architecture when artificial agents enter the evaluative field. Such phenomena require descriptive tools: models of attention, salience, empathy, and social meaning—not principles or moral doctrines [16, 10, 18, 71, 6].

Second, the distinction prevents the **misinterpretation of empirical findings** as moral judgments. If a robot's presence reduces prosocial behaviour, this is a psychological effect, not a moral failure. It does not imply that agents have acted wrongly or that the robot has transgressed any ethical boundary. It reflects a perturbation in the evaluative machinery that gives moral cues their behavioural force [1, 2, 5, 33, 34].

Third, the distinction isolates the **causally relevant components of morality**

for the experiment. The mechanisms at stake—affective resonance, accountability salience, attentional modulation—belong entirely to descriptive cognition [18, 62, 63, 6]. Normative theories are indispensable for understanding the structure of moral reasoning, but they do not generate behaviour [37, 15, 36]. Keeping the domains separate ensures that the phenomenon is examined at the correct Level of Abstraction [25, 26].

Finally, the distinction prepares the ground for **integrating normative theory later without conceptual confusion**. Normative materials will reappear, not as behavioural engines, but as structural constraints within the evaluative topology—deontic invariants, consequentialist gradients, virtue-theoretic attractors, sentimentalist vectors, and contractualist equilibria [46, 14, 69, 81]. This reinterpretation is only possible once descriptive and normative domains have been clearly disentangled.

In sum, the distinction is introduced here because it secures the conceptual boundary conditions of the thesis. It establishes the domain in which the claims are made, prevents methodological conflation, and ensures that the phenomenon under investigation—moral perturbation under synthetic presence—is analysed at the level where it actually occurs. The orientation of the thesis is therefore precise: moral cognition is the object of study; normative theory provides the vocabulary of justification; and coherence requires that these domains remain distinct.

The project now turns to a minimal operational definition of morality. This may appear abrupt, but its placement at this point in the chapter is deliberate. The preceding sections established the conceptual boundaries required to analyse moral cognition without collapsing distinct Levels of Abstraction or importing normative assumptions into descriptive models. Having drawn these boundaries, the thesis now requires a definition precise enough to guide empirical and theoretical analysis, yet modest enough to avoid the philosophical commitments associated with substantive normative theories.

3.1.1 Why Definitions Vary

There is no single universally accepted definition of morality, and this plurality is neither accidental nor superficial. Different research programmes emphasise different elements of the moral domain. Cognitive approaches foreground the mechanisms by which agents form evaluative judgments [82]; affective traditions emphasise the emotional systems that underpin moral concern [83]; rationalist accounts privilege normative reasoning [80]; social-scientific models attend to conventions and cultural norms [84]; evolutionary frameworks focus on the adaptive functions of cooperation and prosociality [76, 77]. Philosophical traditions likewise diverge in grounding morality in rationality, sentiment, virtue, utility, social contracts, or evolutionary pressures.

Computational treatments often inherit only one strand of this diversity. They default to rule-based perspectives not because such models accurately describe human moral cognition, but because they are structurally convenient to implement [21, 20, 22, 23]. This convenience has encouraged the misleading interpretation of moral behaviour as rule following and has fostered oversimplified models of moral decision-making that obscure the cognitive–affective architecture through which

real moral judgments are produced [16, 31, 17, 18].

A primary aim of this chapter is therefore corrective: to replace these inherited simplifications with a framework grounded in contemporary moral psychology, cognitive science, and social-signal research [67, 63, 6]. Only such a framework can support the empirical and conceptual analysis required by the research question.

3.1.2 Minimal Operational Definition for This Thesis

Within this clarified landscape, the thesis adopts the following minimal, action-oriented definition of moral cognition:

> *Moral cognition is the evaluative process through which agents detect normatively salient features of a situation, generate judgments concerning permissible or obligatory actions, and select behaviour accordingly.*

This definition is intentionally modest. It avoids entanglement in substantive normative theories while isolating the components necessary for empirical investigation: evaluation, judgment, and action. It reflects contemporary moral psychology, which treats moral cognition as the product of interacting affective and cognitive mechanisms [16, 31, 17, 18], and it coheres with the theoretical machinery developed throughout this thesis—evaluative topology, Levels of Abstraction [25, 26], and synthetic perturbation as documented in HRI and SSP [34, 51, 63].

Under this definition, moral cognition functions as a mapping from situational cues to action policies, shaped by trait-level dispositions [85, 86] and by the affective and attentional structures of the evaluative field [6, 71]. It provides the minimal conceptual anchor required to examine how synthetic presence modulates the transformation from moral perception to moral action.

Before proceeding to the distinction between factual and normative judgments, it is important to make explicit what has been achieved in the preceding sections. Although these sections are primarily conceptual, they perform essential scientific functions. They do not merely summarise philosophical background; rather, they establish the explanatory conditions under which the empirical and theoretical claims of the thesis become possible. Three achievements are central.

First, we have identifying the correct level of explanation for the research question. The literature review and the clarificatory sections that follow it isolate the cognitive–affective Level of Abstraction as the locus of the phenomenon under investigation. This is not a descriptive flourish: it is a scientific result. By showing that the perturbation induced by synthetic presence occurs upstream of explicit reasoning, these sections locate the causal substrate that must be modelled if the experiment is to be intelligible. Without this, the observed attenuation could not be interpreted without ideological or normative distortion.

Second, we have eliminated those category errors that distort empirical interpretation. The distinction between descriptive and normative domains, and the clarification of their respective inferential structures, remove a set of systematic mistakes that plague the technical literature. This is not conceptual housekeep-

ing; it is **methodological decontamination**. By preventing the importation of prescriptive content into cognitive models—or the projection of cognitive regularities into normative claims—the chapter ensures that empirical outcomes are interpreted within the correct domain. This conceptual hygiene is a precondition for generating reliable scientific knowledge.

Third, we have established a minimal, action-guiding definition of moral cognition. The operational definition introduced in the previous section is itself a contribution. It provides the first precise specification of the cognitive object under study: moral cognition understood as an evaluative process connecting situational cues to action selection. This definition constrains the mechanisms that may legitimately be invoked as explanations—salience, affect, attention, social meaning—and excludes mechanisms that belong to the wrong LoA. It also provides the structural interface between empirical data and the evaluative-topological model developed later.

Collectively, these achievements secure the conceptual foundations of the thesis. They define the explanandum, delimit the explanatory layer, and prevent methodological conflation [25, 26]. Only after completing this work can the project turn to finer distinctions—such as the difference between factual and normative judgments—that further refine the architecture of moral cognition at the level where synthetic perturbation takes effect [37, 15].

This is why the next section follows naturally. Understanding moral perturbation requires understanding which kinds of judgments are being perturbed. Synthetic presence does not alter factual beliefs; it alters the evaluative force that connects normative appraisal to behaviour. The distinction between factual and normative judgment is therefore not decorative: it is the next analytic step in specifying the mechanism through which moral cognition is modulated [17, 16, 46].

3.2 Judgments: Factual and Normative

A central distinction for analysing moral cognition—and for understanding the experimental phenomenon at the heart of this thesis—is the difference between factual and normative judgments. Although both concern evaluations of situations, they operate at distinct logical and functional levels. Factual judgments describe states of affairs: they answer questions about what is the case. Normative judgments concern what ought to be done, what is *permissible*, *required*, or *forbidden*. The distinction is classical in philosophy, yet remains frequently blurred in computational and psychological treatments of morality [87, 88]. Its importance here lies in the fact that:

> *synthetic perturbation affects normative judgment, even though the factual perception of the situation might remains unchanged.*

Because the synthetic perturbation operates selectively on the normative layer, we must first clarify what distinguishes normative judgment from the factual

input on which it depends. Only then can we specify the mechanism that is being modulated.

Factual judgments derive their correctness from empirical features of the world; their truth depends on observation or inference. Normative judgments embed reasons for action—they carry prescriptive force even when tacitly represented [89, 80]. This is more than a semantic contrast. It marks a functional division within the cognitive architecture: judgments about what is engage classificatory and predictive systems, whereas judgments about what ought to be done recruit mechanisms that assign motivational weight, integrate affective cues, and generate the directional force that links evaluation to action.

This division maps directly onto the psychological conception of moral cognition, understood as the ensemble of perceptual, affective, and inferential processes that register morally salient features and transform them into evaluative representations [31, 16]. Moral cognition includes explicit moral judgment as well as the upstream mechanisms that detect salience, encode social meaning, and initiate the transition from appraisal to behaviour [17, 60]. The descriptive–normative distinction is mirrored in these systems: factual information is processed by mechanisms specialised for representational accuracy, while normative appraisal engages systems that confer action-guiding significance [19, 10, 90].

Psychological models therefore treat factual information as input to evaluative appraisal [91, 92, 93, 94]. Normative judgment requires an additional mapping: the transformation of descriptive cues into action-guiding evaluations [95, 96, 97]. Collapsing normative into factual judgment erases this architecture. For empirical research—and especially for paradigms measuring moral behaviour—maintaining this distinction prevents behavioural outputs from being mistaken for moral endorsement or internalised norms.

This separation also clarifies the mechanism probed by the experiment. Synthetic presence does not alter what participants believe about the scenario. *It alters how strongly normative force is experienced.* The attenuation effect is therefore not a change in factual judgment but a deformation of the evaluative dynamics that convert normative appraisal into action.

Recognising this prepares the ground for the next step. Once factual uptake and normative evaluation are disentangled, it becomes clear that moral judgment cannot be reduced to belief or emotion alone. It arises from the coordinated operation of perceptual, affective, inferential, and motivational systems that jointly confer normative authority and behavioural direction. It is this internal evaluative architecture—linking perception to action—that synthetic presence perturbs. To understand how such perturbation is possible, we now examine the structure of moral judgment itself.

3.3 Internal Architecture of Moral Judgment

Moral judgments are not mere expressions of preference or affective reaction. They exhibit a characteristic structure that combines evaluative content, justificatory grounding, and action-guiding force [98, 99, 100, 101, 102]. For the purposes of this thesis, a moral judgment involves at least three interlocking

components:

1. **Salience detection**: the recognition that a situation contains normatively relevant features—harm, fairness, honesty, obligation, care. This process draws upon perceptual, affective, and social-cognitive systems [19, 18].
2. **Evaluative appraisal**: the assessment of those features in light of internalised norms, dispositions, or reasons. This appraisal may be intuitive or reflective, emotionally charged or deliberative, depending on context and individual differences [83, 82].
3. **Practical commitment**: the formation of an action-guiding stance, in which the judgment functions as a reason for or against a particular behaviour [79, 80].

These components distinguish moral judgments from other evaluative acts—such as aesthetic impressions or strategic choices—and ground the thesis's operational conception of moral cognition as an **evaluative mapping** from situational cues to action policies. They also clarify why synthetic perturbation can alter behaviour without altering factual beliefs: the perturbation targets the mechanisms that assign motivational weight, not the mechanisms that register empirical information.

This tripartite structure accommodates both intuitive and deliberative models of moral judgment. Intuitive processes typically dominate in everyday moral encounters; yet even when reasons are not explicitly articulated, these judgments retain justificatory form [16, 96, 97, 94]. Conversely, deliberative processes involve explicit reasoning, counterfactual consideration, and appeals to principles or character traits [69]. This duality reflects not two kinds of morality, but two modes of access to the same evaluative architecture.

This distinction between intuitive and deliberative processes is not merely taxonomic; it initiates a deeper inquiry into the mechanisms that make moral judgment possible. To understand why certain stimuli reliably elicit prosocial behaviour whereas others disrupt or attenuate it, we must examine the architecture through which moral salience is perceived, represented, and acted upon. The transition from perception to appraisal, and from appraisal to action, is mediated by identifiable affective, perceptual, and executive systems, each contributing distinct computational roles within the broader evaluative ecology.

As the next section shows, contemporary psychological and neuroscientific research converges on a model of moral cognition as a distributed, dynamically interactive network. This framework clarifies how humans ordinarily navigate morally charged environments and provides the conceptual foundation for understanding how these processes may be perturbed—subtly yet systematically—by the presence of agents whose social and ontological status is ambiguous, such as humanoid robots. In this sense, the empirical foundations surveyed below serve as the substrate upon which the subsequent experimental analysis is built.

Understanding the internal architecture of moral judgment is not an abstract philosophical exercise. It is a methodological necessity imposed by the research question and the experimental paradigm developed in later chapters. The phenomenon under investigation—the attenuation of prosocial behaviour in the pres-

ence of a silent humanoid robot—occurs precisely within the architecture just described. Without a clear account of this architecture, the empirical effect would be unintelligible or, worse, misinterpreted.

The experiment demonstrates that the presence of a humanoid robot does not alter what participants believe about the situation. The factual content of the scenario remains stable. What changes is the normative force experienced in response to it: the directional pressure that transforms evaluative appraisal into action. Such a shift can only be understood if moral judgment is recognised as a composite process involving salience detection, affective appraisal, and practical commitment. The attenuation effect reveals a perturbation in one or more of these components—the curvature of the evaluative field—rather than any alteration in belief or principle.

This analysis also clarifies why the ontological ambiguity of the robot is central rather than incidental. The NAO robot used in the experiment possesses no beliefs, goals, or communicative intentions. Yet it is perceptually agentic: its morphology, gaze posture, and embodied presence activate social-cognitive mechanisms ordinarily reserved for human agents. This ambiguous status—more than an object, less than a person—positions the robot uniquely within the evaluative architecture. It can recruit salience-detection systems, modulate affective appraisal, or reshape perceived accountability without supplying any of the intentional content associated with genuine agency.

In other words, the robot functions not as a locus of moral claims but as a perturbation operator acting on the substrate that generates moral judgment. Recognising this requires precisely the distinctions drawn in this chapter: between descriptive and normative domains, between factual and normative judgments, and between intuitive and deliberative processes. These distinctions allow us to see what the empirical effect is—a deformation of the evaluative field—and what it is not: a change in belief, a failure of reasoning, or an abandonment of moral principle.

For the reader who has progressed to this point in the thesis, the significance should now be clear. The conceptual machinery developed in this chapter is not preparatory ornamentation; it is the explanatory foundation upon which the entire project rests. The experiment measures subtle changes in prosocial behaviour, but the theoretical contribution lies in explaining why such changes occur and how artificial agents exert influence within the cognitive–affective ecology of moral judgment. Only with a precise account of the internal architecture can the thesis articulate, diagnose, and ultimately theorise the phenomenon of synthetic moral perturbation.

This is the point where philosophical analysis, cognitive science, and experimental design converge. And it is within this convergent space that the remainder of the thesis will operate.

3.3.1 Psychological and Neuroscientific Foundations of Moral Decision-Making

A substantial body of cognitive neuroscience demonstrates that moral decision-making does not arise from a single "moral centre." Instead, it emerges from coordinated activity across affective, social-cognitive, and executive networks. These systems jointly determine how agents detect morally salient cues, generate evaluative appraisals, and select behaviour. The architecture is therefore inherently practical: the neural substrates implicated in moral judgment are also those responsible for valuation, behavioural control, and action selection.[1] Contemporary research thus situates moral judgment within a distributed computational system whose governing question is not "What is right?" but "What should I do here?" [103, 19, 96].

Affective and Value-Based Systems. The ventromedial prefrontal cortex (vmPFC) and orbitofrontal cortex (OFC) compute affective and motivational value, integrating emotional information with anticipated outcomes. Lesions to vmPFC disrupt the incorporation of social and emotional consequences into decision-making, producing choices that appear normatively inappropriate or insensitive to harm [103]. Functional imaging reveals vmPFC engagement during judgments involving interpersonal harm, care, and empathic concern [19]. Together, these findings show that moral judgments depend on mechanisms that encode the valence of behavioural options.

The amygdala and anterior insula provide early affective tagging for morally salient stimuli [104, 105, 106]. The amygdala detects threat, intentional aggression, and aversive outcomes [107, 47], while the anterior insula responds to disgust, norm violations, and aversive interoception [108, 109, 110]. Electrophysiological studies indicate that these affective signals often precede conscious deliberation [111, 112], functioning as rapid gating mechanisms for downstream moral appraisal.

Social-Cognitive and Interpretive Systems. Moral judgments frequently hinge on beliefs, intentions, and reasons [113, 114]. The temporo-parietal junction (TPJ), medial prefrontal cortex (mPFC), and posterior superior temporal sulcus (pSTS) form a network specialised for mental-state attribution [115, 116, 117, 118]. TPJ activation, for example, is reliably observed when distinguishing intentional from accidental harms or attributing blame or forgiveness [119, 17]. These systems ensure that moral cognition tracks reasons and intentions, not merely outcomes.

The anterior cingulate cortex (ACC) monitors conflict between competing evaluative signals [120, 121]. Classic moral dilemmas recruit ACC activity when intuitive emotional responses and reflective considerations collide [10, 122]. This conflict-monitoring function indicates that moral cognition involves arbitration among multiple evaluative forces [123, 124].

[1] This stands in contrast to folk-psychological depictions of moral judgment as passive contemplation of moral facts. Neuroscientific evidence overwhelmingly shows that moral cognition is organised around action guidance.

Executive and Action-Guidance Systems. The dorsolateral prefrontal cortex (dlPFC) supports controlled cognitive operations, including inhibition of affective impulses, representation of rules, and evaluation of long-term consequences [125, 126]. Disruption of dlPFC activity via TMS alters willingness to endorse instrumental harm [127, 128], demonstrating that this region contributes to structuring action policies that integrate affective, deontic, and goal-directed considerations [90, **?**].

Crucially, the dlPFC does not operate in isolation. Its interactions with vmPFC, ACC, and parietal regions reveal an integrated system in which valuation, social interpretation, and executive control jointly shape moral decisions [129, 130, 131]. Recent accounts describe this network as computing action-guiding commitments rather than abstract evaluations [132, 133].

This distributed architecture demonstrates a key claim that motivates the project:

> *moral decision-making is inherently action-oriented and computationally grounded in mechanisms of valuation, salience, and behavioural control.*

The experiment later introduced does not perturb beliefs, rules, or principles. It perturbs this action-guidance machinery—the very substrate through which moral salience becomes behaviour.

The neuroscientific evidence therefore provides the empirical foundation for the thesis's central argument: a silent humanoid robot does not need beliefs or intentions to influence moral behaviour. Its ambiguous social presence modulates the affective, attentional, and interpretive systems that constitute the architecture of moral judgment.

This is why the neuroscience matters, and why it belongs here in the argument: it shows, at the biological level, that morality is a process of evaluative action selection, and therefore vulnerable to the kinds of perturbation artificial agents can introduce.

Functional Integration and Practical Orientation. Across these subsystems, a coherent picture emerges: moral cognition is not a contest between "emotion" and "reason," but a dynamically integrated process in which affective valuation, social interpretation, and executive control jointly determine behaviour [16, 134, 135]. This integration is fundamentally practical. The vmPFC and OFC compute the affective value of potential actions [136, 137]; the TPJ and mPFC generate intention-sensitive interpretations of agents' behaviour [116, 119]; the ACC detects conflict between competing behavioural tendencies [120, 121]; and the dlPFC regulates whether intuitive impulses should be suppressed, enacted, or balanced against normative constraints [125, 127]. Even primary affective structures such as the amygdala and insula contribute to behavioural readiness by producing rapid somatic markers and prioritising morally relevant cues in the environment [47, 110].

Lesion studies, electrophysiological evidence, and neuroimaging findings converge on a single conclusion: moral judgment is an action-guidance mechanism operating under conditions of social meaning. On this view, moral cognition constitutes a form of evaluative control—a mapping from cue detection to practical commitment—rather than a detached assessment of abstract moral truths [96, 138]. This interpretation aligns with philosophical accounts emphasising the intrinsically action-directed nature of moral evaluation [79, 80], while grounding those commitments in empirical evidence about the neural architecture of agency, valuation, and control.

3.4 From Moral Architecture to Perturbation by Synthetic Agents

The integrated picture that emerges from cognitive neuroscience and psychology provides the conceptual bridge to the central phenomenon examined in this thesis. If moral judgment operates through distributed systems that compute *salience*, *affective weight*, and *behavioural readiness*, then **moral behaviour can be perturbed without altering beliefs or principles**. A humanoid robot need not issue commands or express intentions to exert influence: by reshaping the affective and attentional substrates of moral appraisal, it can modulate the likelihood that moral perception culminates in prosocial action.

This follows directly from the practical orientation of the moral architecture described earlier. Moral cognition is not an abstract exercise in principle-identification; it is a mechanism for transforming perceptual and affective cues into behaviour. Any alteration to the social or perceptual environment—particularly one involving the presence of an entity with ambiguous social status—can shift the evaluative computations that guide action. Later chapters develop this claim empirically, showing how synthetic presence attenuates the behavioural expression of moral salience (see Hypothesis 3 in Chapter 5).

A humanoid robot is especially revealing as a perturbation. It is *perceptually social* (in virtue of humanoid form), yet *ontologically indeterminate* (neither fully agentic nor behaviourally irrelevant). Such indeterminacy can disrupt attentional allocation, dampen affective resonance, and introduce uncertainty in mind attribution. These upstream shifts alter the weighting, timing, and accessibility of evaluative signals. In short: **the robot changes the evaluative conditions under which moral appraisal becomes moral action**.

Understanding this architecture is therefore indispensable for interpreting the empirical findings. The experiment does not measure abstract moral judgments but the *practical enactment* of moral cognition in an environment subtly transformed by synthetic presence. The neuroscientific foundations surveyed here provide the scaffolding for explaining how a silent observer can attenuate prosocial behaviour in stable, measurable ways.

A final conceptual step is required. If moral cognition is an architecture for transforming evaluative information into action, then **any alteration to the informational field is, in principle, a moral intervention**. A humanoid robot—an entity shaped like a person, yet not one—constitutes such an intervention. It does not supply new moral content; it *reconfigures the conditions under which content becomes operative*. The moral landscape is therefore not defined

only by principles or dispositions, but by the *topology of the environment* in which they are enacted.

This insight has two consequences that structure the remainder of the thesis.

First, it shifts the explanatory centre of gravity: from conscious deliberation to the *situated dynamics of evaluative processing*. The experiment asks how moral cognition functions when confronted with an entity whose social meaning is ambiguous.

Second, it reframes the normative question. The significance of artificial agents lies not merely in what they do, but in how their *mere presence* modifies the normative affordances of a shared environment. Artificial agents reshape the moral field long before any explicit moral reasoning occurs.

In this way, the Moral Primer prepares two convergent lines of inquiry. The empirical chapters show how minimal synthetic presence modulates the behavioural expression of moral cognition. The normative chapters argue that this modulation exposes a structural oversight within classical Machine Ethics: the assumption that moral agency can be understood independently of the *environmental scaffolds* that shape human evaluation.

These threads suggest a view of artificial agents not as moral subjects or mere tools, but as *operators on moral space*—entities capable of bending the pathways through which moral meaning becomes action. The full implications of this perspective emerge only once the empirical and philosophical analyses are brought into dialogue. For now, it suffices to note that understanding moral decision-making under conditions of social and ontological ambiguity is not preparatory background; it is the *conceptual linchpin* of the entire thesis.

This conceptual foundation also illuminates the methodological commitments that follow: the *Level of Abstraction* at which moral cognition is analysed, and the *topological structure* of evaluative processes under perturbation. An LoA, in Floridi's sense, fixes the informational distinctions that matter for explanation. Here, our LoA does not concern the metaphysics of moral agency nor the justification of principles, but the *functional transformation* of perceptual and affective cues into action-guiding evaluation. At this LoA, robots are not modelled as moral agents but as *modulators of the evaluative field*.[2]

Once this LoA is fixed, moral cognition can be modelled topologically: as a system mapping inputs to behavioural outputs through a structure shaped by salience, attention, affective resonance, and interpretive inference. Changing the environment—in this case by introducing a synthetic observer—can therefore be understood as a *deformation* of the evaluative landscape. The experiment developed later investigates precisely such a deformation.

This topological perspective also clarifies why synthetic agents matter ethically even when behaviourally inert [139, 140]. At our operative LoA, the morally relevant property of a robot is its ability to *warp attentional and affective gradients* that structure human appraisal [141, 142]. A robot can function as a normative

[2]On LoA as a methodological device for analysing informational systems, see Floridi 2010, 2011, 2013.

deflector or semantic attractor, subtly redistributing the vectors through which moral salience exerts its pull [143, 144]. Later empirical chapters document these redistributions; later normative chapters examine how they challenge Machine Ethics, which typically locates moral significance in the agent rather than the *perturbation it induces* [145, 146].

Seen through this joint lens of LoA and moral topology, the empirical question at the heart of the thesis takes clear shape:

> *Does the presence of a synthetic agent reshape the evaluative field in which humans convert moral perception into prosocial action?*

The formalism

$$f : \Sigma \to \Delta, \qquad \mathcal{P}_{\mathscr{R}} : \Sigma \to \Sigma', \qquad f_{\mathscr{R}} = f \circ \mathcal{P}_{\mathscr{R}}$$

offers a conceptual anchor—nothing more than a vocabulary—for expressing this claim: robotic presence functions as a perturbation operator on the evaluative field.

3.4.1 Philosophical Synthesis

This framework reframes perennial philosophical disputes. A Kantian model locates moral authority in rational principle; an Aristotelian model situates it in cultivated perception; a Humean model grounds it in sentiment and intuitive appraisal. The cognitive–affective architecture described earlier aligns most closely with the Humean–Aristotelian hybrid: moral judgment is rooted in *evaluative sensitivity*, not detached rationality. When the social world is reconfigured—when its cues are displaced or reframed—the moral response shifts accordingly.

3.4.2 Concluding Perspective: Why This Matters for the Thesis

The preceding analysis converges on a single insight: **robots reshape the evaluative topology of moral life**, not by reasoning, nor by instructing, but by altering the perceptual–social gradients through which moral meaning becomes behaviour.

The experimental chapters test this claim; the normative chapters show why it challenges the foundational assumptions of Machine Ethics. What emerges is a technomoral thesis: as artificial agents permeate human environments, they will inevitably reshape the *topology of moral experience*—subtly, silently, and often without intention. This is why synthetic presence matters. This is why the experiment matters. And this is why the conceptual groundwork laid in this chapter is essential for everything that follows.

The claim that artificial agents will reshape the *topology of moral experience* may at first seem tailored to embodied, physically present robots. But its significance extends directly to the contemporary landscape dominated by large language models. As the earlier discussion of LLMs and the "post–Machine Ethics" era

makes clear, modern AI systems no longer resemble the rule-based architectures that shaped the first wave of Machine Ethics. They operate through statistical patterning, implicit social modelling, and affectively charged conversational exchanges. They recalibrate attention, shape expectations, influence interpretation, and modulate interpersonal stance.

In other words, even without bodies, **LLMs are already perturbation operators on the evaluative field**. What varies is the channel of perturbation. Robots perturb *perceptual* and *embodied* salience. LLMs perturb *semantic*, *discursive*, and *interpersonal* salience. Both influence the intuitive layer of moral cognition—the layer that precedes deliberation and shapes the evaluative landscape in which reasons and principles gain behavioural traction.

Seen from this perspective, the technomoral thesis is not limited to robotics. It is a general claim about how artificial systems—embodied or disembodied—reconfigure the cognitive–affective conditions under which human moral judgment unfolds. The role of this chapter is precisely to make this conceptual shift visible. Without a clear account of moral cognition as an *action-guiding*, *field-sensitive*, and *LoA-dependent* architecture, discussions about LLM "moral competence" or "machine virtue" become methodologically ungrounded.

Classical Machine Ethics imagined that the moral significance of AI lay in the principles encoded into the machine. The present analysis shows that the real significance lies in the *perturbations AI induces in us*.

Thus the technomoral thesis challenges Machine Ethics not because LLMs solve the old problems of rule-encoding, but because they demonstrate the irrelevance of those problems. If moral behaviour is shaped at the level of salience, affect, and social meaning, then the central question is no longer:

> *"Can a machine follow an ethical principle?"*

but rather:

> *"How does the machine's presence—physical, linguistic, or social—alter the evaluative field in which human agents form moral judgments?"*

The role of this chapter, therefore, is foundational. It provides the cognitive, psychological, and philosophical machinery required to see why this reframing is necessary. Without the distinctions introduced here—between descriptive and normative domains, factual and moral judgment, intuitive and deliberative processing, and above all, between Levels of Abstraction—one could easily mistake the current success of LLMs at producing coherent moral-sounding text for evidence of genuine moral cognition.

The chapter prevents this mistake. It equips the reader with the conceptual discipline needed to interpret both robotic and linguistic systems not as moral agents in any substantive sense, but as *environmental modifiers*: systems that reshape salience, meaning, and behaviour by transforming the evaluative topologies within which human moral cognition is enacted.

Thus the link back to the earlier discussion is straightforward: the technomoral thesis is the correct answer to the question of AI's moral significance in the LLM

era—not because machines have become moral, but because our *moral environment* is being continuously reshaped by artificial systems whose influence operates beneath the threshold of reflective judgment.

4. Tools of Measurement, Framework and Experimental Design

4.1 Tools of Measurement

Empirical work aimed at understanding moral cognition must specify, with some philosophical care, the instruments through which psychological and behavioural structures become accessible to observation. Moral appraisal itself is never directly given; it does not present as a datum in the way a magnetic field or a spectral line may. *It is inferred from patterned responses*: affective, dispositional, perceptual, and social that reveal how evaluative information is encoded and transformed within the agent's cognitive architecture [9, 147, 10, 11, 12, 148].

The instruments employed in this thesis therefore function not as neutral measurement devices but as *theoretically motivated probes*. Each tool targets a specific dimension of the evaluative topology developed in earlier chapters, allowing latent dispositional structure to be rendered empirically tractable without collapsing its complexity into reductive summary scores. Their significance is thus analogous to that of the instruments of physics and the conceptual scaffolds of philosophy: they do not merely "record" a value but *constitute the mode of access* through which the phenomenon becomes observable at all.

In this respect, psychological instruments resemble the measuring practices of both laboratory physics and analytic philosophy. In physics, one does not detect an electron or a gravitational wave without the apparatus that makes such a phenomenon measurable; the device does not simply capture reality but partially *defines* the phenomenon by specifying the *level of abstraction* and the dimension of variation it reveals. Similarly, philosophical analysis specifies the conceptual lens through which reasoning, inference, or normativity become discernible. Measurement is not passive reception but disciplined *construction of access*.

The same principle governs the tools used here. Measures of systematising and empathising dispositions (EQ/SQ) do not claim to exhaust personality, but they isolate axes of cognitive–affective variation known to shape intuitive and deliberative routes in moral cognition [85, 149, 150]. The Big Five Inventory (BFI) captures broad dispositional gradients that interact with evaluative salience and behavioural inhibition [151, 152, 153]. These instruments are therefore not "psychological thermometers" but structured interventions into the *evaluative field*: each selects, with theoretical justification, the dimensions along which individual differences become experimentally meaningful.

This methodological stance also informs the design of the Watching-Eye paradigm used in the experimental study. The effect is not introduced as a folkloric behavioural curiosity but as a calibrated environmental perturbation:

> *a means of modulating accountability salience and affective vigilance at the cognitive level of abstraction identified earlier.*

The Watching-Eye cue is thus treated as a *contextual operator* on the evaluative topology, providing a controlled channel through which implicit social meaning acquires behavioural force. Its careful specification is essential, for—as in physics—the measurement depends not only on the quantity being observed but on the entire apparatus through which observation is made possible.

Throughout this chapter, the emphasis will therefore not be on the instruments as psychological artefacts, but on their *epistemic role* in the explanatory framework of the thesis: how each measure maps onto the evaluative architecture, what assumptions it encodes, and how it constrains the interpretation of the behavioural data that follows.

4.2 Measurement as Theoretical Access

The methodological commitments of this thesis require a principled account of the instruments through which evaluative behaviour becomes empirically accessible. Work in moral psychology and cognitive science has repeatedly shown that moral appraisal is not directly observable but manifests through structured patterns of affective response, controlled cognition, and social cue integration [9, 147, 10, 11, 12, 148]. For this reason, empirical studies of moral cognition depend on validated constructs and measurement strategies capable of rendering latent dispositions observable without distorting their theoretical significance.

The present work does not align itself with moral cognition research as a discrete disciplinary domain. Instead, it draws upon rigorously established constructs from moral psychology, cognitive science, and social signal processing as operational resources for making evaluative dispositions tractable. Instruments such as the Empathizing Quotient [7], the Systemizing Quotient [154], and the Big Five Inventory [155, 153] provide precisely the kind of psychometric access to stable individual differences that contemporary models of moral cognition identify as structurally relevant. Likewise, the analytical frameworks developed within Social Signal Processing [63] offer methodological grounding for understanding how agents register, interpret, and respond to contextually salient perturbations.

In this sense, the psychometric tools employed here are not neutral measurement devices, but *theoretically motivated probes* into the dispositional structures that shape how agents encode,negotiate, and respond to morally salient changes in their evaluative environment.

4.2.1 A Coherent Measurement Suite

The Empathizing Quotient (EQ), the Systemizing Quotient (SQ), and the Big Five Inventory (BFI) offer validated operationalisations of dispositional constructs repeatedly implicated in moral judgment and social decision-making. Likewise, the Watching–Eye paradigm [1, 2, 4, 6, 5] constitutes a mature experimental framework for probing reputational concern, prosocial motivation, and sensitivity to subtle social cues. Together, these instruments form a coherent

measurement suite capable of isolating trait-level parameters that interact with contextual salience to shape moral behaviour.

If the theoretical chapters have argued that moral cognition is best understood as an evaluative topology shaped by attention, affect, social meaning, and trait-level curvature, then the tools introduced here function as the *coordinate system* through which that topology becomes visible. Their role is not to reduce personality to numbers, nor to treat empathy or systemizing as atomic psychological entities, but to expose the *invariant structures along which agents differ in how they process moral salience.*

4.2.2 Measurement in Experimental Context

In the experiment motivating this thesis, evaluative perturbation is elicited not through explicit moral dilemmas but through a more subtle and ecologically grounded manipulation: the silent perceptual presence of a humanoid robot. Prior work in human–robot interaction shows that even passively positioned robots can shift perceived social affordances, alter attentional allocation, and modulate expectations concerning norm-relevant behaviour [35, 156, 157]. Their ambiguous ontological status disrupts default social priors and thereby reconfigures the salience landscape within which moral reasons become behaviourally operative.

In this respect, robotic presence functions as a controlled perturbation of the evaluative topology itself, enabling the empirical study of how dispositional invariants interact with contextual cues to produce measurable differences in moral behaviour. The Watching–Eye cue provides a second calibrated perturbation; together, they specify the salience structure of the environment in which participants navigate moral action.

4.2.3 Purpose and Structure of this Chapter

The aim of the chapter is thus twofold.

1. First, to establish that each psychometric and experimental tool is grounded in stable bodies of empirical and theoretical research across psychology, cognitive science, HCI/HRI, and social signal processing. This ensures that the constructs they measure—empathic sensitivity, systemizing tendencies, personality traits, and responsiveness to social cues—are well-defined, reproducible, and theoretically interpretable within the broader landscape of moral psychology and social cognition.

2. Second, to show how each tool contributes to the modelling of the dispositional term β_C in the formal expression

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R),$$

where β_C denotes the latent trait configuration governing how a participant's evaluative topology is modulated by the perturbation introduced by the humanoid robot. In this sense, the tools are not ancillary components of the experiment but operationalisations of the dispositional invariants that mediate the transformation of evaluative salience under robotic presence.

The instruments included here—the Empathizing Quotient (EQ), the Systemizing Quotient (SQ), the Big Five Inventory (BFI), and the Watching–Eye paradigm—were selected because they satisfy three stringent criteria grounded in established empirical research [149, 85, 150, 151, 152, 153, 1, 2, 5]:

1. **Theoretical relevance:** Each tool targets a component of moral topology (affective resonance, evaluative precision, personality curvature, or salience modulation) [18, 62, 6, 63].
2. **Empirical robustness:** Each tool is validated across multiple cultures, large samples, and decades of psychological research, and has been used in studies of prosociality, moral sensitivity, social attention, and Human–Robot Interaction (HRI) [158, 159, 160, 86, 1, 2, 3, 33, 34, 51].
3. **Computational suitability:** Each tool produces variables suitable for integration into regression models, cluster analysis, and topological interpretation [17, 161, 90].

Before turning to the tools themselves, we first articulate the methodological role they play within this thesis. Their significance lies not in psychometric convenience but in their ability to expose the latent structures through which evaluative salience is processed and transformed—structures that, as the experiment will show, can be subtly but measurably deformed by the presence of a synthetic agent.

At this point we can raise an important question:

> *How does the theoretical weight of the measurement framework reconcile with the fact that the experiment involves a relatively modest sample of seventy-one participants? And further, have these tools been employed in comparable studies with similar data constraints?*

The answer reveals something essential about the architecture of the project. The tools used in this thesis—EQ, SQ, the BFI, and the Watching–Eye paradigm—were not selected because they demand large samples for interpretability, but because they target *structurally stable* psychological constructs. These instruments are grounded in decades of psychometric work involving thousands of participants, and their factor structures, reliability profiles, and discriminant properties are well established across diverse populations [149, 85, 150, 151, 152, 153, 158, 159, 160]. In effect, they carry their statistical scaffolding with them. A study does not need to reproduce the entire validation literature; it inherits the stability of constructs that have already been exhaustively characterised.

This matters because the goal of the experiment is not to discover new personality factors nor to recover latent dimensions from scratch. It is to examine how *known dispositional invariants* interact with a controlled perturbation of the evaluative field. Small-to-moderate sample studies are the norm in this domain. Replications of the Watching–Eye effect routinely employ samples ranging from 40 to 120 participants [1, 2, 4, 5], and HRI studies investigating the behavioural impact of robotic presence commonly operate within similar ranges [35, 34, 51]. Even studies integrating personality measures into moral-decision paradigms—for

example, the use of BFI or EQ/SQ to predict prosociality, empathic concern, or social attention—often rely on samples of comparable scale [71, 86, 157, ?].

The statistical strategy deployed in this thesis reflects this precedent. Rather than fitting high-dimensional models or mining for latent structure, the analysis treats dispositional measures as low-dimensional, theoretically structured parameters influencing the deformation of evaluative gradients. The inferential load therefore falls not on discovering complex patterns in sparse data, but on detecting systematic, directional shifts in behaviour induced by the experimental manipulation. For this purpose, a well-powered design does not require a large sample; it requires a clean manipulation, validated constructs, and an analysis aligned with the theoretical architecture [17, 161, 90].

In short, the experiment does not attempt to estimate the topology of moral cognition from scratch. It examines how a synthetic agent perturbs an already well-understood structure. The sample size is calibrated not to psychometric exploration but to experimental contrast:

> *detecting whether robotic presence produces a measurable attenuation of prosocial action across dispositional profiles.*

Numerous studies across HRI, SSP, and moral psychology demonstrate that such effects are robustly detectable with sample sizes of the magnitude employed here [67, 63, 6, 51].

With this clarification in place, we now turn to the tools themselves. Their significance lies not in psychometric convenience, but in their ability to expose the latent structures through which evaluative salience is processed and transformed—structures that, as the experiment will show, can be subtly but measurably deformed by the presence of a synthetic agent.

4.3 The Role of Psychometric Tools in the Evaluative–Topological Architecture

Within the framework developed thus far, moral behaviour is modelled as the endpoint of a trajectory across an evaluative field. Contemporary work in moral psychology and cognitive science converges on the idea that such trajectories arise from the coordinated influence of three factors: environmental cues, dispositional structure, and perturbational forces [9, 147, 10, 11, 12, 148]. This is captured, in schematic form, by the functional decomposition

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R),$$

where:

- α_E encodes the *environmental inputs*, such as the Watching–Eye prime and task context;
- β_C represents the *dispositional configuration* measured by psychometric instruments;

- γ_R denotes the *perturbation operator* introduced by the humanoid robot.

The psychometric tools employed in this study populate the β_C term. They render stable individual differences empirically visible by quantifying constructs known to influence how agents register and integrate affective, social, and contextual information. The Empathizing Quotient [7] indexes the *affective bandwidth* through which others become morally salient; the Systemizing Quotient [154] captures the *structural bias* shaping analytic interpretation; and the Big Five Inventory [155, 153] maps broad *personality curvature* influencing attention, norm-sensitivity, and regulatory control [162]. These variables do not exhaust the dispositional space, but they provide theoretically grounded coordinates on dimensions repeatedly implicated in moral appraisal and prosocial action [9, 12].

Their role in the analysis is therefore structural rather than decorative. Without them, dispositional heterogeneity would remain unmodelled, and any perturbation effect could be mistakenly attributed to uncontrolled trait variance. The cluster analysis of EQ, SQ, and BFI scores indeed revealed a non-trivial dispositional topology: affectively warm profiles, analytically structured profiles, and reactive–volatile profiles. Participants did not enter the experimental setting as psychologically interchangeable agents.

What matters is what came next. Despite this structured diversity, the humanoid robot produced a *uniform directional attenuation* of prosocial behaviour across all dispositional clusters. No Big Five trait, EQ dimension, SQ factor, or latent profile moderated the effect. This finding parallels results in human–robot interaction showing that even passive robots can globally modulate social affordances, attentional allocation, and normative expectations [35, 156, 157]. The present study extends that literature by demonstrating that robotic presence does not selectively amplify or suppress particular traits. Instead, it acts on the *evaluative field* itself: reshaping salience gradients, damping affective trajectories, and shifting the topology within which all trait-based pathways unfold.

The psychometric tools were indispensable for establishing this point. They allowed the analysis to dissociate the *shape of the dispositional manifold* from the *geometry of the perturbation.* In the experimental formalism, dispositional structure enters the perturbation comparison as

$$f(\alpha_E, \beta_C, \gamma_R) - f(\alpha_E, \beta_C),$$

a difference that isolates the contribution of γ_R while holding β_C fixed. The empirical pattern in Chapter 5 showed that while β_C exhibits a structured internal topology, the perturbation generated by the robot overwhelms trait-specific differences and applies a global deformation to the evaluative landscape. This is precisely the signature of a field-level operator rather than a trait-contingent stimulus.

Thus, the purpose of this section is not simply to catalogue the tools, but to clarify their methodological necessity. They provide the coordinates required to demonstrate that the robot acted not on *who* participants were, but on the evaluative conditions under which their moral trajectories unfolded. Psychometrics

makes visible the dispositional substrate; the experiment reveals the topological deformation imposed upon it.

With this distinction in place—between dispositional structure and field-level perturbation—we can now turn to a concise examination of the specific constructs measured by each instrument and how they map onto the evaluative–topological architecture of moral cognition.

4.4 Why These Tools: Methodological Criteria and Alignment with the Thesis

Given the dual-layer structure revealed by the experiment—stable dispositional variation on one hand, and a field-level displacement induced by robotic presence on the other—the choice of psychometric and experimental instruments cannot be arbitrary. The tools selected here satisfy three methodological criteria that are essential for interpreting the attenuation of prosocial behaviour in a theoretically meaningful way.

(1) Cross-paradigmatic relevance. The EQ, SQ, BFI, and Watching–Eye paradigm each derive from long-standing empirical traditions spanning moral psychology, social cognition, personality research, and Human–Robot Interaction. Across these literatures, they have been used to study prosociality, empathic concern, harm aversion, cognitive style, and the integration of affective and deliberative processes in moral evaluation [9, 147, 10, 11, 12, 148].

The Big Five Inventory remains the canonical operationalisation of broad personality architecture with well-established predictive value for behavioural outcomes [155, 153, 162]. The Empathizing and Systemizing Quotients provide validated assessments of affective resonance and analytic curvature [7, 154]. Meanwhile, the Watching–Eye paradigm constitutes one of the most robust manipulations of prosocial salience, repeatedly demonstrating that minimal cues of observation modulate cooperative and charitable behaviour [1, 2, 4, 6, 5].

Taken together, these instruments align the present study with a broad empirical landscape while remaining faithful to the evaluative–topological framework established earlier.

(2) Topological relevance. Each tool probes a structurally distinct component of the evaluative manifold:

- **EQ**: the affective attractors anchoring early moral appraisal [7];
- **SQ**: the curvature associated with analytic or rule-based processing [154];
- **BFI**: the personality geometry modulating salience, attention, and regulatory control [155, 153, 162];
- **Watching–Eye**: a validated perturbation of moral salience without instruction or coercion [1, 2, 4, 6, 5].

This heterogeneity of scope provides the granularity needed to model the dispositional term β_C in the formal expression

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R),$$

and to cleanly distinguish trait-level variation from field-level perturbation. This distinction is the key empirical insight: robotic presence acted on the evaluative field rather than on personality-dependent gradients.

(3) Stability and interpretability. The selected instruments satisfy three further requirements:

- **Stability**: each has robust psychometric validation across cultures and samples;
- **Analytical tractability**: each yields variables suitable for clustering, regression, and topological modelling;
- **Interpretability**: each connects to established moral-psychological and philosophical accounts, enabling behavioural findings to be integrated with theoretical models of moral appraisal.

Most importantly, these tools provided the precision required to demonstrate that the attenuation effect was not driven by personality configurations, empathizing profiles, or systemizing tendencies. The psychometric suite revealed a structured dispositional landscape, but the robot altered behaviour *irrespective* of that structure. The tools therefore allowed the experiment to distinguish *who the participants were* from the *geometry of the evaluative field* within which their choices were made.

With these criteria established, we now turn to the first measurement instrument: the Empathizing Quotient.

4.5 The Empathizing Quotient (EQ): Affective Resonance as Evaluative Curvature

The Empathizing Quotient (EQ) provides a validated measure of affective resonance—an individual's capacity to detect, register, and respond to the emotional and psychological states of others [7]. Originally developed within the Empathizing–Systemizing framework [163, 164], the EQ captures both emotional reactivity and cognitive perspective-taking, two mechanisms repeatedly shown to influence prosocial behaviour, harm aversion, and sensitivity to moral salience [9, 147, 11, 12].

Why EQ Matters Conceptually

Within the evaluative–topological model developed in this thesis, empathizing corresponds to the *affective curvature* of the evaluative field. High EQ scores indicate steep affective gradients: morally relevant others appear more salient, distress is more motivationally weighted, and the transition from appraisal to prosocial action becomes more strongly guided by affective dynamics. Low EQ

profiles, by contrast, reflect flatter affective manifolds in which moral cues exert weaker pull.

In this sense, the EQ is not merely a trait measure; it provides a quantitative coordinate for the dispositional term β_C in the mapping

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R),$$

where β_C denotes the stable parameters shaping how evaluative information is transformed into behaviour.

Historical and Psychometric Grounding

Empirically, the EQ has a robust record: strong internal reliability, stable factor structure across cultures [158], convergence with related constructs (empathic concern, emotional intelligence), and predictive validity for prosociality in behavioural economic tasks. Neurocognitive studies further show correlations between EQ scores and activation in vmPFC, anterior insula, and TPJ—regions central to affective resonance and mental-state attribution [19, 18].

These features make the EQ particularly suitable for this thesis: it is theoretically interpretable, computationally tractable, and empirically grounded.

4.5.1 EQ and Synthetic Presence

The central scientific function of EQ in this experiment was to determine whether empathic sensitivity moderated the attenuation effect introduced by the humanoid robot. One plausible hypothesis, grounded in moral psychology and HRI, is that high-empathy individuals would exhibit stronger prosociality and possibly stronger perturbation under synthetic social cues [33, 35].

The data ruled this out. EQ did *not* moderate the displacement effect. High- and low-empathy participants alike showed reduced prosocial donation in the robot condition. This finding is theoretically decisive:

the robot altered the evaluative field itself, not the trait-dependent gradients within it.

This result aligns with evidence from HRI showing that robotic presence modulates attentional and social-evaluative processing independently of empathic predisposition [156, 157].

4.5.2 Methodological Role in the Thesis

The EQ served two indispensable methodological purposes:

1. **Controlling for affective heterogeneity**. Without a measure of empathic sensitivity, reductions in donation could have been attributed to unmeasured differences in participants' empathy levels. The EQ rules out this confound.

2. **Modelling the affective dimension of β_C**. EQ provides the affective coordinate of the dispositional manifold, enabling cluster analysis and regression models to distinguish dispositional shape from field-level perturbation.

Thus, even though affective resonance is central to moral cognition, the experiment shows that the perturbation introduced by the humanoid robot acted *upstream* of empathy—altering the evaluative topology rather than amplifying or suppressing empathic traits.

With the affective dimension of β_C established, we now turn to the analytical dimension: the Systemizing Quotient.

4.6 The Systemizing Quotient (SQ): Structural Precision in the Evaluative Field

Where the Empathizing Quotient (EQ) indexes affective resonance, the Systemizing Quotient (SQ) [165, 159, 158] quantifies a cognitive style characterised by rule extraction, structural analysis, and the search for causal regularities. Within the evaluative–topological model developed in this thesis, the SQ corresponds to the *analytical curvature* of the evaluative field: the extent to which agents encode situations via stable structural relations rather than affective gradients.

4.6.1 Theoretical Background and Psychometric Foundations

The SQ emerged from the Empathizing–Systemizing framework [163, 164], originally designed to capture the dissociability of affective versus rule-based processing in autism research. Subsequent work broadened this motivation: systemizing is now associated with mechanistic reasoning, pattern extraction, predictive modelling, and a preference for low-noise, high-coherence causal schemas [159]. Psychometric studies demonstrate high internal reliability, cross-cultural robustness, and predictable correlations with analytic problem-solving and rule-consistent behaviour.

Neurocognitively, higher SQ scores correlate with lateral prefrontal and parietal activation during analytic reasoning; they are also associated with reduced activation in affective salience networks during social tasks [8]. These findings support the interpretation of SQ as measuring a cognitive style that privileges structural stability over affective modulation.

4.6.2 SQ Across Moral Psychology and HRI

In moral psychology, systemizing predicts greater reliance on deliberative processing, reduced affective interference, and increased endorsement of principle-based judgments in high-conflict dilemmas [46, 11]. In behavioural economics, high-SQ individuals show more consistent strategic patterns and reduced susceptibility to framing effects.

In Human–Robot Interaction, systemizing tendencies shape expectations about synthetic agents: high-SQ participants tend to interpret robots through structural and functional cues rather than anthropomorphic ones and attribute competence and reliability more readily than emotional or social qualities [35, 156, 157]. This makes the SQ especially relevant in the present experiment, where the perturbation introduced by the robot is primarily structural rather than affective.

4.6.3 SQ in the Evaluative–Topological Framework

In the formalism of this thesis, SQ contributes to the dispositional term β_C in

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R).$$

Where EQ shapes the *steepness* of affective gradients, SQ shapes the *rigidity* and *smoothness* of evaluative trajectories. High systemizing corresponds to a more stable evaluative surface: situations are encoded through structural invariants, making low-level affective perturbations less influential.

This intuition can be expressed heuristically through curvature:

$$\nabla^2 V(x) \propto \mathrm{SQ},$$

where larger values indicate more rigid evaluative structures.

4.6.4 SQ, Synthetic Presence, and Field-Level Perturbation

Despite these theoretical expectations, the experiment showed that SQ did *not* moderate the behavioural attenuation caused by the humanoid robot. High-SQ individuals—those most likely to rely on rule-based evaluation—displayed the same directional reduction in prosocial behaviour as high-empathy and low-empathy participants.

This finding is conceptually important. It demonstrates that robotic presence operated not on the cognitive style of participants but on the *evaluative field itself*. Systemizing tendencies did not buffer, amplify, or redirect the behavioural effect.

The perturbation introduced by the robot was global, not trait-specific.

This aligns with existing HRI work showing that ambiguous synthetic agents alter social affordances and attentional dynamics independently of analytic or empathic predispositions [35, 156].

4.6.5 Methodological Significance

SQ served two methodological functions within the experiment:

1. **Controlling for cognitive style**. Without an explicit measure of systemizing tendencies, attenuation could have been misattributed to analytic disposition rather than environmental perturbation.
2. **Modelling the structural dimension of β_C**. SQ provides the analytical coordinate within the dispositional manifold, enabling the analysis to distinguish dispositional geometry from field-level displacement.

Together with the EQ, the Systemizing Quotient ensures that dispositional structure is properly characterised before interpreting the behavioural impact of robotic presence. The next tool completes this picture: the Big Five Inventory, which captures broad personality geometry beyond empathy and systemizing.

4.7 The Big Five Inventory (BFI): Personality Geometry and Evaluative Topology

The Big Five Inventory (BFI) is one of the most robust instruments in differential psychology. It distils decades of lexical and psychometric research into five broad, cross-culturally stable dimensions—Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism [166, 167]. Within the evaluative–topological model introduced earlier, these traits provide a principled coordinate system for mapping the dispositional manifold (β_C): the stable personality geometry through which evaluative trajectories take shape.

4.7.1 Why Personality Matters for This Thesis

Personality traits function as attractors and modulators in behavioural space. They influence affective responsiveness, attentional allocation, social orientation, and regulatory stability—precisely the mechanisms identified in earlier chapters as constitutive of moral cognition. The BFI therefore allows us to characterise the dispositional background against which the perturbation introduced by the humanoid robot operates.

Crucially, the BFI offers the stability required for distinguishing dispositional structure from the field-level displacement effect observed in the experiment. Without a measure of trait geometry, we would lack the dimensional resolution necessary to determine whether the attenuation of prosocial behaviour reflected personality differences or a global perturbation of the evaluative field.

4.7.2 Psychometric Strength and Cross-Domain Predictive Value

The BFI is among the most widely validated trait measures in psychology. Its factor structure replicates across cultures; its items display strong internal reliability; and short forms such as the BFI-10 preserve psychometric clarity under experimental time constraints [153]. The Big Five dimensions predict a wide range of behavioural outcomes—social engagement, helping, rule adherence, and responsiveness to interpersonal cues [162, 168, 86]. These properties make the BFI an ideal tool for modelling β_C within a topological framework concerned with how agents integrate contextual and affective information into action.

4.7.3 Personality, Moral Behaviour, and Social Presence

Each Big Five trait has theoretical relevance for moral behaviour:

- **Agreeableness** steepens prosocial attractors and predicts cooperation, altruism, and sensitivity to interpersonal harm.
- **Conscientiousness** stabilises evaluative trajectories and supports rule-consistent behaviour.
- **Neuroticism** introduces volatility and heightens susceptibility to contextual variation.
- **Extraversion** amplifies responsiveness to social presence and perceived observation.

- **Openness** broadens contextual sampling and modulates tolerance for ambiguity.

In Human–Robot Interaction, these traits influence how artificial agents are perceived—whether as social entities, competent tools, or norm-relevant observers [35, 169]. The BFI therefore ensures that personality-driven interpretations of robotic presence can be empirically tested rather than assumed.

4.7.4 Personality Geometry in the Evaluative–Topological Model

Within the formalism

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R),$$

the BFI quantifies the geometry of β_C. Personality traits define the curvature, stability, and directionality of the evaluative field for each participant:

- Agreeableness deepens altruistic basins.
- Conscientiousness smooths and stabilises evaluative gradients.
- Neuroticism increases local fluctuations.
- Extraversion amplifies social input channels.
- Openness expands contextual sensitivity.

These geometric interpretations allow personality to be formally integrated into the evaluative architecture without reducing behaviour to trait-level dispositions.

4.7.5 Cluster Analysis: Making Personality Geometry Visible

The cluster analysis (Chapter **??**) revealed three dispositional attractors:

1. **Prosocial–Empathic**: high Agreeableness and high EQ; strong affective attractors.
2. **Emotionally Reactive**: high Neuroticism; unstable gradients and high volatility.
3. **Analytical–Structured**: high Conscientiousness and high SQ; rigid evaluative curvature.

These clusters show that participants entered the experiment with *structured dispositional diversity*. Psychological homogeneity cannot be assumed; it had to be measured.

4.7.6 The Key Empirical Result: Uniform Displacement

Despite these pronounced dispositional differences, the experiment revealed a striking result:

The humanoid robot produced a uniform attenuation of prosocial behaviour across all clusters.

No Big Five trait—and no cluster—moderated the effect.

This finding is decisive. It demonstrates that the perturbation introduced by the robot acts at the *field level*. It reshapes the evaluative topology itself, not the trait-specific pathways that populate it. This aligns with work in HRI showing that robotic presence can shift perceived social affordances independently of personality [156, 157].

4.7.7 Methodological Significance

The BFI provides the evidential basis for distinguishing between:

- **dispositional geometry** (the shape of β_C), and
- **field-level deformation** induced by the robotic perturbation (γ_R).

Without the BFI, the attenuation could easily have been misinterpreted as a by-product of personality—differences in Agreeableness, Extraversion, or Neuroticism—rather than as a global shift in the evaluative field.

4.7.8 Point of the Situation: What the BFI Shows

At this stage in the book, the tools chapter reaches its central conclusion:

The personality manifold is structured, but robotic presence bends the evaluative field in a direction that does not depend on personality.

The BFI demonstrates three essential achievements:

1. It verifies that participants differ dispositionally in meaningful, theoretically interpretable ways.
2. It anchors the cluster analysis that reveals the architecture of β_C.
3. It proves that the behavioural attenuation is not trait-driven but topology-driven: a global deformation of evaluative structure induced by synthetic presence.

This completes the dispositional component of the evaluative–topological model and prepares the ground for the next chapter. Having established the geometry of β_C and ruled out trait-based explanations, we can now turn to the design of the experimental perturbation itself: the Watching–Eye paradigm and the silent humanoid robot that reconfigures the evaluative field.

4.8 The Watching–Eye Paradigm: Amplifying Moral Salience and Revealing Field-Level Deformation

Across behavioural ethics, social psychology, and field experiments on prosociality, one finding has proven remarkably robust: minimal cues of being observed—stylised eyes, schematic gaze, or even two black circles resembling pupils—reliably increase cooperation, charitable giving, and norm compliance [1, 2, 4, 6]. This "watching–eye effect" operates without instruction or coercion. It is a perturbation of the perceptual environment that increases the salience of norm-relevant behaviour.

Within the evaluative–topological framework developed earlier, watching-eye cues function as controlled amplifiers of moral salience: they steepen prosocial attractors in the evaluative field by increasing the perceived social meaning of one's actions. This makes them the ideal baseline against which to detect whether synthetic presence deforms evaluative trajectories.

4.8.1 Watching–Eye Cues as Topological Amplifiers

Classical interpretations framed the effect in terms of reputational vigilance: an implicit inference that one's behaviour is observable and potentially judged by others [1, 2]. More recent accounts show that the effect emerges from the coordinated modulation of:

- **attentional uptake** of norm-relevant cues,
- **affective arousal** associated with evaluation or self-conscious emotions,
- **interpretive expectations** shaped by implicit social monitoring systems.

Formally, watching-eye cues operate on the environmental input term by increasing prosocial weighting:

$$\alpha_E \mapsto \alpha_E + \delta\alpha_{\text{eye}}, \qquad \delta\alpha_{\text{eye}} > 0.$$

This steepens the initial gradients through which intuitive appraisals evolve, making cooperative trajectories more accessible in the evaluative field.

4.8.2 Why Child-Pair Eyes Provide a Clean Experimental Baseline

Child-eye posters are widely used in prosociality experiments because they combine perceptual sociality with minimal conceptual content. Decades of work demonstrate that stylised child eyes:

- robustly increase prosocial behaviour across cultures and settings [1, 2, 3, 72, 4];
- evoke empathic and care-based affective responses [170];
- amplify attentional vigilance without implying the presence of a moral agent [6].

This makes them ideal for experimental use. They provide a *high-salience but low-interpretation* cue: strong enough to elevate prosocial gradients, simple enough not to introduce confounds involving mind attribution or intentionality.

4.8.3 Why Synthetic Presence Dilutes or Distorts the Effect

The central theoretical claim of the thesis—that humanoid robots act as *perturbation operators* on the evaluative field—becomes particularly clear when considering their interaction with watching-eye cues.

Humanoid robots are perceptually social but ontologically indeterminate. They are seen, but not reliably understood, as bearers of evaluative or moral capacities [35, 156, 157]. This ambiguity weakens all three mechanisms that normally support the watching-eye effect:

1. **Reputational inference is unstable.** Robots rarely trigger the implicit assumption that one is being morally evaluated.
2. **Affective resonance is dampened.** Observation by a non-agentive entity does not engage self-conscious emotions strongly.
3. **Attentional cues conflict.** The perceptual system registers social presence; higher-order systems deny full agency.

The result is a fractured evaluative landscape: the cue "someone is watching" is present at the perceptual level, but stripped of the evaluative force that normally steepens prosocial attractors.

4.8.4 Empirical Finding: Uniform Attenuation of the Watching–Eye Effect

The experiment confirms this prediction:

> *The presence of a humanoid robot uniformly attenuated the watching–eye effect across all dispositional clusters.*

Even participants with traits associated with high social sensitivity (Agreeableness, Extraversion, EQ) showed the same directional decrease in prosocial behaviour. Formally:

$$(\alpha_E + \delta\alpha_{\text{eye}}) \mapsto (\alpha_E + \delta\alpha_{\text{eye}}) - \Delta_{\mathscr{R}},$$

where $\Delta_{\mathscr{R}}$ is a field-level displacement induced by the robot. The absence of moderation by EQ, SQ, or any BFI trait demonstrates that this displacement operates independently of dispositional geometry.

4.8.5 Why the Watching–Eye Paradigm Is Indispensable

For the purposes of this thesis, the watching-eye paradigm serves four methodological functions:

- **It provides a reliable high-salience baseline** against which attenuation can be detected.
- **It links the experiment to established moral psychology**, enabling direct comparison with decades of prosociality research.
- **It isolates genuine perturbation effects**, since attenuation can only occur if salience is first elevated.
- **It reveals the topology of moral cognition**, showing how synthetic presence deforms evaluative gradients rather than simply reducing generosity.

Without this paradigm, the behavioural shift could not be interpreted as a deformation of the evaluative field.

4.8.6 Integration With Costly Prosocial Action

Donation tasks provide observable moral action rather than abstract moral judgment. Their integration with watching-eye cues allows the experiment to follow the evaluative trajectory from:

1. cue uptake, to
2. salience amplification, to
3. action selection.

The robot's attenuation of this sequence demonstrates that synthetic agents alter the mapping from perceptual cues to moral behaviour.

4.8.7 Synthesis: A Window Into Moral Topology

The watching-eye paradigm serves as a conceptual and methodological hinge in the experiment. By steepening prosocial gradients, it makes the evaluative field's structure visible. By attenuating these gradients, the humanoid robot reveals the central result of the thesis:

> **Synthetic presence acts on the evaluative field itself rather than on personality-dependent pathways.**

The watching-eye effect therefore provides the diagnostic contrast needed to show how robotic co-presence deforms the topology of moral cognition.

4.9 General Conclusion: Measurement as the Logic of Synthetic Moral Perturbation

This chapter has developed far more than a list of instruments. It has established the measurement logic of the entire thesis: the conceptual grammar through which synthetic presence becomes empirically legible. The Empathizing Quotient (EQ), Systemizing Quotient (SQ), Big Five Inventory (BFI), and the Watching–Eye paradigm form a unified system of epistemic probes. Each is theoretically grounded, psychologically validated, and methodologically indispensable for making the evaluative topology of moral cognition observable without reducing it to caricature.

The formal architecture introduced earlier models moral behaviour as the output of a mapping

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R),$$

where:

- α_E captures the structure of environmental moral cues;
- β_C denotes the dispositional manifold shaping evaluative uptake;
- γ_R represents the perturbational operator introduced by synthetic presence.

Each measurement tool corresponds to a distinct component of this model:

- **EQ** probes the affective attractors of β_C: the steepness, reach, and accessibility of prosocial gradients.

- **SQ** probes the structural curvature of β_C: the deliberative rigidity, rule-coherence, and model-based stability of evaluative trajectories.
- **BFI** provides the *coordinate system* of β_C: the multi-dimensional personality geometry needed to identify dispositional clusters and map their evaluative signatures.
- **Watching–Eye cues** perturb α_E: they steepen prosocial gradients and thereby create the diagnostic contrast necessary to observe displacement by γ_R.

Taken together, these tools do not simply "measure variables." They give the experiment an *evaluative topology*—a structured moral landscape within which deformation can be detected, described, and interpreted.

4.9.1 Dispositional Mapping: A Structured Manifold, Not a Confound

A major contribution of this chapter is the demonstration that dispositional diversity is structured, measurable, and separable from perturbational effects. The cluster analysis derived from EQ, SQ, and BFI revealed three dispositional attractor types—Affective–Prosocial, Emotionally Reactive, and Analytical–Structured—each characterised by distinct evaluative curvature.

Yet the experiment showed a striking and theoretically decisive pattern:

The humanoid robot attenuated prosocial action uniformly across all clusters.

This is a non-trivial finding. It rules out trait-level explanations—agreeableness, extraversion, empathy, systemizing, emotional volatility—as proximate drivers of the attenuation. The dispositional manifold β_C was not the site of modulation.

Instead, the perturbation operated at the level of the evaluative field itself.

Without the psychometric tools, this inference would have been impossible: the attenuation could have been misread as personality noise rather than as a genuine deformation of moral topology.

4.9.2 Watching–Eye Cues as Diagnostic Amplifiers

The Watching–Eye paradigm provided the complementary half of the measurement logic. By steepening prosocial attractors in α_E, it created the high-salience baseline against which synthetic attenuation became visible. The robot's presence did not merely reduce generosity—it *neutralised a well-established amplifier of moral salience*. This interaction is the clearest empirical signature of field-level perturbation.

In theoretical terms, the eyes amplified the gradient; the robot deformed the landscape.

Only the combination of psychometric mapping (of β_C) and salience amplification (of α_E) allowed this deformation to be isolated as an operation of γ_R.

4.9.3 Philosophical and Ethical Meaning

Placed in dialogue with the philosophical frameworks introduced earlier, the tools reveal the following:

- **Against rationalist models:** the perturbation bypasses deliberation.
- **Against virtue-theoretic accounts:** stable dispositions do not shield agents from synthetic deformation.
- **Against sentimentalist explanations alone:** the effect persists even in high-empathic profiles.
- **Against Machine Ethics assumptions:** moral significance lies not in the agent (robot) but in the environment the agent reshapes.

The instruments thus do double philosophical work: they expose the mechanisms through which moral action is generated, and they reveal the conceptual blind spots in contemporary ethical thinking about artificial agents.

Synthetic presence does not simply "influence" behaviour; it refracts the geometry through which moral meaning becomes action. It is neither a moral agent nor merely a tool. It is a *moral perturbator*: an entity capable of bending the evaluative field.

4.9.4 Methodological Synthesis: The Tools as Epistemic Infrastructure

This chapter has constructed the epistemic infrastructure required for the experiment. It has shown that:

1. moral behaviour can only be interpreted through a model that distinguishes environmental cues, dispositional structure, and perturbational operators;
2. psychometric tools provide the resolution needed to map β_C precisely enough to rule out trait-based explanations;
3. observational cues provide the experimental leverage needed to manipulate α_E in a controlled and theoretically meaningful manner;
4. synthetic presence must therefore be analysed as a deformation of *evaluative topology*, not as a stimulus acting upon isolated traits.

In this sense, the tools are not auxiliary components of the experiment—they are the *conditions of intelligibility* for its results.

4.9.5 Transition to the Experimental Methods

The next chapter operationalises everything established here. It translates the theoretical variables into stimuli, tasks, and statistical models. It describes how psychometric instruments were administered, how salience modulation was implemented, how synthetic presence was introduced, and how evaluative deformation was quantified.

The tools provide the coordinates; the experiment traces the trajectory.

The question that now motivates the remainder of the thesis is precise:

> *Does synthetic presence reshape the evaluative field through which moral salience becomes action?*

The methodological architecture developed in this chapter ensures that the experiment can answer this question with conceptual clarity, empirical rigor, and philosophical depth.

5. Experimental Methods

5.1 From Conceptual Architecture to Empirical Test

The preceding chapters established a theoretical claim with both philosophical depth and empirical ambition: *that moral behaviour emerges from a topologically structured evaluative field, and that synthetic agents can perturb this field by altering the conditions under which moral salience becomes action.* The present chapter marks the transition from conceptual architecture to empirical adjudication. Here, every assumption must be operationalised, every construct measured, and every inference anchored in explicit experimental procedure.

This section begins with the precise research question that animates the experiment:

Question 5.1: *Inferential Displacement*

Does the silent presence of a humanoid robot—perceptually social yet ontologically indeterminate—alter the evaluative process that transforms moral perception into prosocial behaviour?

This question is not a rhetorical prompt but a methodological commitment. It situates the experiment within the evaluative–topological model developed earlier, in which moral action is expressed as:

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R),$$

where α_E denotes morally salient environmental cues, β_C the dispositional manifold quantified through psychometric tools, and γ_R the perturbation operator instantiated by the robot's presence. The purpose of the experiment is to determine whether γ_R induces a measurable deformation in the mapping from α_E to observable moral action.

5.1.1 Why the Question Matters

Although behaviourally simple, the question reaches beyond classical experimental paradigms in moral psychology. It does not ask whether robots communicate norms, nor whether they persuade or instruct. It asks whether synthetic *presence* alone—minimal, silent, behaviourally neutral—modifies the inferential pathway through which moral salience produces action. Within the broader research programme of social signal processing and moral AI, this constitutes a stringent and foundational test:

> *can an artificial agent operate as a perturbation operator on the moral field even in the absence of agency?*

Embedding a humanoid robot into a moral environment thus serves as a direct empirical probe of the thesis developed in earlier chapters: namely, that moral cognition is not solely a matter of internal reasoning or personality structure, but a dynamic, context-sensitive transformation governed by the topology of situational cues.

5.1.2 Operationalising Moral Action: Prosocial Donation as Behavioural Endpoint

To render this transformation empirically measurable, the experiment operationalises moral action through a cost-bearing behavioural choice: voluntary donation of a portion of the participant's monetary compensation to a children's medical charity. This measure, extensively validated in behavioural ethics and moral psychology, captures the endpoint of the evaluative trajectory: the point at which moral salience is either converted into action or allowed to dissipate.

Costly charitable donation has been repeatedly validated across moral psychology, behavioural economics, evolutionary anthropology, and developmental science as the most reliable behavioural proxy for prosocial moral action [171, 172, 173, 174, 175]. It satisfies the three criteria required at the Level of Abstraction adopted in this thesis: it is elicited by morally salient cues [1, 2, 71]; it incurs real cost [175, 176]; and it expresses the action-guiding force of moral evaluation [17, 46, 18]. Its long-standing use as the behavioural termination point of moral cognition [171, 172, 174] justifies its role here as the measurable endpoint of the evaluative trajectory under synthetic perturbation.

The independent variable is equally minimal: the presence or absence of a humanoid robot autonomously animating in *life-mode*: NAO does not speak, instruct, or engage. Its movements are restricted to micro-gestures—simulated breathing, subtle postural adjustments, and gaze-orienting behaviours triggered only by human eye contact. These micro-movements, while non-agentic, replicate the perceptual features known to activate the Watching-Eye effect, thereby introducing a controlled form of synthetic social salience into the evaluative environment.

5.1.3 Why a Humanoid Robot?

The choice of a humanoid robot reflects a deliberate methodological position. As established in Chapter 3, synthetic agents occupy an unstable location in our social ontology: they possess perceptual salience and humanoid morphology, yet lack the moral-evaluative capacities ordinarily ascribed to observers. This combination creates the precise form of perturbation the experiment seeks to test: a perceptibly social presence whose normative meaning is ambiguous.

The question is therefore not whether participants think the robot is judging them; rather, it is whether the robot's presence alters the field of salience within which morally relevant cues exert their behavioural pull.

Question 5.2: *Inferential Displacement*

Can the mere presence of a synthetic observer—lacking agency, intention, and moral standing—perturb the inferential transformation that converts morally salient cues into prosocial action?

5.1.4 From Question to Design: Why We Do Not Begin with a Hypothesis

Framing the study around a research question rather than a directional hypothesis is intentional. In interdisciplinary work spanning philosophy, psychology, neuroscience, and HRI, a premature hypothesis risks narrowing the interpretive field and smuggling in unexamined assumptions about how synthetic presence ought to behave. The methods must therefore preserve epistemic openness: *the design must reveal whether perturbation occurs, not assume that it does.*

This methodological humility is continuous with the philosophical commitments articulated earlier. If moral behaviour arises from a dynamic integration of environmental cues, dispositional structure, and social presence, then the experiment must be sensitive to field-level deformations that cannot be anticipated a priori.

5.1.5 The Logic of the Experimental Test

In practical terms, the experiment leverages the integrated measurement framework developed in the previous chapter. The Watching-Eye paradigm constructs a baseline of elevated prosocial salience (α_E). The EQ, SQ, and BFI quantify the structure of the dispositional manifold (β_C). The robot enacts the perturbation operator (γ_R). The donation task measures the resulting behavioural transformation $\mathscr{P}(\delta_m)$.

The empirical question is therefore precise:

Question 5.3: *Empirical Question*

Does γ_R—the silent, perceptually social presence of a humanoid robot—systematically deform the evaluative mapping from α_E to $\mathscr{P}(\delta_m)$ across the dispositional manifold β_C?

If the answer is affirmative, the findings reveal a foundational claim: that artificial agents, even when behaviourally minimal, exert moral influence not by persuasion or instruction but by reshaping the topological conditions under which moral salience becomes action.

What follows in this chapter details the machinery by which this question is tested: the design logic, the structure of the experimental task, the observational conditions, the psychometric integration, and the analytic strategies used to detect perturbation.

> *The conceptual framework provided the variables. The empirical design now tests their transformation.*

5.2 Experimental Design and Behavioural Paradigm

To address Question 5.1.3 (p. 68), we implemented a controlled behavioural experiment [177, 178, 179] grounded in the *Watching–Eye* paradigm [65, 2, 180, 181, 182, 183, 184]. The scientific objective was not simply to measure donation behaviour, but to determine whether γ_R, the silent perceptual presence of a humanoid robot, systematically deforms the evaluative mapping

$$\alpha_E \longmapsto \mathscr{P}(\delta_m)$$

across the dispositional manifold β_C.

Participants were recruited individually into a lab environment under the pretext of participating in a personality study in exchange for monetary compensation. This cover task served two methodological purposes. First, it provided a psychologically neutral framing for the room-based task. Second, it elicited trait-level measurements (EQ, SQ, BFI) necessary for modelling the dispositional manifold (β_C) within the evaluative–topological framework.

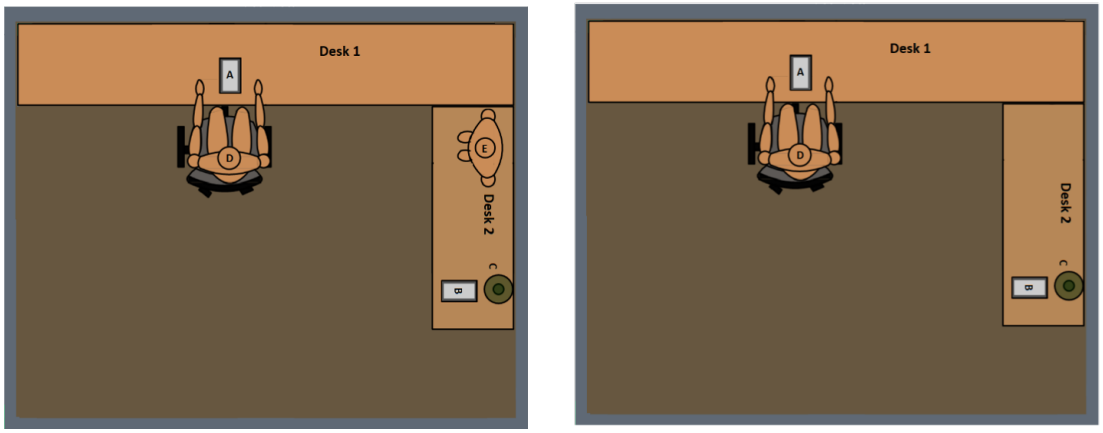
Embedded within this setting was a morally salient cue: a prominently placed charity poster depicting a child in medical need. Decades of evidence (see Chapter 4) demonstrate that such stimuli reliably activate prosocial dispositions through implicit monitoring, empathic resonance, and affiliative concern [1, 6]. Within the formalism introduced in earlier chapters, this stimulus increases α_E, the environmental salience input, steepening the prosocial attractor in the evaluative field.

5.2.1 Experimental Manipulation: Presence as the Only Ontological Difference

Participants were randomly assigned to one of two conditions.

1. **Control Condition**: the participant completed the questionnaires alone in the room.
2. **Robot Condition**: a humanoid NAO robot [185] was present, operating in *autonomous life mode*.

NAO emitted no speech and performed no task-directed actions. Its behaviour consisted solely of the minimal embodied micro-cues characteristic of this mode: simulated breathing, subtle shifts of posture, and head-orientation responses triggered only by direct eye contact. These are precisely the class of low-dimensional social cues shown to activate or modulate the Watching–Eye effect: movement, gaze potentiality, and the perceptual suggestion of observation.



(a) Experimental condition: robot present.

(b) Control condition: robot absent.

Figure 5.1: Top–down view of the experimental and control configurations. Both layouts are spatially and visually identical; the humanoid robot is the only ontological difference between conditions. In the evaluative–topological framework developed in this thesis, this equivalence is essential: the geometry of the environment (desk positions, donation box placement, participant orientation) is held constant so that any change in prosocial behaviour can be attributed to a deformation of the evaluative field induced by synthetic presence. Formally, the figure depicts two instantiations of the same environmental input α_E, differing only by the activation of the perturbation operator γ_R. The robot's placement maps onto a local modification of the salience landscape—an additional source of perceived observation—while the control condition represents the unperturbed topology.

Crucially, both experimental rooms were geometrically and visually identical (Fig. 5.1). The *only* manipulated variable was the presence or absence of the humanoid robot. Spatial layout, lighting, informational content, and the moral cue (α_E) were held constant.

In this design, the robot does not "do" anything in a behavioural sense. Instead, its minimal perceptual affordances present the participant with an ontologically ambiguous entity—perceptually social, morally inert, and semantically potent. The manipulation therefore isolates *presence as such* as the epistemic and experimental variable.

5.2.2 Why Minimal Presence Matters: Ontological Ambiguity as Cognitive Perturbation

The overwhelming majority of HRI and HMI studies assume that moral modulation arises through interaction: overt communication, feedback, adaptive behaviour, or explicitly framed expectations [34, 186, 187, 188, 189]. The present design rejects this assumption deliberately.

Rather than investigating how robots *act*, we investigate how they *appear*—how their mere existence within a perceptual field alters the evaluative pathway from

moral salience to moral action. The experimental focus is therefore on **pre-reflective permeability**: the extent to which minimal agent-like cues reshape inferential structure prior to conscious deliberation [190, 191, 192, 193].

This approach isolates a structural vulnerability of norm-sensitive cognition: humans routinely over-ascribe agency in contexts of uncertainty [194, 195, 196]. By placing NAO precisely at the boundary between objecthood and agenthood, the design probes whether anticipation—not interaction—is sufficient to distort the evaluative topology.

5.2.3 Levels of Abstraction: Why the Robot Can Matter Without Doing Anything

Floridi's Levels of Abstraction (LoA) [25, 197, 198] provide the formal justification for treating NAO's silent presence as epistemically potent.

At the operative LoA of the participant, what is visible are *informational affordances*: posture, eyes, symmetry, subtle biological motion, the inert promise of mutual gaze [199, 200, 201, 202, 203, 204, 205, 206]. These cues are sufficient to trigger the primitives of social monitoring, even when the entity producing them is known to be non-human.

Thus, at this LoA, NAO functions as a *semantic perturbator*: not a moral agent, nor a communicative partner, but an informational presence that reshapes the participant's evaluative background conditions. If the robot were interactive, the LoA would shift (introducing agency, reciprocity, intentional stance). If the robot were inert, the social affordance would vanish. Autonomous life mode occupies the narrow space between these extremes.

This design choice aligns with Floridi and Sanders' analysis of artefactual moral agency [145]. Their 2004 account does not attribute consciousness, intentionality, or moral reasoning to artificial systems. Rather, it identifies moral relevance at the *Level of Abstraction* at which an artefact can contribute causal or informational influence within a given environment [25, 26]. At this LoA, an artefact may count as a "moral agent" in the minimal and operational sense that its presence supplies, modifies, or filters morally relevant information.

This perspective is directly compatible with contemporary discussions of large language models (LLMs), which similarly operate as *artefactual sources of semantic perturbation* rather than as bearers of intrinsic moral status [56, 55]. In both cases—the embodied robot tested here and the disembodied LLM—moral relevance arises not from interior capacities but from how the system reshapes the informational and social conditions under which human agents form evaluations and make decisions. Related arguments in HRI emphasise that robots exert moral and social influence through their perceived agency, morphology, and communicative affordances, not through any intrinsic mental properties [34, 35, 169].

For this reason, Floridi's account is particularly well suited to the present experimental context: it licenses the treatment of NAO's minimal, non-interactive presence as an epistemically potent variable without implying any claim about the robot's inner ontology. At the LoA operative for the participant, the robot is a *semantic perturbator*: a structured informational presence capable of altering

the evaluative field through which moral salience becomes behaviourally operative. This conceptual continuity also clarifies why the findings developed in this thesis generalise to other classes of artificial systems—including LLM-based agents—whose moral significance likewise depends on the informational roles they play rather than on their metaphysical constitution [139, 207].

5.2.4 Behavioural Paradigm: Donation as Moral Action

After completing the questionnaires, each participant received £10 in £1 coins and encountered a voluntary donation option: a charity box positioned near the exit. They could donate any subset of their compensation. The amount donated served as the behavioural measure of prosocial action.

This operationalisation follows a long-established tradition in moral psychology, moral economics, and behavioural ethics in which cost-bearing prosocial behaviour tracks the practical expression of moral salience [208, 172, 209, 77, 210, 211, 62, 37, 212]. As demonstrated in Chapter 4, donation behaviour reliably expresses the terminal point of a moral evaluative trajectory.

5.2.5 Preliminary Findings

Initial analyses revealed a robust and theoretically coherent effect: participants in the Robot condition donated *significantly less* than those in the Control condition. Personality data (EQ, SQ, BFI) showed no meaningful differences between conditions, ruling out dispositional confounds and providing strong initial support for a field-level perturbation induced by synthetic presence.

These results motivate the next step: formalising the evaluative structure through which this behavioural displacement must be interpreted.

5.2.6 From Behavioural Setup to Evaluative Structure

The experimental setup provides the behavioural substrate. What remains is to specify the evaluative architecture through which any behavioural modification must be interpreted. In moral philosophy, action is often treated as the terminus of deliberation [13, 79, 15]. Yet the present study does not investigate deliberation itself. It examines the *transformation* that precedes deliberation's endpoint: the cognitive–affective process by which morally salient cues become behaviourally operative [83, 80].

Donation, within this design, is therefore not an isolated act but the *observable boundary condition* of an evaluative process. The Watching–Eye stimulus renders moral salience explicit; the robotic manipulation introduces a synthetic perturbation; the donation behaviour provides the measurable output of the transformation. This ensures that what is being tested is not trait-level generosity, but the *susceptibility of moral appraisal to synthetic co-presence.*

Classic variants of the Watching–Eye paradigm rely on pictorial cues or supernatural primes [2, 213]. The present experiment instead embeds an embodied but minimally active humanoid robot. This shift is critical: it replaces a two-dimensional prime with a three-dimensional presence whose *perceived ontology* is

neither inert object nor full social agent. This ambiguity is precisely the condition under which moral salience may be refracted or displaced.

To formalise what the experiment tests, we treat moral action as the output of an evaluative function integrating environmental cues, dispositional structure, and perturbational affordances:

$$\mathbb{E}[f(\Sigma \cup \mathscr{R})] \neq \mathbb{E}[f(\Sigma)],$$

where:

- Σ is the morality-salient perceptual field (the Watching–Eye cue),
- $\mathscr{R}$ is the synthetic co-presence,
- f is the evaluative transformation linking perception to action,
- $\mathbb{E}[f(\cdot)]$ denotes the expected behavioural output.

Read informally: *the expected moral behaviour differs when the robot is added to the perceptual–moral environment.* This yields our first empirical hypothesis:

Hypothesis 1: *Evaluative Deformation Hypothesis*

The expected outcome of moral behaviour, as computed through the evaluative process f, is altered when the robot is present within the perceptual–moral environment.

To clarify the structure of this transformation, we decompose the probability of a deviation in moral action into its constituent determinants:

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R),$$

where:

- α_E represents the environmental moral cue (Watching–Eye),
- β_C encodes the dispositional structure measured by EQ, SQ, and BFI,
- γ_R denotes the perturbational effect of robotic co-presence.

In plain language: *the probability of observing a change in moral behaviour depends jointly on the moral cue, the agent's dispositional profile, and the presence of the robot.* This is the operative logic of the experimental design: the robot is not treated as a moral agent, but as a *topological perturbation*—a factor that reshapes the evaluative field within which moral cues are processed.

Why should a robot be capable of such perturbation? The answer lies in the notion of *moral salience*. Across cognitive science and moral philosophy, moral

salience refers to the way certain features of the environment become normatively charged prior to explicit reasoning [80, 83, 31, 108]. It is a pre-reflective gatekeeper: what is foregrounded, what stands out, and what demands attention.

A synthetic presence may influence this salience not by speaking or acting, but by altering the perceptual and inferential background against which moral cues are interpreted. NAO's form, gaze orientation, and subtle embodied motions evoke the minimal conditions associated with social monitoring. They place the participant in a borderline space between being **alone** and being **observed**. This ontological ambiguity—central to human–robot interaction research—is precisely what makes NAO a semantically potent perturbation of the moral field.

Hypothesis 2: *Synthetic Normativity of Moral Displacement*

Synthetic presences, though devoid of sentience, may acquire *normative affordances* by virtue of their perceived ontology. When situated within morality-salient environments, such presences may disrupt, refract, or displace the evaluative machinery through which moral judgments are ordinarily formed.

This hypothesis extends the behavioural prediction into the normative domain: the robot may change not only what people *do*, but the conditions under which moral meaning becomes actionable. The Watching–Eye paradigm thus becomes a conceptual probe—a way of examining the *structural elasticity* of norm-sensitive cognition in the presence of synthetic observers.

Under this interpretation, generosity is not a simple expression of stable virtue or personality; it is the *emergent property* of a cognitive–affective system embedded in a structured moral environment. Robotic presence, by virtue of its ontological ambiguity, acts as a refractive affordance: it bends the path from moral perception to moral action, attenuating the behavioural expression of prosocial salience.

This notion of an *emergent property* deserves clarification, for it plays an important explanatory role in how the experiment should be interpreted. In the present context, emergence does not denote mysterious or irreducible behaviour; it describes a structural fact about norm-sensitive cognition [31, 16, 17]. Prosocial donation arises here not from any single component of the experimental system—neither from the moral cue alone (α_E), nor from the dispositional architecture (β_C), nor from the robot's presence (γ_R) taken in isolation. Rather, generosity appears as the *behavioural output of an interaction* [18, 6]:

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R).$$

Under fixed dispositions, the output can change simply because the evaluative field in which those dispositions operate has been deformed [67, 63]. This is precisely what the data reveal: the robot produces a *uniform directional shift* in donation behaviour despite stable trait profiles [51, 33, 34]. In this sense, prosocial behaviour is emergent: it is a property of the *system* formed by dispositions,

environmental cues, and contextual topology, not a direct expression of any one part [173, 174].

A helpful comparison can be drawn—carefully—with contemporary discussions of emergent capacities in large language models. In LLMs, emergence refers to capabilities that arise from the interaction of many parameters without being explicitly encoded [56, 55]. Here, too, the behavioural effect reflects an interactional architecture: moral action is generated by the coupling of perceptual salience, affective readiness, and contextual priors [46, 62]. Yet, unlike in LLMs, the emergence observed here is phenomenological and contextually scaffolded: the evaluative field itself is altered, and behaviour shifts even though the underlying dispositions remain constant [35, 169].

This also clarifies the function of the mathematical formalism introduced in the preceding chapters. The equations do not quantify moral agency in any metaphysical sense; they provide an explicit epistemic schema for locating the point of deformation [161, 90]. By decomposing the evaluative transformation into α_E, β_C, and γ_R, the formalism makes it possible to rule out trait-level explanations and demonstrate that the behavioural shift originates at the level of the mapping:

$$f(\alpha_E, \beta_C, \gamma_R) \neq f(\alpha_E, \beta_C).$$

In this respect, the mathematics functions as a conceptual microscope: it enables the isolation of the structural point at which synthetic presence exerts influence. Without such decomposition, the uniform attenuation might be mistakenly attributed to personality differences, random noise, or implicit experimental demand [5, 71].

Thus, when the analysis later reports that moral behaviour changed while traits did not, the claim is not that generosity "collapsed", nor that personality "failed" to predict behaviour. The claim is that the *evaluative topology* was reconfigured by an ontologically ambiguous presence—yielding an emergent behavioural pattern that no component of the system could produce alone [1, 2]. This, in turn, is what lends the experiment its broader philosophical significance: it demonstrates that synthetic agents can perturb the moral field not by thinking, or by acting, but simply by *being present* within the perceptual architecture through which moral salience becomes action [35, 34, 51].

With this evaluative architecture established, the next section examines how this deformation manifests empirically—first in behavioural data, and then in its interaction (or lack thereof) with dispositional structure. The question (5.1.5), as framed at the outset, demanded a yes/no answer. The analysis to follow now supplies the evidential basis for that answer.

5.3 Synthetic Perturbation of Moral Inference

Before entering the empirical phase, we require a precise *mechanistic anchor*:[1] a statement that links the evaluative–topological model developed in the preceding

[1] In this context, "mechanistic" refers not to physical causation but to the minimally specified, testable account of *where* in the evaluative process a perturbation is expected to act. It identifies the locus of influence within the mapping from moral salience to behavioural output.

chapters to the behavioural analyses that follow. Without such an anchor, the experiment would risk degenerating into a mere behavioural vignette, detached from the normative and computational structure established earlier. The present section therefore identifies the precise inferential target against which all subsequent statistical results must be interpreted.

Chapters 3–4 articulated the evaluative architecture through which moral salience (α_E) is transformed into behavioural output ($\mathscr{P}(\delta_m)$), modulated by dispositional structure (β_C) and,potentially, by synthetic perturbation (γ_R). The central empirical question (Question 5.1.3) asked whether the mere presence of a humanoid robot systematically deforms the mapping from salience to action. The role of the present hypothesis is to turn that question into a testable inferential claim: it specifies *how* and *where* the perturbation is expected to manifest within the evaluative transformation.

In the experimental setting, the Watching–Eye stimulus structures the moral field Σ; the dispositional manifold β_C, measured through EQ, SQ, and the BFI, provides each participant's cognitive–affective baseline; and the robot's presence $\mathscr{R}$ introduces a perceptually social, ontologically ambiguous affordance. The crucial question is whether $\mathscr{R}$ modulates the internal transformation that links perceptual–affective inputs to prosocial action.

$$\Sigma \longrightarrow \mathscr{D}$$

Under ordinary conditions, this transition is driven by the salience of the moral cue. When the robot is present, however, its ambiguous social ontology may refract or suppress the affective and reputational components that ordinarily support prosocial decision-making. This motivates the mechanistic hypothesis.

Hypothesis 3: *Synthetic Perturbation of Moral Inference*

The humanoid robot NAO does not function as a passive observer, but as a perturbative presence that refracts the transition from moral salience to prosocial action. Its ontological ambiguity displaces the affective and reputational cues that ordinarily support donation, thereby modulating the evaluative pathway by which moral stimuli gain behavioural expression.

This hypothesis identifies the mechanistic level at which synthetic presence is expected to operate. The claim is not that NAO exerts coercive influence or that participants attribute moral authority to it. Rather, the prediction is that NAO's perceptually social yet ontologically indeterminate presence alters the *topology* of the evaluative field: shifting which features are foregrounded, how moral cues are weighted, and how affective resonance is integrated into action. In this sense, the robot functions as a *semantic perturbation*—a presence that reconfigures the informational structure through which salience becomes behaviour.

With this mechanistic hypothesis established, we can now transition to the empirical analysis. The next section evaluates whether the two experimental groups

were equivalent in their demographic and dispositional structure, ensuring that any subsequent behavioural divergence can be attributed to the perturbative role of $\mathscr{R}$ rather than to background variation within β_C. The behavioural results that follow then provide the evidential basis for adjudicating whether the deformation predicted here is indeed observed.

5.4 Inferential Analysis of Experimental Data

Before we enter the empirical phase of the argument, it is crucial to clarify what this section contributes to the architecture of the thesis. Up to this point, the chapter has operated at the level of *evaluative structure*: we have identified the components of the perceptual–moral field, specified the variables of the evaluative transformation

$$\mathscr{P}(\delta_m) = f(\alpha_E, \beta_C, \gamma_R),$$

and articulated the mechanistic hypothesis governing how synthetic presence (γ_R) may refract the mapping from moral salience (α_E) to behavioural output ($\mathscr{P}(\delta_m)$).

What follows changes register. This section inaugurates the *inferential* phase of the thesis: the point at which conceptual commitments must submit to statistical adjudication. If the preceding sections drew the topology of the evaluative field, the analyses to follow measure its curvature.

Two principles govern the transition.

1. **Inferential validity requires structural symmetry.** Before testing whether the perturbation γ_R deformed the evaluative mapping, we must first establish that the two experimental groups were equivalent with respect to demographic and dispositional structure. Without this symmetry, any behavioural divergence would be uninterpretable at the level of mechanism.

2. **Statistical analysis is not a post-hoc addition, but the operational expression of the theoretical model.** The inferential pipeline—from distributional checks to regression modelling and cluster analysis—implements the evaluative framework developed in earlier chapters. Each statistical test corresponds to a theoretical question: Does γ_R shift the distribution of prosocial action? Does β_C moderate that shift? Is the effect uniform across the dispositional manifold?

The present section therefore serves a dual purpose. First, it validates the experimental precondition of group comparability. Second, it establishes the methodological pathway through which the mechanistic hypothesis introduced above will be empirically evaluated.

> *From this point onward, every claim is grounded not in conceptual plausibility, but in statistical evidence.*

We begin by demonstrating the demographic and dispositional equivalence of the two participant groups. Only once this foundational condition is met can we proceed to analyse whether synthetic presence introduced a systematic deformation in the evaluative mapping from moral salience to observable moral action.

5.4.1 Demographic Equivalence as a Symmetry Condition

Before any inferential claims can be drawn from the behavioural data, we must establish that the two experimental groups were demographically comparable. Within the evaluative–topological framework developed earlier, demographic symmetry functions as a foundational *inferential constraint*: only when the underlying populations exhibit similar baseline characteristics can any observed behavioural divergence be attributed—within the limits of the design—to the perturbative presence of the robot $\mathscr{R}$ rather than to sampling asymmetries in the human substrate.

To this end, we examined three demographic variables that plausibly influence prosocial responsiveness in field and laboratory studies: gender, age, and educational background. Each was tested across the **Control** and **Robot** conditions using standard inferential procedures, with Benjamini–Hochberg False Discovery Rate (FDR) correction applied to guard against spurious equivalence due to multiple comparisons.

- **Gender distribution**: a chi-squared test revealed no significant difference between conditions ($p = 1.00$, FDR-corrected).
- **Age**: an independent-samples t-test detected no difference in mean age between groups ($p = 1.00$, FDR-corrected).
- **Educational background**: a chi-squared test again showed no reliable difference ($p = 1.00$, FDR-corrected).

The convergence of these results under strict FDR control allows us to draw the following methodological conclusion:

> **The two experimental groups are demographically equivalent.**

This symmetry condition is essential for the analyses that follow. It ensures that the behavioural differences later observed cannot be attributed to demographic imbalance or hidden stratifications in the participant pool. Instead, under the architecture developed in the preceding sections, any systematic divergence in prosocial behaviour becomes attributable to the semiotic and perceptual perturbation introduced by the robot, $\mathscr{R}$, after holding α_E constant and before considering variation in the dispositional manifold β_C.

Test	Original p-value	FDR-corrected p-value	Significant after FDR?
Gender vs Condition (Chi-squared)	1.000	1.000	✗ No
Age vs Condition (t-test)	0.351	1.000	✗ No
Group vs Condition (Chi-squared)	0.956	1.000	✗ No

Table 5.1: Demographic balance tests across experimental conditions. Values shown include original and FDR-corrected p-values for gender, age, and educational background. No comparison reached significance after correction, supporting the assumption of demographic equivalence required for subsequent inferential interpretation of behavioural effects.

With demographic symmetry established, the analysis proceeds to the next inferential layer: the behavioural effects of synthetic presence. Subsequent sections will assess donation outcomes directly, and only *thereafter* will the dispositional structure—encoded via EQ, SQ, and BFI—be examined for potential interactions with $\mathscr{R}$. This ordering preserves the logic of the evaluative–topological framework: baseline equivalence first, behavioural effects second, dispositional modulation third.

5.4.2 Data Preparation and Preprocessing Workflow

Because the inferential analyses that follow rely on contrasts across experimental conditions, dispositional variables, and behavioural outputs, a principled preprocessing pipeline is an epistemic prerequisite rather than a technical convenience. The aim of this stage is to ensure that the dataset constitutes a coherent and interpretable representation of the experimental structure, free from syntactic artefacts, coding inconsistencies, or latent category imbalances. Only under such conditions can the subsequent statistical models be taken to track the evaluative transformations at issue in this chapter.

The dataset comprises demographic descriptors, psychometric measures (EQ, SQ, BFI), and the behavioural outcome (donation magnitude). These variables differ in type, scale, and inferential role; they therefore require tailored preprocessing steps to preserve their semantic integrity.

Standardisation of variable names. All variable names were converted to lowercase, whitespace-trimmed, and harmonised to eliminate discrepancies introduced through manual data entry. This ensures referential consistency throughout the analysis.

Encoding of behavioural outcome. The binary variable `donated_anything` was created (1 = donated at least one coin; 0 = donated nothing). This permits modelling of prosocial behaviour at two complementary levels: (i) the full distribution of donation amounts and (ii) the threshold decision to donate at all.

Encoding of experimental condition. The variable `condition_bin` was constructed (0 = Control, 1 = Robot) to allow direct incorporation into regression frameworks and to maintain a clear contrast between conditions.

Verification of categorical coherence. Categorical fields (e.g., `gender`) were inspected for irregularities such as collapsed, duplicated, or misspelled levels. No anomalies requiring recoding were identified.

Preliminary distributional checks. Initial visual inspections (histograms, density plots, boxplots) revealed no anomalous values requiring removal or recoding. Age distributions and donation distributions are shown in Figures 5.2 and 5.3, respectively, illustrating the distributional structures to be analysed in the inferential sections that follow.

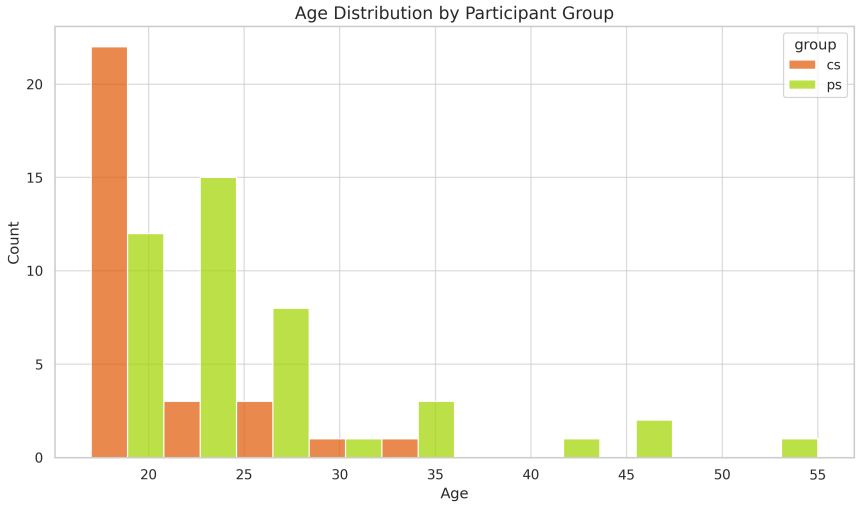


Figure 5.2: Age distribution across experimental conditions. The histograms illustrate the demographic structure of the sample to be examined in later analyses.

Taken together, these preprocessing steps establish the analytic coherence required for valid inferential modelling. With demographic equivalence confirmed in the previous subsection and the present transformations ensuring structural stability of the data, the chapter now proceeds to the statistical models that evaluate whether the perturbation introduced by $\mathscr{R}$ manifests in the transition from moral salience to moral action.

5.4.3 Preliminary Descriptive Patterns: Orientation Prior to Inferential Analysis

Before entering the inferential phase, it is useful to outline the basic distributional structure of the key behavioural and psychometric variables. Descriptive statistics possess no evidential force in themselves; their role is purely orientational. They summarise the raw landscape of the data so that the formal tests in the following sections can be interpreted against a clear empirical backdrop.

Table 5.2 reports the central tendencies for the principal variables collected in the study. The mean donation values in the two conditions (*Control* and *Robot*)

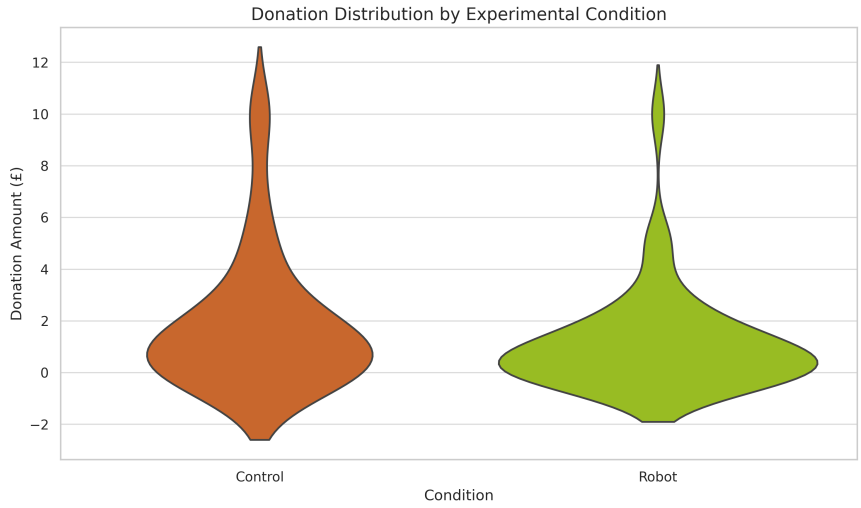


Figure 5.3: Distribution of donation behaviour by condition. The plot presents the behavioural data whose inferential assessment constitutes the next stage of analysis.

appear numerically distinct, and several psychometric scores (EQ, SQ, BFI subscales) exhibit small numerical differences across groups. These contrasts, however, are *purely descriptive*: they record observed sample characteristics and do not imply either imbalance or effect. Their interpretive significance, if any, will be assessed formally in the subsequent statistical analyses.

The descriptive summaries therefore serve three limited but important functions:

1. they present the distributional contours that later inferential tests will interrogate;
2. they facilitate visual inspection for anomalous values, without indicating any need for exclusion;
3. they prepare the reader for the dispositional and behavioural modelling developed in the sections that follow.

Crucially, nothing in the descriptive patterns licences an inferential conclusion. Whether the robotic presence $\mathscr{R}$ perturbs the evaluative mapping from moral salience to action is a question answered only by the formal models presented later. These descriptive tables merely contextualise the data that will feed into those models.

Variable	Mean (Control)	Mean (Robot)	Overall Mean
Donation (£)	1.89	1.17	1.51
Age (years)	22.71	24.29	23.53
Empathizing	45.94	42.82	44.32
Systemizing	30.00	32.45	31.27
Openness	1.86	1.32	1.58

Table 5.2: Descriptive summaries of behavioural and psychometric variables across experimental conditions. These values provide an orienting overview of the sample; they do not support any inferential claims regarding group differences or perturbation effects.

With this preliminary orientation in place, we now turn to the inferential structure itself, beginning with the verification of demographic symmetry across conditions—a prerequisite for attributing any subsequent behavioural divergence to the experimental manipulation rather than to background variability.

5.4.4 Inferential Comparison of Donation Patterns Across Conditions

Having established the demographic symmetry of the sample and the analytic coherence of the dataset, we now turn to the first formal evaluation of whether robotic presence $\mathscr{R}$ influences prosocial behaviour. Up to this point, all analyses have been structural or descriptive; the task now is to determine whether the behavioural distributions associated with the moral decision—the donation act—show any statistically reliable divergence across conditions. This is the first moment in the chapter where inferential weight is brought to bear on the *Evaluative Deformation Hypothesis* (Hypothesis 1), and the transition therefore marks a shift from conceptual scaffolding to statistical adjudication.

We proceed in an intentionally layered way. A single test rarely captures the complexity of a behavioural distribution; instead, a sequence of complementary analyses is required. We begin with a chi-squared test on coin-frequency distributions, then examine the full donation distributions using a Mann–Whitney U test, and finally quantify the magnitude of the difference via a nonparametric bootstrap. Each method probes a different facet of the data: aggregate totals, distributional structure, and effect-size stability respectively.

Chi-squared test on donation frequencies. A chi-squared test comparing the *frequency distribution of donated coins* across the Control and Robot conditions revealed a statistically detectable divergence:

$$\chi^2 = 4.25, \qquad p = .039.$$

This test does not assess means or medians but evaluates whether the overall pattern of coin contributions differs across conditions. The result indicates that

> *The aggregate structure of donation behaviour is not evenly distributed across the two environments.*

Test Type	Statistic / Estimate	p-value / CI	Interpretation
Chi-squared (donation totals)	$\chi^2 = 4.25$	$p = 0.039$	Significant difference in donation sums
Mann-Whitney U (nonparametric)	$U = 777.0$	$p = 0.194$	No significant difference in distributions
Bootstrapped Mean Diff	$\Delta M = 0.71$	CI = [−0.33, £1.79]	Directional but CI includes 0

Table 5.3: Inferential comparisons of donation behaviour across conditions. The chi-squared test compares coin-frequency distributions, while the Mann–Whitney U test and bootstrapped mean difference assess distributional structure and effect magnitude respectively.

It is crucial, however, that this result be interpreted with methodological restraint. The chi-squared test establishes an *aggregate* divergence, not a uniform shift in individual tendencies. To understand the behavioural topology more fully, we must examine the entire donation distribution.

Mann–Whitney U test on donation distributions. A Mann–Whitney U test, applied to the full distribution of donation amounts, did not detect a statistically reliable difference:

$$U = 777.0, \qquad p = .194.$$

This indicates substantial overlap between individual donation behaviours in the two conditions. In other words, while coin-frequency totals diverge, the fine-grained distribution of donation amounts remains broadly similar. This pattern suggests that the influence of $\mathscr{R}$ may be probabilistic and heterogeneous rather than deterministic or uniform across participants.

Bootstrapped estimate of the mean difference. To complement these analyses, we calculated a nonparametric bootstrap estimate of the mean donation difference:

$$\Delta M = 0.71, \qquad 95\%\ \text{CI} = [-0.33, 1.79].$$

The estimate aligns directionally with the group-level pattern (Control > Robot), but the confidence interval includes zero, reinforcing the conclusion that the effect is subtle and probabilistic rather than sharply bifurcated.

Taken together, these three analyses trace a coherent statistical profile. There is evidence of divergence in aggregate coin-frequency behaviour, yet the distributional overlap and wide bootstrap interval demonstrate that the perturbation introduced by $\mathscr{R}$ is not uniform across individuals. This is exactly the pattern predicted by the evaluative-topological model:

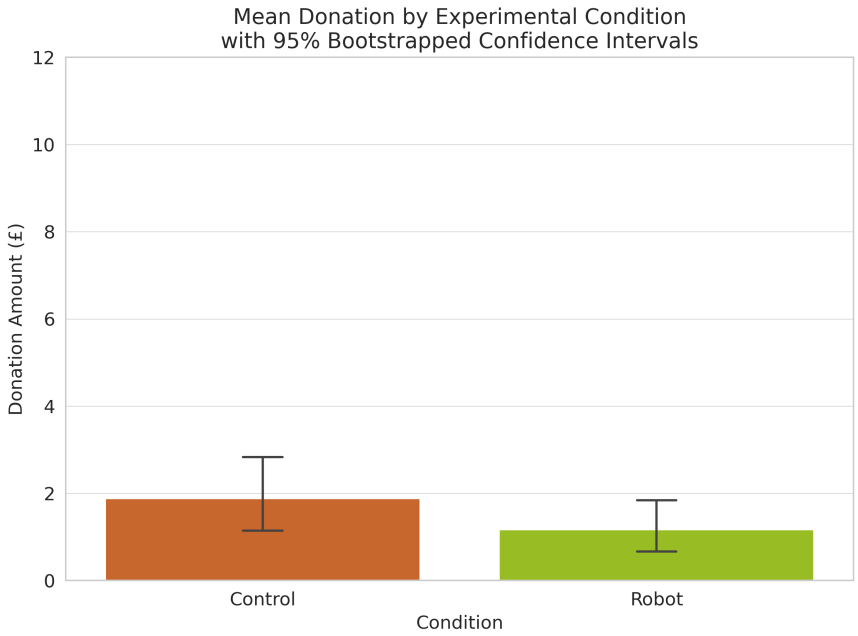


Figure 5.4: Mean donation amounts by experimental condition, with 95% bootstrapped confidence intervals. The overlapping intervals illustrate substantial individual-level variability, indicating that any perturbative influence of $\mathscr{R}$ is diffuse rather than deterministic.

> *Synthetic presence functions not as a coercive force but as a semiotic perturbator, modulating the evaluative mapping from moral cue to action in a heterogeneous population.*

In interpretive terms, the results neither dismiss nor overstate the effect. They demonstrate that robotic presence is behaviourally consequential at the aggregate level while leaving open, and thereby motivating, the central analytical task of the next subsections: determining whether this perturbation interacts with the dispositional manifold β_C. The inferential focus therefore now turns to regression modelling, interaction tests, and Bayesian estimation, where the structure of β_C can be incorporated directly into the evaluation of γ_R.

5.4.5 Interim Conclusion to Question 5.1.3

Partial Conclusion to Question 5.1.3

The behavioural evidence obtained thus far indicates that the silent co-presence of a humanoid robot, operating with minimal but perceptually salient behavioural affordances, systematically attenuates aggregate donation behaviour under a Watching Eye paradigm. This attenuation is modest, probabilistic, and heterogeneously distributed across individuals, but it is empirically detectable and statistically non-trivial.

Within the formal and philosophical architecture developed in this chapter, these findings support the plausibility of *evaluative deformation*: the robot perturbs the inferential transformation from morally salient cues to observable moral action. Floridi's Levels of Abstraction framework explains why such perturbation is possible—because the robot's *perceived ontology* and informational encoding render it normatively relevant at the operative LoA, even in the absence of sentience or interaction. The Synthetic Perturbation of Moral Inference hypothesis then specifies *how* this relevance is instantiated, by refracting the evaluative pathway rather than overriding it.

The role of individual traits, represented by the vector β_C, and their interaction with robotic presence γ_R, remains an open and theoretically salient question. The next sections therefore move from aggregate contrasts to trait–context modelling, in order to determine whether moral displacement is uniformly distributed or preferentially expressed in specific psychological profiles.

In summary, the results to this point justify the claim that robotic co-presence modifies the evaluative conditions under which morally salient cues become behaviourally actionable, in a manner that is fully consistent with the informational and topological commitments of the Floridian framework. The retained hypotheses and formalism together provide the conceptual, ontological, and mechanistic scaffolding for the more fine-grained analyses that follow.

Beyond establishing the statistical significance of the observed differences, it is epistemically imperative to quantify the magnitude of behavioral perturbation induced by robotic presence. The following analyses introduce both parametric and nonparametric effect size metrics to characterise the structural modulation of moral decision-making.

5.4.6 Quantification of Behavioural Modulation: Parametric and Nonparametric Effect Sizes

Having established that the experimental groups are demographically symmetric and that the aggregate-level analyses reveal a measurable difference in charitable behaviour across conditions, we now turn to the question of *magnitude*. Significance tests indicate whether a behavioural contrast is detectable relative to sampling variability; they do not characterise the structural amplitude of the perturbation induced by the synthetic co-presence $\mathscr{R}$. For this reason, the present sec-

tion complements the inferential tests with parametric and nonparametric effect-size metrics, thereby quantifying the extent to which robotic presence modulates prosocial behaviour under the Watching–Eye paradigm.

Because the subsequent regression and interaction analyses will examine the interplay between robotic presence and dispositional structure, it is essential to begin with a transparent description of the overall behavioural landscape. The effect sizes presented here serve as the bridge between aggregate-level contrasts and the more nuanced trait–context models developed later in the chapter.

Effect-Size Framework

Two complementary measures were selected:

- **Cohen's** d: a parametric index of standardised mean difference, sensitive to shifts in central tendency;
- **Cliff's** Δ: a nonparametric ordinal effect size that estimates the probability that a randomly selected individual from one condition donates more (or less) than a randomly selected individual from the other.

Taken together, these metrics evaluate whether the presence of $\mathscr{R}$ reshapes the evaluative output distribution in a manner consistent with the deformation posited in the Evaluative Deformation Hypothesis (Hypothesis 1).

Cohen's d.

$$d = \frac{\bar{x}_1 - \bar{x}_2}{s_p} \quad \text{where} \quad s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

Where:

- $\bar{x}_1, \bar{x}_2$ = group means (Control, Robot),
- s_1, s_2 = corresponding standard deviations,
- n_1, n_2 = sample sizes.

Cliff's Delta.

$$\Delta = \frac{\#(x > y) - \#(x < y)}{n_x n_y}$$

Where:

- $\#(x > y)$ counts all cases where a Control donation exceeds a Robot donation,
- $\#(x < y)$ counts the inverse,
- n_x, n_y are the sample sizes of each group.

The empirical results yield:

$$d \approx 0.30, \qquad \Delta \approx 0.20.$$

Both indices fall within the range typically interpreted as *small to modest* behavioural modulation. Their relevance lies not in magnitude alone, but in the fact that both metrics converge on the same directional pattern: robotic presence is associated with lower prosocial donation on average.

To ensure interpretive clarity, two complementary visualisations are provided. The kernel density estimate (Fig. 5.5) depicts the *shape* and spread of donation distributions, enabling inspection of distributional tails and modes. The mean-with-standard-error plot (Fig. 5.6) focuses on *central tendency* and sampling variability. Although partially overlapping in content, the two figures serve distinct analytic functions and together offer a transparent view of the behavioural landscape that informs the subsequent modelling work.

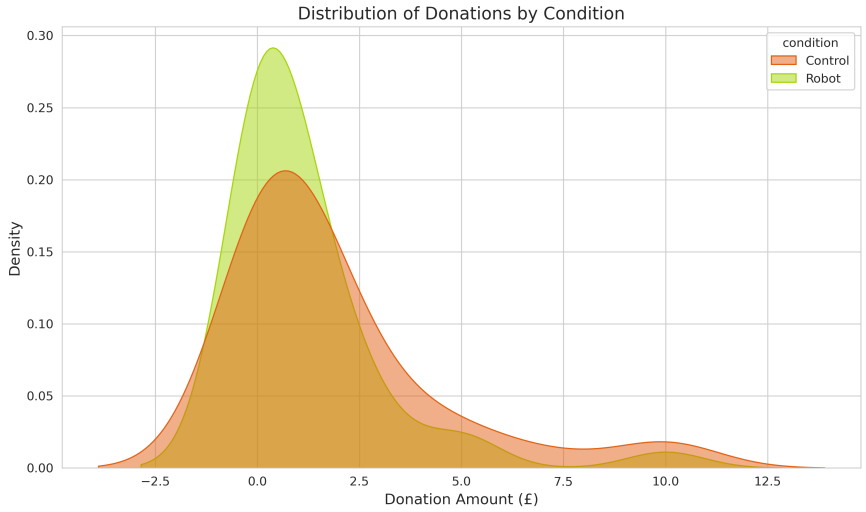


Figure 5.5: Kernel density estimates of donation distributions across experimental conditions. The Control group exhibits greater mass at higher donation values, whereas the Robot group shows a mild left-shift in density. These plots provide distributional context for the effect-size metrics discussed in the text.

For completeness, the inferential tests introduced earlier are reproduced in Table 5.4 alongside the effect-size metrics, ensuring that all aggregate-level results appear within a single consolidated reference point before turning to trait–context modelling.

Test Type	Statistic / Estimate	p-value / CI	Interpretation
Chi-squared (donation totals)	$\chi^2 = 4.25$	$p = 0.039$	Significant difference in donation sums
Mann-Whitney U (nonparametric)	$U = 777.0$	$p = 0.194$	No significant difference in distributions
Bootstrapped Mean Diff	$\Delta M = 0.71$	CI = [−0.33, £1.79]	Directional but CI includes 0

Table 5.4: Inferential comparisons of donation behaviour across conditions. The chi-squared test (applied to total coin frequencies), the Mann–Whitney U test, and the bootstrapped mean difference collectively characterise the behavioural contrast.

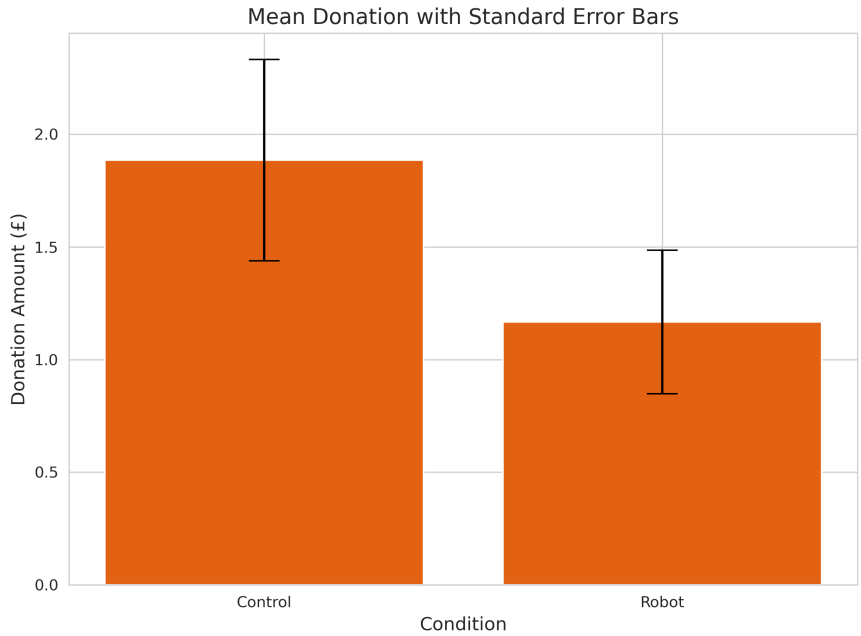


Figure 5.6: Mean donation amounts with standard error bars by condition. While the Control group donates more on average, the overlapping error bars reflect substantial individual-level variability. The figure complements the density plot by highlighting differences in central tendency rather than distributional shape.

Overall, the effect sizes indicate that robotic presence exerts a *directionally consistent, behaviourally modest* modulation of prosocial action. These outcomes are consistent with—though they do not in isolation confirm—the prediction that $\mathscr{R}$ perturbs the evaluative transformation from moral salience to behaviour. Importantly, the effect is *graded*, not binary: the evaluative system remains operative, but the strength with which moral cues are translated into action is probabilistically dampened.

Conclusion: Amplitude of Moral Refraction

Synthetic co-presence does not function as a binary suppressor of moral behaviour. Instead, it modulates the amplitude of the evaluative transformation from moral salience to action, introducing a subtle, probabilistic refractive shift consistent with its ambiguous ontological encoding at the operative Level of Abstraction.

At this point, the analysis shifts from evaluating the *main effect* of $\mathscr{R}$ to examining its interaction with individual-level dispositions. The dispositional manifold β_C—comprising empathizing and systemizing tendencies as well as Big Five personality traits—may modulate the susceptibility of the evaluative mapping $f(\alpha_E, \beta_C, \gamma_R)$ to perturbation. The following sections introduce regression models, interaction tests, and Bayesian estimation procedures designed to determine whether the attenuation observed here is uniform across the population or concentrated within specific psychological profiles.

5.5 Dispositional Baseline: Big Five Personality Traits Across Conditions

A foundational requirement for attributing the observed attenuation of prosocial behaviour to the presence of the humanoid robot is the establishment of *dispositional equivalence* between the two experimental groups. If participants in the Robot condition were, for example, systematically lower in Agreeableness or Empathizing, then differences in donation behaviour could be trivially explained by trait imbalance rather than by the perturbative effect of $\mathscr{R}$. The question addressed in this section is therefore epistemically prior to all subsequent modelling:

> *Do the Big Five personality traits differ between the Control and Robot conditions, and thus constitute a potential confound for interpreting the displacement of prosocial behaviour?*

5.5.1 Between-Condition Comparisons of Big Five Personality Traits

The effect-size analyses above established that robotic co-presence ($\mathscr{R}$) exerts a modest but directionally consistent modulation of donation behaviour. Before examining whether this perturbation interacts with individual differences, we must ensure that the two experimental groups were not already differentiated at the level of personality. If the Control and Robot conditions differed systematically in the Big Five traits, any apparent behavioural attenuation could reflect pre-existing dispositional imbalance rather than the influence of $\mathscr{R}$.

To assess this, we compared Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism across conditions using the Mann–Whitney U test. This test is appropriate for the structure of the dataset: the Big Five scores are bounded, ordinal psychometric variables exhibiting mild skew, and the sample size ($N \approx 70$) does not justify strong parametric assumptions. Because examining five traits entails five simultaneous hypothesis tests, the Benjamini–Hochberg False Discovery Rate (FDR) correction was applied to control Type I error.

After FDR correction, **none of the Big Five traits differ significantly** between the Control and Robot groups. Small numerical tendencies (e.g., slightly higher Openness in the Control condition) fail to approach corrected significance thresholds, and all distributions display substantial overlap.

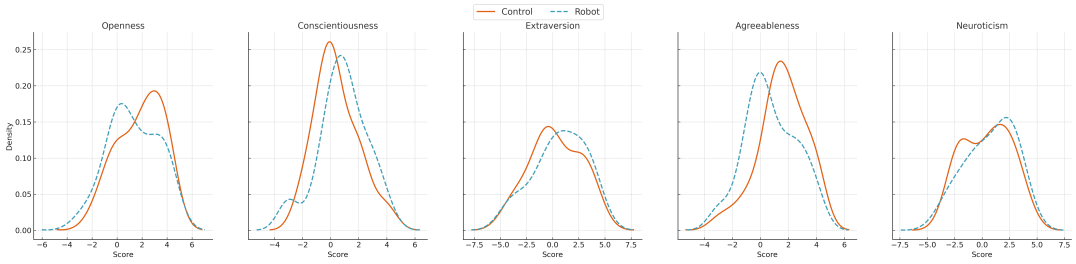


Figure 5.7: Kernel density estimates for each Big Five trait across conditions. All five distributions show substantial overlap, visually corroborating the non-significant Mann–Whitney tests.

This supports a key methodological inference:

The two experimental groups can be treated as dispositionally equivalent.

Accordingly, the behavioural difference observed earlier is *most plausibly attributed* to the presence of $\mathscr{R}$ rather than to pre-existing personality differences.

Having established dispositional equivalence, we now examine whether personality nonetheless predicts prosocial behaviour or interacts with the attenuation associated with robotic co-presence.

5.5.2 Predictive and Moderating Roles of Big Five Personality Traits

This analysis addresses a further theoretical question of interest:

> *Even if the groups are balanced, do the Big Five traits predict donation, or modulate the displacement induced by $\mathscr{R}$?*

(1) Predictive effects. Spearman rank correlations were computed between each Big Five score and donation amount. Spearman's ρ is appropriate for zero-inflated, bounded, and non-normal behavioural data, and for ordinal psychometric measures. Scatterplots with monotonic trend lines were examined to detect any nonlinear patterns not captured numerically.

(2) Moderation effects. To test whether personality modulates the displacement effect, interaction models of the form

$$\text{donation} \sim \text{condition} \times \text{trait}$$

were estimated for each Big Five dimension. This correctly operationalises the possibility that robotic presence acts as a *moral refractor*, exerting differential influence depending on dispositional architecture.

Methodologically, the findings are straightforward. **No statistically reliable associations** between any Big Five trait and donation amount appear in this dataset, and **no interaction** with experimental condition reaches significance.

The behavioural attenuation associated with $\mathscr{R}$ therefore shows no detectable variation across Big Five personality profiles.

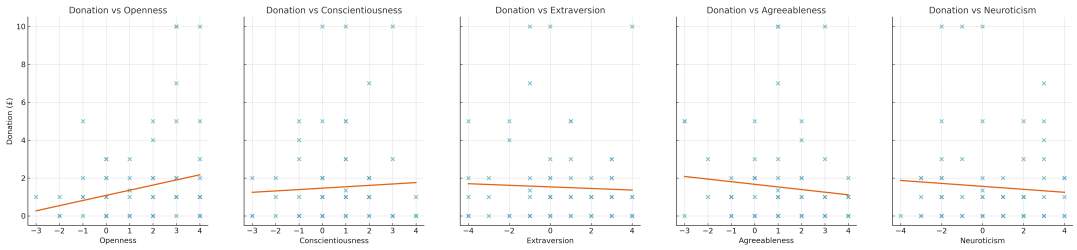


Figure 5.8: Scatter plots with monotonic trend lines for each Big Five trait against donation amount. No predictive relationships appear, and no moderation patterns are visible. This matches the null results from correlations and interaction models.

In summary, within the Big Five framework:

- no trait reliably predicts prosocial donation;
- no trait moderates the attenuation introduced by robotic co-presence;
- the displacement effect of $\mathscr{R}$ shows no detectable variation across Big Five profiles *in this sample*.

Conclusion: Trait-Independence of Evaluative Displacement

The attenuation of prosocial donation under robotic co-presence shows no detectable modulation by Big Five personality traits in this dataset. This supports the interpretation that $\mathscr{R}$ acts on the evaluative field itself rather than on specific dispositional pathways.

The next subsection examines whether more specialised social-cognitive traits—the Empathizing Quotient (EQ) and Systemizing Quotient (SQ)—show predictive or moderating roles that the broad Big Five taxonomy does not capture.

5.5.3 Transition to Structural Modelling of Dispositional Architecture

The analyses reported above establish two methodological foundations that shape the remainder of the statistical pipeline. First, the Big Five traits do not differ across conditions after False Discovery Rate correction, confirming dispositional symmetry between the Control and Robot groups. Second, within this sample, none of the Big Five traits reliably predict donation behaviour, nor do they interact with experimental condition. In inferential terms, the dataset contains no evidence of trait imbalance and no statistically detectable trait–by–condition moderation at the level of the classical personality taxonomy.

These observations do not *rule out* the relevance of dispositional structure; instead, they clarify the level of representation at which such structure should be modelled. The Big Five are coarse-grained scalar descriptors and may not capture

the finer relational geometries (i.e., covariation patterns and trait interdependencies) that shape evaluative processing. Accordingly, the next stage of analysis adopts a more structurally sensitive approach to the dispositional manifold β_C, examining whether latent configurations of empathizing, systemizing, and Big Five attributes jointly organise susceptibility to robotic perturbation.

In this sense, the null findings within the Big Five framework serve a methodological rather than interpretive purpose. They demonstrate that any systematic modulation of donation behaviour by the synthetic presence $\mathscr{R}$ cannot be attributed to imbalances or linear trait effects within the classical personality model. This provides the inferential basis required to proceed to clustering and latent-structure modelling, where β_C is treated not as a vector of independent traits, but as a structured configuration whose internal organisation may interact with the perturbative affordances of $\mathscr{R}$.

The subsequent section therefore introduces the clustering methodology used to derive latent dispositional ecologies and examines whether these ecologies exhibit differential susceptibility to synthetic co-presence. This marks the transition from trait-level analysis to structural modelling within the broader evaluation of Question 5.1.3.

5.5.4 Latent Dispositional Structures and the Modulation of Moral Perturbation

The analyses thus far establish two essential points. First, the presence of the robot $\mathscr{R}$ is associated with a modest but coherent attenuation of prosocial donation at the aggregate level. Second, this attenuation cannot be attributed to differences in any individual Big Five trait. These results motivate a sharper question:

> *If conventional trait magnitudes do not explain variability in responsiveness to $\mathscr{R}$, might the perturbation be differentially expressed across* latent *cognitive–affective configurations within the dispositional manifold β_C?*

This question is structurally aligned with the evaluative model developed earlier. If synthetic presence perturbs moral behaviour by refracting the evaluative transformation $f(\alpha_E, \beta_C, \gamma_R)$, its influence need not be uniform across all individuals: the effect may depend on how dispositions combine into higher-order regimes rather than on isolated trait scores. To investigate this, we turn from scalar traits to a structural modelling of β_C.

Clustering the Dispositional Manifold

Seven psychometric variables—Empathizing, Systemizing, and the five Big Five traits—were used to construct the dispositional space. Each score vector was z-standardised, and dimensionality was reduced using Principal Component Analysis (PCA). Two orthogonal components were retained as they captured the dominant axes of variance while reducing redundancy among correlated traits.

The reduced two-dimensional representation served as input for k-means clustering. The choice of $k = 3$ rested on both methodological and conceptual grounds:

- The within-cluster sum of squares displayed a clear elbow at $k = 3$, indicating diminishing returns for higher k.
- Although a silhouette maximum was observed at $k = 9$, such peaks often reflect over-partitioning when N is modest; those solutions were therefore rejected.
- A three-cluster solution produced groups of interpretable size with stable internal variability, consistent with the expectation that a small number of dispositional regimes may structure evaluative responsiveness.

Figure 5.9 visualises the resulting partitions. The figure is retained because it provides essential structural justification for treating the clusters as psychologically interpretable configurations.

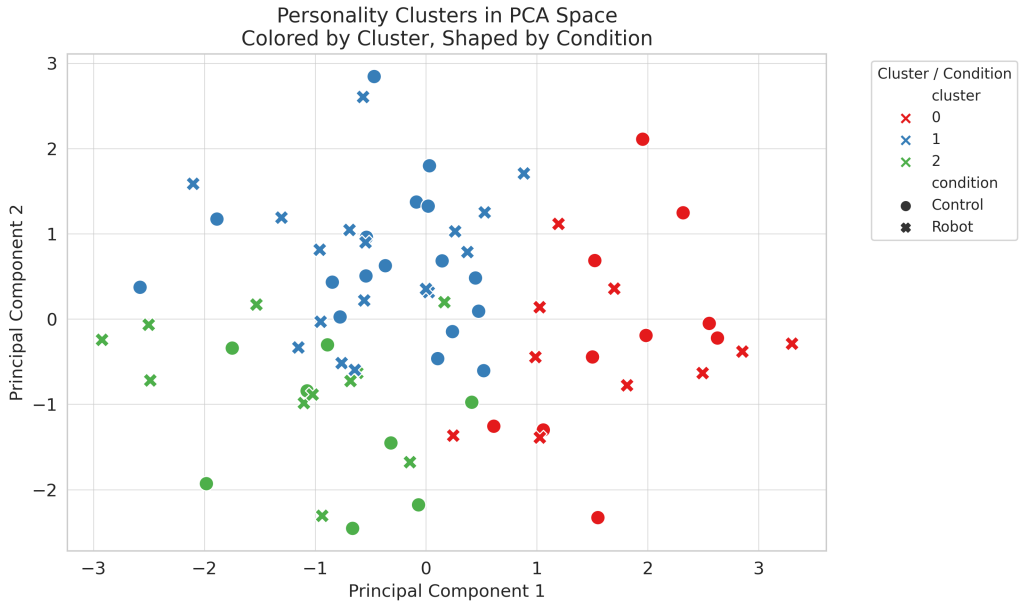


Figure 5.9: Participants clustered in PCA-reduced psychometric space. Three clusters emerge as coherent and visually distinguishable groupings, providing a structural basis for subsequent analyses of condition-by-cluster effects.

Justification of $k = 3$: Diagnostic Criteria

Figure 5.10 displays both the elbow curve and silhouette profile. It is included here because these diagnostics are standard tools for validating clustering solutions and demonstrate that $k = 3$ is a parsimonious and defensible choice.

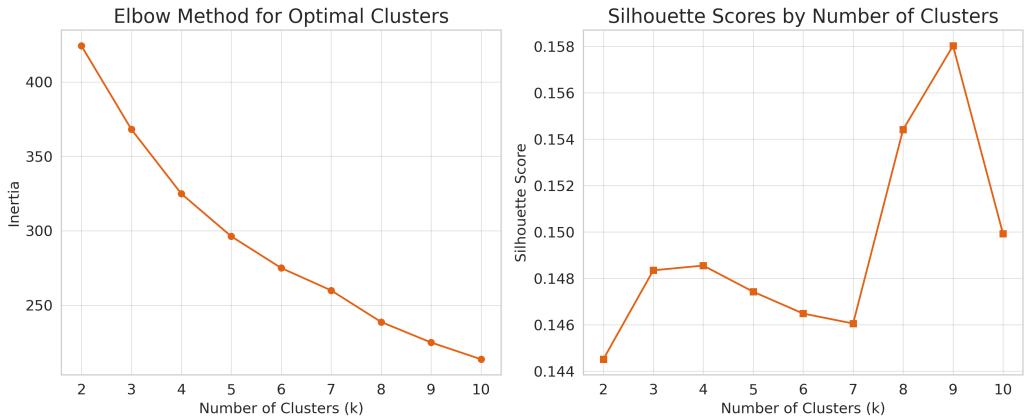


Figure 5.10: Elbow plot (left axis) and silhouette coefficients (right axis) across candidate values of k. The elbow at $k = 3$ and stable silhouette profile support selecting three clusters as an interpretable and parsimonious solution.

Conceptually, a small number of clusters is consistent with the idea that only a limited set of dominant dispositional regimes may modulate how moral salience is processed under synthetic perturbation.

Cluster-Specific Patterns of Moral Response

We then examined whether the donation attenuation associated with $\mathscr{R}$ differed across clusters. Figure 5.11 shows mean donation by condition within each cluster. This visualisation is essential because it provides the descriptive foundation for the interaction models to be developed next.

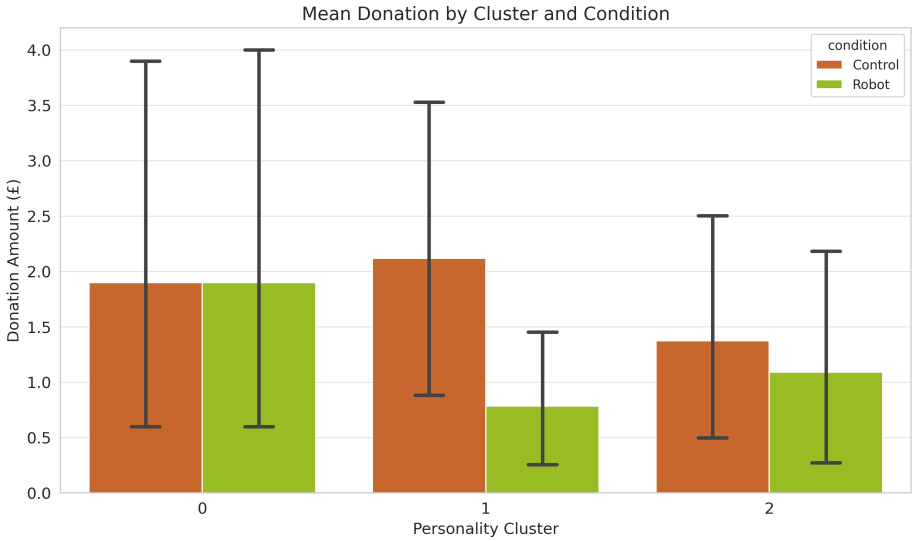


Figure 5.11: Mean donation amount by condition within each personality cluster. Error bars represent standard deviation. Cluster 1 shows a clearer attenuation of donation under robotic presence, while Clusters 0 and 2 display only modest or negligible differences.

The pattern is not uniform across clusters. Preliminary inspection of the cluster

centroids suggests that Cluster 1 is characterised by higher systemizing and lower empathizing scores—a cognitive–affective style that may rely more on structural processing and less on affective resonance. This offers a plausible interpretive foothold: the evaluative perturbation induced by γ_R may interact with configurations of traits rather than their isolated values.

These descriptive patterns motivate the formal interaction models introduced next, where cluster membership is incorporated as a moderator in the mapping from condition to donation.

Conclusion: Dispositional Regimes and Moral Perturbation

Interpretive Conclusion

Preliminary evidence suggests that the attenuation associated with robotic co-presence is not uniformly distributed across participants. Instead, latent dispositional regimes—rather than individual trait scores—appear to modulate susceptibility to the perturbative influence of $\mathscr{R}$. This provides the conceptual and empirical basis for the interaction models developed in the next section.

5.5.5 Psychometric Interpretation and Semantic Labelling of Latent Personality Clusters

The identification of three latent dispositional clusters provides a structural refinement of the dispositional manifold β_C, yet clustering alone does not reveal the *psychological architecture* encoded in each grouping. The analyses thus far established that the attenuation associated with $\mathscr{R}$ is not uniformly distributed across participants; the present task is to make explicit the dispositional logic through which this heterogeneity arises.

This interpretive step is essential. Without a principled semantic characterisation of the latent clusters, the analysis would remain mathematically partitioned but psychologically opaque. Although the broader philosophical implications will be developed more fully in the Discussion chapter, the Experimental Methods chapter must already articulate the *structural meaning* of these clusters, since subsequent modelling relies directly on these semantic anchors.

To move from numerical clusters to psychologically interpretable ecologies, we project the unscaled cluster centroids back onto the original psychometric dimensions. Radar plots (Figure 5.12) provide a justified visual tool for this step: they depict the *normalised* centroid values across traits, offering a relational overview of each ecology's internal configuration—something numeric tables alone cannot provide.

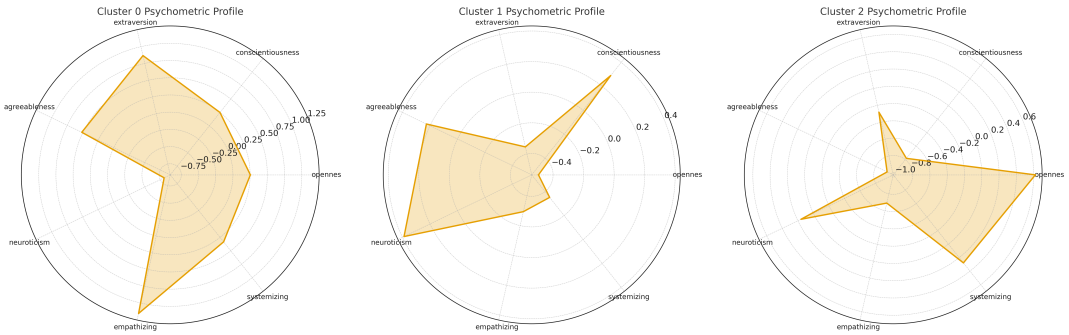


Figure 5.12: Radar profiles (normalised for comparability) of the three latent dispositional ecologies. Left: Cluster 0 (Emotionally Reactive / Low-Structure); Centre: Cluster 1 (Prosocial–Empathic / Warm–Sociable); Right: Cluster 2 (Analytical–Structured / High-Systemizing). These plots visualise the relative psychometric configuration of each ecology.

Ecology I: Emotionally Reactive / Low-Structure

Cluster 0 exhibits elevated Neuroticism, low Conscientiousness, reduced Systemizing, and moderate values across Openness, Extraversion, and Agreeableness. This constellation reflects an *affectively reactive configuration with comparatively weaker structural coherence.* Within the moral-topological framework developed earlier, such an ecology corresponds to a *loosely stabilised evaluative field*: moral cues propagate through an architecture more susceptible to contextual fluctuation, including ontological ambiguity.

Ecology II: Prosocial–Empathic / Warm–Sociable

Cluster 1 is characterised by elevated Openness, Extraversion, Agreeableness, and Empathizing—a *warm, sociable, affectively attuned* profile. This ecology represents the canonical prosocial configuration frequently documented in moral psychology: empathically oriented, interpersonally open, and responsive to moral cues.

Because empathic pathways are ordinarily the most fluid in this group, the descriptively stronger attenuation of donation under $\mathscr{R}$ carries high interpretive value. It suggests that robotic presence may interfere with affective–evaluative channels rather than rule-based reasoning. The displacement of empathic resonance by an ontologically ambiguous artificial form is therefore not merely possible but observable, at least descriptively, within this ecology.

Ecology III: Analytical–Structured / High-Systemizing

Cluster 2 shows elevated Systemizing and Conscientiousness with comparatively lower Empathizing, forming an *analytical, structured, rule-oriented* regime. Individuals within this constellation privilege explicit structure and informational clarity over implicit social affordances.

From a Level-of-Abstraction perspective, this ecology *may be understood as aligning with* a higher abstraction threshold: ambiguous embodied agents, such as a

non-interactive humanoid robot, are encoded primarily as neutral environmental features. Correspondingly, the attenuation associated with $\mathscr{R}$ appears weaker in this group.

Interpretive Integration

Across these ecologies, a coherent descriptive pattern emerges:

- The **Prosocial–Empathic** ecology displays the *most pronounced descriptive attenuation* under $\mathscr{R}$.
- The **Analytical–Structured** ecology shows *minimal descriptive difference.*
- The **Emotionally Reactive** ecology exhibits *variable* sensitivity, consistent with its affective volatility.

This pattern demonstrates that the influence of robotic presence does not operate through a uniform causal channel. Instead, its impact is *contingently instantiated through latent cognitive–affective regimes.* The evaluative transformation $f(\alpha_E, \beta_C, \gamma_R)$ is modulated by the internal organisation of β_C, not merely shifted by γ_R.

Connection to Floridi's Levels of Abstraction

These ecologies may be understood as corresponding to distinct operative Levels of Abstraction:

- The **Prosocial–Empathic** ecology foregrounds affective salience.
- The **Analytical–Structured** ecology foregrounds structural clarity.
- The **Emotionally Reactive** ecology foregrounds affective variability.

Accordingly, γ_R perturbs different informational channels depending on the ecology through which moral cues are interpreted.

Conceptual Conclusion

Conclusion: Trait-Contingent Structure of Moral Perturbation

The attenuation associated with robotic co-presence is not globally uniform. It emerges from contingent interactions between the synthetic presence γ_R and the latent cognitive–affective ecologies encoded in β_C. These ecologies refract the evaluative transformation from moral salience to action, producing descriptively stronger perturbation in empathically oriented profiles, weaker effects in analytically oriented profiles, and variable responses in affectively reactive configurations. In informational terms, γ_R interacts with participants at different operative Levels of Abstraction, generating heterogeneous moral responses across these latent evaluative architectures.

This structural interpretation provides the necessary grounding for the next analytical step. The forthcoming regression and Bayesian models formally examine whether these ecology-specific patterns persist under inferential scrutiny, thereby testing how β_C modulates the evaluative function $f(\alpha_E, \beta_C, \gamma_R)$ within a principled statistical framework.

5.5.6 Cluster-Specific Regression Analysis of Condition Effects

The latent dispositional clusters identified in the previous subsection provide a structured basis for examining whether the behavioural effect of robotic copresence (γ_R) varies across different cognitive–affective regimes. To assess this possibility, we estimated a simple linear regression within each cluster of the form:

$$\text{donation} = \beta_0 + \beta_1 \cdot \text{condition}_{\text{Robot}} + \varepsilon,$$

where β_1 quantifies the within-cluster contrast between Control and Robot conditions. These stratified regressions serve as **local directional estimates**, establishing whether any cluster exhibits a recognisably stronger attenuation pattern prior to introducing interaction terms or hierarchical Bayesian pooling.

A descriptively uneven pattern emerges across clusters. In the cluster characterised by higher empathizing and sociability (Cluster 1), the estimated coefficient for the Robot condition is negative and comparatively large in magnitude relative to the other clusters ($\beta = -1.33$), though still uncertain given the small within-cluster sample size and the fact that the 95% interval includes zero ($p = .091$, $R^2 = 0.087$). This estimate suggests that the directional attenuation observed at the aggregate level may be disproportionately expressed in this subset of participants.

By contrast, the affectively variable (*Emotionally Reactive*) cluster (Cluster 0) exhibits a coefficient near zero ($p > .70$), and the analytically structured (Cluster 2) regime shows only a modest, non-significant negative coefficient ($\beta = -0.28$, $p > .70$). In both cases the estimates are small, and the associated intervals indicate no reliable deviation between conditions. Taken together, these results imply that the aggregate attenuation documented earlier is not homogeneously distributed across dispositional space.

It is important to emphasise two methodological clarifications. First, these regressions treat cluster assignments as fixed labels. They therefore do not incorporate uncertainty in cluster membership or hierarchical pooling across clusters. Both limitations are addressed explicitly in the **Bayesian modelling framework** introduced in the next subsection, which relaxes linearity assumptions, models bounded and zero-inflated outcomes, and accounts for varying uncertainty across clusters. Second, an omnibus condition $\times$ cluster interaction model is presented later in the analytical pipeline. The stratified regressions provided here serve a narrower epistemic function: they establish **local effect direction** prior to modelling global interaction structure.

Finally, although the donation data are bounded and zero-inflated, we employ ordinary least squares at this stage to provide interpretable contrasts within a

familiar parametric structure. The subsequent Bayesian analyses incorporate appropriate distributional assumptions and therefore supersede these exploratory linear models.

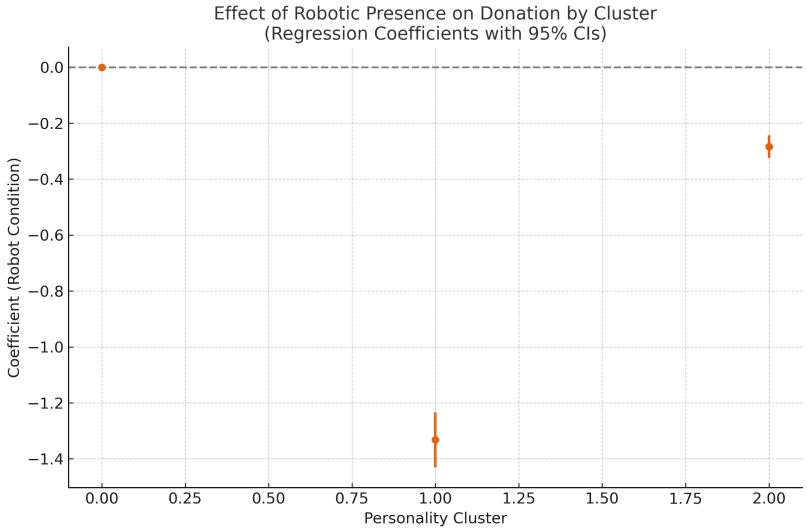


Figure 5.13: Regression coefficients (with 95% confidence intervals) for the Robot condition estimated separately within each latent personality cluster. Cluster 1 shows a larger negative coefficient relative to the other clusters, though uncertainty remains high due to small within-cluster sample sizes. Clusters 0 and 2 exhibit coefficients near zero. These estimates provide local directional contrasts prior to interaction and Bayesian modelling.

The estimated differences can be summarised at the level of expected evaluative output. Let $f(\cdot)$ denote the behavioural transformation introduced earlier. For each cluster k,

$$\mathbb{E}\big[f(\Sigma \cup \mathscr{R})\big]_k \quad \text{vs.} \quad \mathbb{E}\big[f(\Sigma)\big]_k$$

captures the expected donation under Robot and Control conditions respectively. The empirical pattern may be expressed as:

- **Cluster 0 (Emotionally Reactive):** $\mathbb{E}[f(\Sigma \cup \mathscr{R})]_0 \approx \mathbb{E}[f(\Sigma)]_0$ (no detectable within-cluster difference).
- **Cluster 1 (Prosocial–Empathic):** $\mathbb{E}[f(\Sigma \cup \mathscr{R})]_1 < \mathbb{E}[f(\Sigma)]_1$ (largest negative contrast, though interval includes zero).
- **Cluster 2 (Analytical–Structured):** $\mathbb{E}[f(\Sigma \cup \mathscr{R})]_2 < \mathbb{E}[f(\Sigma)]_2$ (small, non-significant difference).

These expressions simply restate, in the language of expected values, the directional information contained in the regression coefficients. They do not imply deterministic effects or global causal claims. Instead, they highlight that:

> *the condition effect is not uniform across latent dispositional regimes, motivating a shift to modelling frameworks that can formally represent uncertainty, zero-inflation, and interaction structure.*

The next subsection therefore introduces a Bayesian estimation approach, designed to assess whether the patterns observed here persist when distributional assumptions are relaxed and when uncertainty is explicitly modelled at the level of both clusters and individual parameters.

5.5.7 Bayesian Estimation and the Representation of Epistemic Gradients

The cluster–specific regressions established that condition effects vary directionally across latent dispositional regimes, but they also highlighted the limitations of ordinary least squares in a bounded, zero-inflated dataset of modest size. Donation amounts exhibit asymmetry, mass at zero, and cluster-dependent variability; moreover, stratified regressions treat cluster membership as fixed and do not pool information across groups. A more flexible inferential framework is therefore required—one capable of representing uncertainty as a structured epistemic property rather than as residual error.

Motivation for a Bayesian approach. Three considerations motivate a transition to Bayesian estimation at this stage:

1. **Sensitivity to subtle effects in modest samples.** Frequentist tests collapse subtle behavioural tendencies into binary outcomes. Bayesian methods provide graded estimates of effect magnitude and uncertainty, which are essential in a study concerned with delicate perturbations of evaluative processing.
2. **Hierarchical structure in the data.** Condition effects (γ_R) interact with latent dispositional regimes (β_C). A Bayesian hierarchical model naturally incorporates this structure via partial pooling.
3. **Conceptual alignment with the evaluative framework.** If robotic presence exerts a refractive, context-dependent influence, then the inferential representation of this influence should itself be graded and continuous. Bayesian inference provides this representational form.

Model structure. A hierarchical Bayesian model was specified in which:

- donation amount was the outcome variable (after mild variance-stabilising transformation to accommodate zero inflation),
- experimental condition was the primary predictor,
- cluster membership contributed varying intercepts and varying slopes,
- weakly informative priors regularised estimates while allowing the data to drive posterior shape.

The likelihood was implemented using a Student-t distribution, which is robust to skew, heavy tails, and zero-inflated behaviour—a pragmatic solution that avoids imposing unrealistic Gaussian assumptions while maintaining computational stability.

Posterior estimation. The posterior distribution for the *modelled* donation difference (`Control - Robot`) shows a central tendency of approximately £0.70, with a 95% credible interval ranging from about –£1.75 to £0.30. Although the interval includes zero, its mass is asymmetrically concentrated toward positive values, indicating *directional probabilistic evidence* for attenuation under robotic co-presence. Rather than yielding a binary verdict, the posterior encodes a structured probability over plausible effect magnitudes.

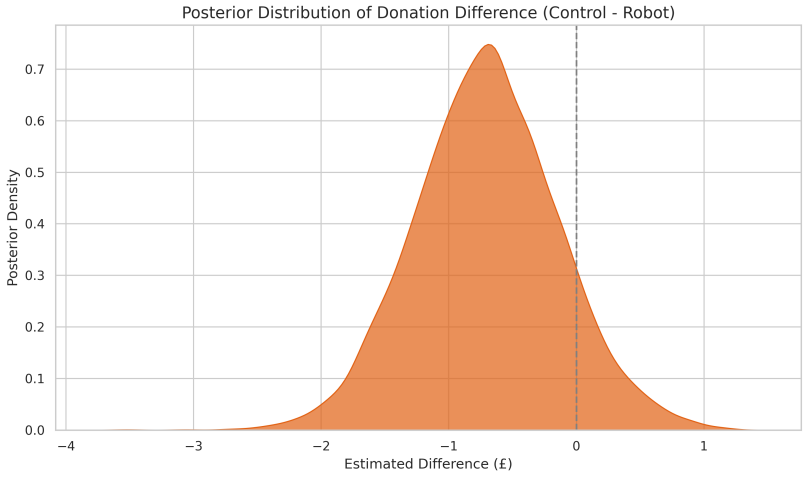


Figure 5.14: Posterior distribution of the modelled donation difference between conditions. The density is skewed toward positive values (greater expected donations in the Control condition), providing directional probabilistic evidence for attenuation under robotic co-presence. The dashed line marks the point of no effect.

Interpretive value of the Bayesian framework. The Bayesian posterior advances the methodological arc of the chapter in three ways:

1. **It treats uncertainty as epistemic structure.** Rather than compressing uncertainty into a single threshold, the posterior renders it as a gradient reflecting the fine-grained ambiguity intrinsic to morally loaded decisions in minimally interactive environments.

2. **It integrates hierarchical heterogeneity.** Partial pooling allows condition effects to vary by cluster while borrowing strength across the population. This avoids overfitting in smaller clusters and respects the structural complexity of the latent evaluative regimes.

3. **It offers a representational analogue of interpretive indeterminacy.** The moral perturbation introduced by NAO operates amid ontological ambiguity; the Bayesian posterior provides a natural representational analogue

of this indeterminacy, modelling moral displacement not as a discrete shift but as a probabilistic modulation.

Connection to Floridi's Levels of Abstraction. Within the LoA framework, agents interpret synthetic entities through informational filters that shape what counts as morally salient. Because NAO's presence introduces indeterminacy in these filters, the inferential system used to model its effect should preserve—rather than collapse—that indeterminacy. The posterior distribution does precisely this: it expresses the impact of γ_R as a graded epistemic field, mirroring the cognitive state of an agent responding to ambiguous moral cues.

Conclusion: Bayesian Representation of Moral Perturbation

Bayesian estimation shows that robotic co-presence yields a probabilistic attenuation of prosocial donation rather than a discrete behavioural shift. The posterior distribution expresses directional evidence for reduced donation in the Robot condition while fully representing the uncertainty expected for subtle, context-dependent perturbations of moral salience. This graded inferential form is consistent with the chapter's evaluative framework: synthetic presence reshapes the topology of moral evaluation in a continuous rather than binary manner.

With this Bayesian model, the inferential sequence of the Experimental Methods chapter reaches completion. The next chapter synthesises these findings to articulate their broader philosophical and normative significance.

Epistemic Interpretation of the Bayesian Results

The Bayesian model developed above enriches the inferential structure of this chapter by representing uncertainty as an explicit epistemic quantity rather than as a residual error term. This shift is methodologically appropriate for the present design, but also conceptually aligned with the chapter's broader focus on graded perturbations of evaluative structure.

Unlike frequentist procedures that partition outcomes into "significant" and "non-significant" categories, the posterior distribution in Figure 5.14 expresses a *graded representation of evidential support for differences in donation across conditions*. The posterior for the modelled donation difference (`Control - Robot`) displays a central tendency near £0.70, but with a wide credible interval spanning mildly positive and negative values. The posterior mass is asymmetrically concentrated toward higher donations in the Control condition, providing *directional probabilistic evidence* for attenuation under robotic co-presence—while making the uncertainty surrounding this effect fully transparent.

In relation to earlier analyses, the Bayesian posterior does not "rescue" non-significant frequentist tests; rather, Bayesian inference *frames the question differently*, updating the plausibility of attenuation effects under explicit modelling of uncertainty, heterogeneity, and zero inflation. Frequentist tests ask whether the

data cross a threshold under idealised distributional assumptions; the Bayesian model asks how the data shift our degree of belief in an attenuation effect. These perspectives are epistemically distinct yet empirically compatible, and their convergence on the same directional trend provides a robust evidential basis for this chapter's claims.

This Bayesian approach is especially appropriate for the present study for two reasons. First, the perturbation introduced by $\mathscr{R}$ is theorised to be subtle, context-dependent, and heterogeneously expressed across participants—properties that hierarchical Bayesian models are designed to represent. Second, the latent dispositional clusters identified earlier generate structured variability that partial-pooling models can incorporate naturally. In this way, Bayesian posteriors provide a *natural representational analogue* of the interpretive indeterminacy through which agents register moral salience under ambiguous conditions.

Conclusion: Gradient of the Impact of Moral Refraction

The Bayesian analysis supports a cautiously framed but epistemically credible claim: attenuation of prosocial donation under robotic co-presence is *probabilistically more likely than not*, with directional support emerging despite substantial uncertainty. This effect is therefore best understood not as a binary shift but as a graded modulation of the evaluative transformation through which moral salience becomes action.

Taken together, the Bayesian results complete the inferential arc of this chapter. The behavioural attenuation, the latent cluster structure, and the posterior's graded evidential pattern converge on a coherent empirical picture: robotic co-presence subtly and heterogeneously modulates the evaluative mapping from morally salient cues to prosocial behaviour.

The next chapter develops the corresponding theoretical interpretation—particularly within the intuitionist tradition in moral psychology, the Watching-Eye literature, and broader debates in Social Signal Processing, Affective Computing, and Machine Ethics, where context-modulated salience and perceptual framing play a central conceptual role.

5.5.8 Closing Reflection: How Synthetic Presence Reconfigures the Moral Field

When we look back across the full analytical arc of this chapter—from raw behavioural contrasts to hierarchical Bayesian estimation—a single idea comes into focus. Moral behaviour does not unfold in a vacuum. It grows out of what we notice first, how we feel the atmosphere of a situation, what we treat as relevant long before we begin to reason through it. Our decisions emerge from the texture of the environment and from the quiet interplay between our own dispositional architecture and the signals around us.

What this experiment shows is that the presence of a humanoid robot—even one that neither speaks nor evaluates us—can reshape that texture. Not dramatically, not uniformly, but measurably. The charity poster, with its image of a child in

need, is normally a powerful intuitive cue: it draws our attention, evokes concern, and nudges us toward prosocial action before any explicit deliberation takes hold. Yet when NAO is in the room, this intuitive channel is no longer clean. The robot becomes a second centre of salience—an object that feels social enough to matter, but not social enough to interpret. Some participants fold this ambiguity into their evaluative process; others simply disregard it. And those differences are structured, not random.

At the aggregate level, this manifests as a modest reduction in donation under robotic co-presence. At the individual level, the posterior distribution shows that this attenuation is *more likely than not*, though embedded in genuine uncertainty. And at the dispositional level, our latent trait analysis reveals a **clear descriptive pattern**: those whose moral lives are primarily guided by warmth, sociability, and empathic resonance are the very ones most affected by NAO's ambiguous presence. For them, the intuitive pull of the poster is partially displaced; for others, the robot barely registers.

This is not the kind of result that lends itself to simple causal slogans. It is not that "robots reduce generosity" or that "some personalities are immune." The structure is subtler. What we see is a redistribution of intuitive salience: a **subtle bending of the moral field** that makes certain cues lighter, others heavier, and some simply harder to parse. NAO does not instruct anyone to act differently, nor does it hold a moral stance. Instead, it alters the perceptual scaffolding through which moral meaning normally flows. The change is quiet, almost atmospheric—and that is precisely why it matters.

From a methodological standpoint, the chapter demonstrates that such subtle effects can be measured, modelled, and formalised. The combination of frequentist contrasts, latent trait clustering, and Bayesian estimation provides a coherent and discriminating toolset for analysing how artificial systems modulate human moral behaviour. The topological language developed earlier in the thesis—mapping moral salience as a field, evaluative processes as trajectories, and synthetic presences as local perturbations—finds empirical grounding here. What the data offer is not proof of a grand theory, but a carefully bounded demonstration: when the informational structure of a moral environment is altered, even slightly, the intuitive pathways that guide behaviour can shift.

And this, ultimately, is the bridge to the conceptual questions that follow. If moral action is so finely attuned to environmental cues—if it responds to shifts in atmosphere, presence, and perceived social relevance—then the broader ethical landscape of human–machine coexistence cannot be reduced to internal principles encoded in artificial agents. It must be understood in terms of *how machines participate in the environments within which our intuitions take shape*. Before we can talk about alignment, responsibility, or artificial moral competence, we must first understand how artificial systems already influence our evaluative architecture simply by being there.

In this sense, the chapter closes not with a resolution, but with a trajectory. We have established that synthetic presence can deform the moral field in ways that

are modest, structured, and psychologically contingent. The next chapter asks what this means for the stories we tell about moral machines, for the theories we use to explain moral behaviour, and for the frameworks we rely on when designing artificial systems that will inhabit our social and normative spaces. If the intuitive foundations of moral life are as malleable as these findings suggest, then the ethical questions surrounding artificial agents begin long before those agents act. They begin with how they appear, how they are perceived, and how their presence reshapes the quiet, pre-reflective work from which our moral decisions grow.

6. Discussions

6.1 Reframing the Findings: Moral Cognition Under Synthetic Co-Presence

The experimental results developed in the previous chapter permit a substantive reassessment of how moral behaviour is shaped by the structure of the environment in which it unfolds. Throughout this thesis, I have treated moral decision-making not as a single cognitive act but as a sequence of evaluative transitions: from perceptual salience, to affectively weighted appraisal, to the formation of a behaviourally actionable moral judgment. This sequence, as argued in Chapter 1, is sensitive to small variations in context—to subtle shifts in tone, posture, and the broader semiotic landscape within which an agent finds themselves. What appears to be a stable moral conclusion is often the endpoint of a dynamic evaluative pathway in which social and perceptual cues act as modulators long before explicit reasoning enters the scene.

The present experiment was designed to probe one particular form of modulation: the influence of a *synthetic presence* whose behavioural expressivity is minimal yet perceptually salient. The NAO robot, in its silent and non-interactive configuration, does not present reasons, issue commands, or initiate social exchange. Instead, it occupies an ambiguous ontological position—a position that is neither that of a conventional object nor that of a recognisable social agent. In Floridi's terms, it constitutes a *semantic body* situated at a specific Level of Abstraction (LoA), one that carries informational affordances precisely because of how it appears and is interpreted, not because of any intrinsic mental properties it might possess.

The central question of this Discussion is: *what do the observed behavioural perturbations reveal about the evaluative architecture through which moral salience is converted into action?* The attenuation detected in the Robot condition, while modest in absolute terms, is statistically meaningful and theoretically instructive. Its presence demonstrates that moral cognition is structurally permeable to synthetic forms of social salience. The fact that this influence emerges in the absence of interaction suggests that its origin is not motivational suppression or empathic fatigue, but a deformation in the topology of the evaluative field itself.

In what follows, I weave together the empirical findings, the mathematical formalism, and the philosophical commitments articulated in the earlier chapters to provide a unified interpretive account of this deformation. The aim is not merely to summarise the results but to situate them within a broader explanatory framework that respects the complexities of moral psychology while avoiding anthropomorphic assumptions about artificial systems. The discussion proceeds from the structural—how the evaluative mapping was perturbed—to the dispositional—how this perturbation varied across latent cognitive–affective profiles—and finally

to the ontological, where I examine what these findings imply for synthetic normativity and the boundaries of moral agency in human–robot interaction.

Throughout, I adopt a stance of empirical restraint. The modest effect sizes, the heterogeneity observed across individuals, and the inferential limits of the design are treated not as weaknesses but as constraints within which a more precise and philosophically disciplined interpretation can be articulated. Within those constraints, the results offer a rare opportunity: they reveal how the moral field can be deformed not by explicit manipulation or argument, but by the presence of a synthetic entity whose normative force arises from its perceived ontology alone.

This chapter therefore takes as its starting point the notion that the robot functions as a *perturbative operator* within the cognitive ecology of moral appraisal. It does not override moral reasoning; it refracts it. It does not diminish empathy; it redistributes evaluative weight across competing sources of salience. And it does not introduce new norms; it modifies the topology through which preexisting moral cues are interpreted. The discussion that follows builds upon this conceptual foundation to make sense of the empirical signature observed in the experiment and to draw out its implications for moral psychology, human–robot interaction, and the broader landscape of machine ethics.

7. ETHICAL COGNITION AND NORMATIVE FOUNDATIONS

7.1 From Moral Cognition to Ethical Theory

The preceding chapter established three claims that structure the transition to the present discussion.

First, moral judgments were analysed as *first-order evaluative outputs*: context-sensitive assessments generated by the cognitive–affective architecture through which agents register morally salient features of their environment. These judgments are psychologically real, behaviourally tractable, and empirically measurable, but they are neither required to be internally consistent nor grounded in articulated principles.

Second, we showed that such judgments arise from distributed processes—intuitive, affective, inferential, and regulatory—whose integration is sensitive to perturbations in the social and perceptual field.

Third, the experimental work that follows relies on this architecture: what we measure are not abstract commitments but the *practical expression* of moral cognition within environments made ambiguous by synthetic presence.

The present chapter moves from these *first-order phenomena* to the *second-order frameworks* through which philosophers and psychologists, attempt to explain, justify, or discipline them. Whereas moral judgments are the data of moral life, *ethics* is the systematic attempt to interpret that data: to uncover the principles, norms, and justificatory structures that purport to govern moral reasoning. Ethical theory is therefore reflexive in a way that moral cognition is not. It asks not merely *What do agents judge?* but:

What should count as a reason? How are obligations justified? What is the normative architecture that makes moral claims intelligible?

These questions operate at a different Level of Abstraction, and they require a different methodological apparatus.

Seen from this perspective, the opening claim of this chapter—that classical ethical theory treats moral judgment as the outcome of structured deliberation—is not an empirical hypothesis but a *second-order commitment*. It reflects the aspiration that normative authority arises from principled reasoning: the articulation of justifiable rules, duties, or values. Yet the Morality Primer revealed a systematic tension between this normative ideal and the empirical reality of moral cognition. Human agents rarely deliberate in the manner ethical theories presuppose; instead, their judgments emerge from perceptual salience, affective valuation, heuristics of social meaning, and dynamic integration across intuitive and deliberative systems.

The central task of this chapter, therefore, is to reconcile these levels: to examine whether, and under what constraints, ethical theory can remain normatively meaningful while respecting the psychological mechanisms through which moral judgments actually arise.

Computing science, especially in domains such as Machine Ethics, Social Signal Processing, and Affective Computing, faces this tension acutely. It must model behaviour that is empirically grounded yet normatively interpretable, avoiding both the error of treating first-order outputs as if they were principled ethical commitments and the converse error of designing artificial agents around abstract principles that human agents do not in practice instantiate.

This dual demand—empirical fidelity and normative coherence—is the point of departure for what follows.

7.2 Introduction: Why Ethics Needs Psychology (and Why Computing Science Needs Both)

Ethical theory, in its classical formulation, treats moral judgment as the outcome of structured deliberation: a process mediated by reasons, principles, and the articulation of normatively defensible positions. Yet this picture has long been recognised as descriptively incomplete. Human moral behaviour rarely emerges from extended reflection; rather, it unfolds through rapid, affectively mediated evaluations shaped by perception, context, and embodied interaction (see discussion in Chapter 3). The distance between what people *ought* to do, what they *think* they do, and what they *actually* do is substantial. To understand moral action in practice—particularly in technologically saturated environments—ethical inquiry must therefore be coupled with the empirical machinery of moral psychology.

For computing science, this coupling is not optional. Artificial agents are increasingly situated in social contexts where their presence, form, and behaviour modulate human inference, expectation, and decision-making. Fields such as *Social Signal Processing* [63] and *Affective Computing* [68] have already demonstrated that human social cognition is deeply sensitive to subtle cues: gaze, posture, micro-expressions, spatial orientation, and embodied co-presence. These cues structure the "interaction order" [**?**] within which humans interpret intention, assign agency, and evaluate normatively significant behaviour. When synthetic systems enter this order, they perturb it—not through explicit commands, but by altering the informational and affective landscape in which human cognition operates.

This thesis proceeds from the premise that *ethical behaviour cannot be understood without moral psychology*, and that *moral psychology cannot be operationalised within computing science without an account of social signals and affective processes*. Moral action is not reducible to computation over explicit propositions; it is embedded in a situated cognitive ecology shaped by embodied agents, environmental cues, and rapidly deployed intuitive processes.

The central claim developed across the thesis is that *moral behaviour is systematically sensitive to the structure of the immediate perceptual–social environment.*

This is not merely a theoretical commitment but the empirical hypothesis that the experimental chapter will interrogate: if moral cognition is dynamically shaped by intuitive appraisals, attentional salience, and affective resonance, then even a silent, behaviourally neutral synthetic presence can modulate the trajectory from moral perception to moral action. The results previewed later in the thesis provide convergent evidence for this claim, showing that robotic co-presence can *attenuate* prosocial donation despite the presence of a strong moral cue (the Watching-Eye stimulus).

Framed through the lens of ethical theory, the foregoing claim has deeper implications. Ethics, as understood in contemporary philosophy, is a *second-order discipline*: it does not produce moral judgments, but seeks to analyse, justify, or critique them [37, 212, 218]. It examines the *structure* of reasons, obligations, and values, not the psychological mechanisms that generate first-order moral appraisals. The field of Machine Ethics has historically blurred this distinction. By attempting to **engineer** "ethical agents" directly at the level of second-order principles—rule sets, deontic logics, utility functions—it tacitly presumes that moral behaviour can be derived from explicit normative propositions [52, 20]. This presumption is philosophically naïve and empirically untenable. It treats ethics as if it were a generative model of behaviour, rather than a reflective framework that presupposes the very psychological capacities it seeks to evaluate. In doing so, classical Machine Ethics mistakes the normative *grammar* of moral theory for the mechanistic *causality* of moral cognition.

The argument developed in this thesis directly challenges this assumption. If moral action is shaped primarily by perceptual salience, intuitive appraisal, affective resonance, and the dynamics of social attention—as the experimental results later confirm—then second-order normative structures cannot be treated as the proximate drivers of behaviour. They are interpretive and justificatory, *not computationally generative.*

This insight reframes the goal of what I call *Computational Morality*: rather than embedding ethical theories into machines, we must first understand the cognitive–affective machinery that underwrites human moral responsiveness, and only then determine what ethical oversight or normative constraints are appropriate. Classical Machine Ethics inverted this order; the empirical findings of this thesis re-establish it.

At the same time, the scope of this chapter is deliberately circumscribed. It does not attempt a comprehensive reconstruction of moral philosophy, nor does it pursue the full normative debates surrounding moral realism, contractualism, utilitarianism, or virtue theory. Such an undertaking would exceed the remit of an empirical thesis. Instead, the chapter isolates the conceptual and mechanistic structures necessary for the remainder of the work: how ethical theory relies on assumptions about moral judgment, how moral judgment is psychologically realised, and why any account of ethical behaviour in computational settings must be anchored in the empirical architecture of moral cognition. The goal is thus foundational rather than encyclopaedic: to articulate the theoretical substrate that motivates, constrains, and ultimately validates the experimental investigation that follows.

As such, the integration of ethical theory, psychological insight, and computational modelling is not merely interdisciplinary ambition—it is a methodological necessity.

In the chapters that follow, we develop this integration along three axes. First, we introduce foundational ethical concepts—deontic, consequentialist, and virtue-theoretic—that define the normative landscape in which moral behaviour is interpreted. Second, we examine the empirical architecture of moral cognition, with emphasis on intuitionist and dual-process models [16, 31, 17] that capture the rapid, affectively-driven nature of everyday moral judgment. Third, we link these philosophical and psychological constructs to the computational disciplines that analyse social behaviour—most notably Social Signal Processing and Affective Computing—thereby establishing a unified framework for studying ethical decision-making in environments populated by artificial agents.

This synthesis prepares the conceptual ground for the experimental investigation at the heart of this thesis. The manipulation of robotic co-presence, the use of moral primes such as the Watching Eye stimulus, and the measurement of prosocial donation are not methodological curiosities: they are principled probes into the cognitive machinery through which moral cues acquire behavioural force. By integrating ethics, psychology, and computational social science, this chapter equips the reader with the normative and conceptual tools required to understand how—and why—synthetic presence can reshape the moral topology of human decision-making.

7.3 Ethical Theory as Second-Order Analysis

If the introductory sections of this chapter establish the transition from first-order moral cognition to second-order normative reflection, the next task is to make explicit the methodological consequences of this shift. The distinction is not merely terminological. It determines which claims are explanatory, which are justificatory, and which are subject to empirical constraint. Failure to maintain this distinction has led to recurring conceptual errors in both philosophical ethics and computational modelling [87, 89, 219, 25, 52, 145, 220, 54]. This section therefore articulates a principled account of what second-order ethical theory *is*, what it *explains*, and what it *cannot* plausibly do.

7.3.1 Ethical Reflection and the Second-Order Stance

First-order moral judgments arise from the cognitive–affective processes analysed in the Morality Primer. They are psychologically realised, context-sensitive, and behaviourally measurable. Their structure reflects the architecture of moral cognition: operations on perceptual salience, affective intuitions, social meaning, and regulated deliberation. These are the *phenomena* that ethical theory seeks to interpret.

Second-order ethical theory is structurally different. It is reflexive rather than generative. It asks: What counts as a reason? What makes an obligation binding? What is the source of justificatory authority? These questions presuppose capacities for abstraction, generalisation, and rational evalu-

ation that are not themselves the proximate causal mechanisms of moral behaviour [16, 31, 60, 221, 222, 223, 224]. Sidgwick already insisted on this point in *The Methods of Ethics*, where he distinguished between the psychology of moral sentiments and the "*method* of determining right conduct" [36, Book I]. Lemos's treatment of epistemic justification exhibits a similar structural separation between doxastic psychology and the normative assessment of belief [**?**]. The parallel here is instructive: ethics stands to moral judgment as epistemology stands to belief-formation.

Seen from this perspective, second-order theory is not a set of instructions that moral agents follow in producing judgments. It is a framework for articulating the standards by which judgments are evaluated. It makes explicit the *normative architecture* that is only tacitly present in first-order moral life. Its success therefore depends on conceptual clarity and justificatory coherence, not on behavioural predictiveness.

7.3.2 Levels of Abstraction and the Proper Location of Ethical Explanation

The distinction between first-order moral cognition and second-order ethical theory can be sharpened through Floridi's framework of *Levels of Abstraction* (LoA) [25, 197]. On this account, every explanatory enterprise selects a perspective defined by its observables, its conceptual resolution, and the class of questions it is equipped to answer. Moral cognition and ethical theory do not merely operate at different LoAs—they answer *different kinds of questions* and employ *different explanatory primitives*.

At the **cognitive LoA**, the relevant variables are those that govern the generation of moral judgments in real time:

- perceptual salience and attentional capture,
- affective appraisal and embodied valuation,
- intuitive heuristics and rapid social inferences,
- controlled modulation under conflict or uncertainty,
- the temporal dynamics by which these processes integrate.

These are mechanistic, psychologically instantiated processes. They have causal influence on behaviour and can be perturbed by contextual or environmental changes. *This is the LoA at which the experimental work of this thesis operates.*

At the **normative LoA**, by contrast, the objects of analysis are:

- principles of justification,
- conceptions of duty, value, and obligation,
- standards of admissible reasons,
- structural norms governing deliberation, agency, and responsibility.

These are not causal operators but *interpretive* and *justificatory* constructs. They evaluate, discipline, or systematise moral claims but do not themselves generate behaviour. Ethical theory is reflexive: it examines the grammar of reasons, not the mechanisms of cognition.

Classical Machine Ethics collapsed these LoAs. By treating principles, rules, or utility structures as if they were mechanistic generative elements, it implicitly assumed that normative constructs function like cognitive processes. This assumption is doubly mistaken:

1. It attributes to normative concepts a causal role they do not possess: ethical duties do not operate like perceptual salience or affective appraisal.
2. It ignores the empirical architecture of moral cognition, which shows that behaviour emerges from intuitive, affective, and situational dynamics long before explicit reasoning is engaged.

From the perspective developed across this thesis, such an approach is not merely incomplete; it is methodologically incoherent. It attempts to engineer behaviour by manipulating abstractions at a LoA that is *not behaviourally operative*.

LoA discipline therefore becomes a philosophical and methodological necessity. Explanations of behaviour must occur at the cognitive LoA; evaluations of reasons and principles must occur at the normative LoA. Neither can be reduced to the other. Crucially, however, the two LoAs are not independent: normative evaluation presupposes an underlying psychology capable of generating moral sensitivity and action, while psychological findings constrain the plausibility of normative theories.

This interdependence is the key insight that links this chapter to the preceding Morality Primer and to the experimental chapter that follows. The Primer established that the cognitive LoA is *topologically structured*: moral cognition involves the continual reshaping of an evaluative field whose gradients are determined by affective cues, attentional dynamics, and social interpretive processes. Perturbations to this field—whether by altering salience, modifying affective tone, or introducing ambiguous social presence—can shift the system's behavioural trajectory even when normative commitments remain unchanged.

Seen through the LoA framework, the core question of this thesis can now be reformulated with greater precision: *How do normative expectations, psychological mechanisms, and environmental structures jointly determine the transition from moral perception to moral action?*

This question cannot be answered by ethical theory alone, nor by psychology in isolation. It requires a representational structure capable of linking the causal architecture of moral cognition (first-order) with the justificatory architecture of ethical evaluation (second-order). The remainder of this chapter argues that **evaluative topology**—introduced in the Morality Primer and returned to throughout the thesis—provides precisely such a bridge.

Classical Machine Ethics provides a clear illustration of the dangers of LoA confusion. A recurring methodological assumption in early systems was that normative concepts themselves—obligations, duties, utilities, or virtues—could be implemented at the computational LoA and thereby function as direct generators of behaviour. Early top-down approaches treated ethical theory as if its abstractions could be operationalised without remainder. For example, Arkin's "ethical governor" encoded deontological constraints derived from Just War Theory as behavioural regulators [22]; Anderson and Anderson's principlist architectures computationalised Rossian prima facie duties as decision rules [225, 20]; and logic-based approaches by Bringsjord and colleagues modelled deontic operators as executable action-selection mechanisms [21, 226]. Parallel lines of work assumed that utility functions could serve as moral evaluators in consequentialist agents [227, 22], while virtue-theoretic systems attempted to reify character traits as algorithmic dispositions governing moral performance [228, 229]. In all these cases, normative structures were treated as if they occupied the same LoA as the cognitive mechanisms responsible for actual moral behaviour.

Floridi's LoA framework clarifies why such reductions are unsustainable: normative categories belong to a reflective, second-order LoA concerned with justification, whereas computational models operate at an implementational LoA concerned with causal processes. Conflating the two not only mischaracterises the role of normative theory but also yields systems whose behavioural outputs are artefacts of representational choices rather than genuine ethical competence.

7.3.3 Evaluative Topology as a Bridge Between Orders

The challenge, then, is not to collapse first-order cognition into second-order theory, but to articulate a structure that permits principled interaction between them without confusing their explanatory roles. *Evaluative topology*, introduced in the Morality Primer (Chapter 3) and returned to throughout this thesis (see Chapter **??**), provides precisely such a structure.

Evaluative topology can be naturally situated within a long-standing tradition in computational cognitive science that conceptualises perception, valuation, and action as parts of continuous, dynamical systems rather than discrete symbolic modules. Research in moral psychology already demonstrates that moral cognition emerges from distributed interactions between perceptual salience, affective appraisal, attentional dynamics, and context-sensitive social meaning. Empirical models—from Haidt's social intuitionism to Greene's dual-process account—show that moral perception is shaped by multi-dimensional affective and social fields rather than rule-based computations [16, 31, 60]. Neurocognitive analyses extend this point: Nussbaum's and Churchland's treatments of emotion as evaluative perception imply a graded, vector-like structure underlying moral appraisals [83, 230]. Likewise, work in social signal processing models interpersonal evaluation as a shifting landscape of cues that modulate behavioural trajectories in real time [67].

Against this background, evaluative topology provides a computationally meaningful formalisation: it treats the moral landscape as a dynamic field that shapes the flow from perceptual input to action readiness. Instead of assuming that be-

havior results from the application of discrete maxims or utility scores, evaluative topology models moral cognition as continuous transformations across a structured state-space. This aligns with dynamical-systems approaches in cognitive science that explain action selection through attractors, gradients of salience, and field-like organisation rather than propositional inference. The topology encodes the shape of the evaluative field—the stability of certain trajectories, the resistance of others, and the way local variations in perceptual or affective input can redirect the subject toward different moral outcomes.

By locating moral appraisal within a dynamic state-space, evaluative topology offers a principled bridge between first-order moral cognition and second-order ethical theory. It is sensitive to the empirical architecture of human cognition—distributed, affectively grounded, context-responsive—while remaining compatible with the reflective, justificatory concerns of ethical theory. It thus becomes possible to characterise the points of interaction between descriptive and normative orders without reducing one to the other: normative theory shapes the global constraints and evaluative contours within which first-order processes operate, while first-order processes provide the empirical basis upon which second-order theorising must reflect.

At its core, evaluative topology treats the moral landscape not as a set of discrete judgments or isolated principles, but as a *dynamic field* whose configuration determines the pathways through which perception becomes moral action [16, 31, 230, 60, 83, 222] . Its explanatory primitives include:

- **salience gradients**: patterns of perceptual and affective prominence,
- **affective attractors**: regions of the evaluative field toward which intuitive appraisal rapidly converges,
- **attentional pathways**: trajectories through which cognitive resources flow,
- **normative deformations**: structural constraints introduced by commitments, duties, or normative expectations,
- **social or synthetic perturbations**: distortions induced by the presence of other agents—including artificial ones.

Unlike classical ethical theory, which specifies norms at an abstract and often idealised level [36, 231, 232, 80, 37] , evaluative topology is sensitive to the *real-time architecture* of moral cognition. And unlike purely mechanistic models in psychology, which describe causal processes but lack normative structure, topology captures the relational, structural, and counterfactual properties of moral appraisal [16, 31, 60, 222, 36, 37, 80] : how evaluative trajectories *could* unfold under alternative configurations of salience, affect, or context.

This topological approach thus identifies the precise level at which first-order and second-order analyses intersect. It supports the following alignment:

1. **Ethical theory** identifies which evaluative configurations *ought* to have normative authority.

2. **Moral psychology** identifies which configurations *do* govern actual behaviour.
3. **Evaluative topology** identifies how these structures interact, when they diverge, and how they can be perturbed.

This tripartite structure yields both a diagnostic and a constructive insight. Diagnostically, it clarifies why many classical models in Machine Ethics failed: they attempted to engineer behaviour by manipulating abstractions at a normative LoA, ignoring the topological organisation of the cognitive LoA through which behaviour actually emerges. Constructively, it shows how normative analysis can be anchored in a psychologically realistic substrate without reducing ethics to psychology or cognition to normativity.

Topological Consequences for Moral Perturbation. The Morality Primer established that moral behaviour emerges from the traversal of a dynamically shaped evaluative field. Within this framework, *perturbation* has a precise and measurable meaning: any alteration that changes the curvature, gradients, or attractor structure of the field will shift the probability distribution over behavioural trajectories. This is true whether the perturbation arises from shifts in salience, affective modulation, attentional competition, or the introduction of a new agent into the interaction ecology.

A synthetic presence—perceptually social yet ontologically indeterminate—is therefore not merely an "observer" but a topological operator. It changes the field in which moral meaning becomes behaviourally operative. This was the central theoretical insight that shaped the experimental design: by embedding a morally charged cue (the Watching-Eye stimulus) within a field perturbed by a humanoid robot, we could test whether subtle topological deformation is sufficient to attenuate prosocial behaviour.

Interim Synthesis: Where the Chapter Now Stands. The conceptual architecture developed thus far establishes the conditions for experimental design (Chapter **??**):

- First, moral judgment operates at the cognitive LoA through dynamic, affectively responsive, socially sensitive processes.
- Second, ethical theory operates at the normative LoA, providing justificatory structures but not generative mechanisms.
- Third, evaluative topology provides the bridge between these orders by modelling the structural constraints and transformations that govern the transition from moral perception to moral action.
- Fourth, this bridge is indispensable for understanding how synthetic agents perturb human moral behaviour.

We are therefore equipped to proceed. With the methodological scaffolding in place, we can now introduce the major normative theories not as abstract philosophical positions but as structured attempts to locate sources of normativity within the evaluative field. Their reconstruction in the next section is guided by

the LoA discipline established above and constrained by the topological account of moral cognition developed throughout this thesis.

Before turning to the main normative traditions, it is important to clarify *why* this reconstruction is required within the architecture of the thesis. The experimental work developed later does not simply measure behavioural differences; it interrogates a deeper question concerning the *normative interpretation* of those differences. If robotic co-presence reshapes the evaluative topology through which moral salience becomes action, then any claim about the ethical significance of this perturbation—whether it constitutes a moral cost, a distortion, or a benign behavioural shift—presupposes a framework for understanding how normativity itself is structured. Without situating the experiment within a landscape of ethical theories, one could describe *what* changes but not *what the change means*.

The purpose of the next section, therefore, is not to provide a survey of moral philosophy, but to identify the minimal normative scaffolding required to make sense of the empirical findings. Deontic, consequentialist, and virtue-theoretic perspectives articulate distinct accounts of (i) where normative authority resides, (ii) how moral relevance is determined, and (iii) how action-guidance is understood. These differences matter directly for the thesis: each theory yields a different interpretation of what it means for synthetic presence to attenuate prosocial behaviour. By reconstructing these normative architectures through the lens of Levels of Abstraction and evaluative topology, we prepare the conceptual ground for assessing the ethical significance of the perturbation demonstrated experimentally.

What follows, then, is not philosophical ornamentation but a methodological necessity: establishing the normative coordinates that will allow the later empirical results to be interpreted, evaluated, and ultimately situated within a defensible ethical framework.

7.4 The Normative Landscape: Structuring Ethical Theories Through LoA and Topology

With the methodological scaffolding now in place, we can introduce the major normative frameworks that constitute the philosophical backdrop against which the experimental findings must ultimately be interpreted. The aim here is not encyclopaedic exposition but conceptual reconstruction: each theory is presented in a form that preserves its philosophical integrity while situating it within the Levels of Abstraction (LoA) discipline and the evaluative-topological architecture developed in this thesis.

This reconstruction is guided by two methodological constraints:

1. **Philosophical fidelity**: the theories must be represented in a manner faithful to their canonical formulations in moral philosophy.
2. **Integrative compatibility**: the theories must be articulated in a form that allows principled interaction with the psychological and topological models of moral cognition established in Chapter 3.

The purpose of this section, therefore, is not to catalogue doctrines, but to map the deep structure of normativity in a way that can later illuminate the ethical

significance of the empirical perturbations induced by synthetic presence.

7.4.1 The Three Dimensions of Normative Analysis

Normative theories differ not only in content, but in the *architecture of normativity* they assume. To analyse them systematically, we distinguish three fundamental dimensions—each corresponding to an aspect of evaluative topology and LoA structure:

1. **Source of Normativity**: the origin of justificatory authority. This may lie in rational agency (Kant), human flourishing (Aristotle), aggregated welfare (Mill, Sidgwick), affective sentiment (Hume), or interpersonal justification (Scanlon).
2. **Mode of Evaluation**: the features of action or character deemed morally relevant—maxims, consequences, virtues, motives, relational duties, or context-sensitive particulars.
3. **Action-Guidance Mechanism**: the process that connects evaluative judgments to behaviour—categorical imperatives, utilitarian optimisation, virtue-structured perception, affective resonance, or justificatory equilibrium.

These dimensions allow us to re-express classical theories as *evaluative topologies*:

- **Kantian ethics** imposes rigid deontic invariants: absolute constraints that carve the evaluative field into sharply bounded permissible and impermissible regions.
- **Consequentialism** defines a gradient field over outcomes: moral action follows the steepest ascent toward welfare-maximising states.
- **Virtue ethics** defines dispositional attractors: stable patterns of moral sensitivity that shape the agent's perceptual and evaluative orientation.
- **Sentimentalism** defines networks of affective resonance: moral evaluation flows along affectively weighted pathways anchored in human sympathy or aversion.
- **Contractualism** defines justificatory equilibria: a topology structured by mutual recognisability of claims.
- **Particularism** dissolves fixed topologies altogether: normativity emerges from fully context-dependent patterns of salience and relation.

This analytic framing is essential because it provides a common representational language in which ethical theory and moral psychology can be jointly expressed. Theories that differ profoundly in content can be compared in structural terms—how they sculpt the evaluative landscape, where they locate normative constraints, and how they understand the movement from judgment to action.

7.4.2 Why This Framework Matters for the Experimental Chapter

This normative topology is not abstract machinery; it is the conceptual infrastructure that enables us to interpret what the experiment later reveals. The empirical

question—whether synthetic presence attenuates prosocial behaviour—cannot be ethically assessed without first situating it within a framework for understanding how moral cues acquire force.

Three claims follow directly from the preceding reconstruction:

1. **Moral action depends on the configuration of the evaluative field.** Normative theories specify different sources of authority and diverse mechanisms of action-guidance, but all agree that moral behaviour arises from structured evaluative relations, not arbitrary choice.

2. **Synthetic presence modulates this field by perturbing salience, attention, and affective resonance.** A humanoid robot does not supply new reasons; it reshapes the environment in which reasons become behaviourally operative.

3. **Normative theories must therefore be reinterpreted through the joint lens of LoA and evaluative topology if they are to explain or critique the behavioural perturbations observed experimentally.**

This is the philosophical function of the section: to establish the normative coordinates that will allow the experimental findings to be understood not merely as statistical differences, but as shifts in the moral significance of an action within a structured evaluative landscape.

The stage is now set for the substantive reconstruction. In the following sections, each major normative framework—deontological, consequentialist, virtue-theoretic, sentimentalist, contractualist, and particularist—is examined as a topology of normativity embedded within the cognitive–affective architecture of moral agents. These reconstructions will serve as the interpretive foundation for evaluating how, and why, synthetic presence can reshape the moral field in the experiment to come.

7.5 Deontological Structures: The Architecture of Practical Reason

The methodological framework established in the preceding sections motivates a disciplined reconstruction of the major normative theories. Having clarified how ethical explanation must respect both Levels of Abstraction (LoA) and the evaluative topology that mediates the transition from perception to action, we begin with deontological ethics. This is not because deontology offers a direct model of human moral cognition—it does not—but because it illustrates, with exceptional clarity, the gap between *normative authority* and *psychological generation*. This gap is precisely where classical Machine Ethics collapsed distinctions, and where the present thesis departs from that monolithic approach.

The aim here is not historical exegesis. The task is to reconstruct deontological normativity in a form compatible with the cognitive–topological architecture developed so far, and to show how deontological invariants function as structural constraints within the evaluative field investigated empirically in later chapters.

The reconstruction must satisfy three constraints:

1. **Preserve philosophical identity**: retain the core commitments that distinguish deontological ethics.
2. **Avoid LoA confusion**: do not treat deontic principles as if they were psychological mechanisms or generative cognitive operators.
3. **Embed deontology in topology**: express duties as constraints on the evaluative landscape, rather than as engines of behaviour.

When formulated in this way, deontology occupies a precise role: it identifies *invariant structures* within the moral field that delimit the boundaries of permissible action. These invariants are not computational rules; they are reflective standards through which agents assess the coherence of their maxims and commitments.

7.5.1 The Source of Normativity: Rational Agency and the Form of Law

On the Kantian account, moral authority arises from the structure of rational agency. The categorical imperative does not prescribe concrete actions but establishes a formal test for the permissibility of maxims: whether one's maxim could be willed as a universal law [**?**, 80, **?**]. This places the source of normativity at a *higher* LoA than psychological description. It concerns the *conditions of reflective justification*, not the causal mechanisms that generate everyday judgments.

This distinction is essential. Classical Machine Ethics implemented the categorical imperative as a procedural decision rule—an algorithmic operator [225, 20, 21, 233, 226, 22] . But Kant never intended universalisability tests to function as cognitive processes.[1] Their purpose is normative: to articulate the standards under which a maxim can be defended as consistent with rational agency. Treating these tests as computational procedures constitutes precisely the LoA confusion diagnosed earlier.

A survey of Classical Machine Ethics reveals this recurring methodological error: the assumption that Kantian constraints, universalisability tests, or duty-based norms could be directly implemented as procedural decision rules. Early top-down approaches explicitly treated the categorical imperative, or close deontological analogues, as algorithmic operators determining action permissibility. The most widely cited examples are the principlist architectures developed by Anderson and Anderson, where prima facie duties are computationalised as weighted decision procedures whose outputs determine ethically "permissible" behaviour [225, 20]. Similarly, logic-based systems developed by Bringsjord and collaborators represent obligations and prohibitions using deontic logic embedded in the cognitive event calculus, thereby converting normative constraints into executable operators that mechanically evaluate action options [21, 233]. Ganascia's formalisation of ethical rules of warfare follows the same strategy, modelling universally applicable duties as logical conditions that an autonomous agent must satisfy prior to acting [226]. Arkin's "ethical governor" for lethal autonomous robots

[1] See the discussion in [**?**] and [15] on the reflective rather than psychological status of the categorical imperative.

likewise encodes deontological constraints—derived from Just War Theory and Kantian doctrine—as computational filters that block impermissible actions at run time [22]. In each case, a normative principle originally intended for reflective justification is treated as a psychological mechanism or behaviour-generating operator. As Moor and Coeckelbergh observe, this amounts precisely to the Level-of-Abstraction confusion: normative tests designed for rational self-assessment are misinterpreted as causal algorithms capable of producing moral behaviour [216, 54]. These systems thus instantiate the very conflation at issue—collapsing reflective ethical reasoning into first-order cognitive processing.

7.5.2 Mode of Evaluation: Maxims, Duties, and the Structure of Permissibility

Deontological theories evaluate actions through the *form* of the underlying maxim and the duties that follow from rational consistency. These duties generate a characteristic structure within the evaluative field:

- **Invariance**: duties bind independently of consequences or affective states.
- **Non-gradience**: obligations typically define discrete boundaries—permissible vs. impermissible.
- **Symmetry**: the universal law test imposes interpersonal consistency.
- **Role-relativity**: some duties depend on one's position or relationship (e.g. duties of fidelity, respect, and beneficence).

Topologically, these features correspond to *hard constraints* on the evaluative landscape. Rather than shaping the gradients that guide behaviour, deontological duties carve the field into admissible and inadmissible regions. They define the regulatory geometry within which trajectories must lie.

7.5.3 Action-Guidance: How Normative Constraints Influence Behaviour

A central challenge arises here: if deontological rules do not describe cognitive processes, how do they guide action?

The answer, consistent with LoA discipline, is twofold:

1. **At the cognitive LoA**: deontological principles do not produce behaviour. Moral action emerges from intuitive appraisal, affective valuation, attentional salience, and controlled modulation—precisely the components analysed in the Morality Primer (Chapter 3).
2. **At the normative LoA**: deontological principles determine which behavioural trajectories can be reflectively justified. They also shape long-term dispositions, thereby influencing the evaluative topology indirectly through moral training, socialisation, and self-constitution.

Thus, while deontology does not operate the machinery of moral cognition, it contributes to the *calibration* of that machinery over developmental time. Internalised deontic commitments:

- heighten sensitivity to cues of respect and violation,
- modulate affective responses to dishonesty or unfairness,
- strengthen top–down control when intuitive impulses conflict with duty.

In this sense, deontological ethics functions as a form of *normative scaffolding*: it shapes the agent's evaluative posture but does not compute their moment-to-moment behaviour.

7.5.4 Deontological Normativity as Topological Invariance

We can now state the central insight of this reconstruction. Within a topological model of moral cognition, deontological ethics corresponds to the identification of *non-negotiable invariants*—fixed points that define the structural integrity of the moral field.

These invariants:

- partition the space of possible actions into permitted and forbidden zones,
- resist deformation by contextual changes, affective fluctuations, or strategic incentives,
- stabilise behavioural tendencies by constraining rational endorsement,
- provide the reflective standpoint from which agents assess the legitimacy of their conduct.

The categorical imperative thus appears not as an algorithm for decision-making but as a *topological principle*: a formal constraint ensuring that evaluative structure is globally coherent rather than locally opportunistic.

7.5.5 Why Deontology Matters for the Experimental Logic

This reconstruction is essential for integrating the experiment into a normative framework. The purpose of the experiment is not merely to detect behavioural differences but to determine their *moral* significance. Deontology supplies the conceptual structure required for this evaluation.

Before stating the relevance of deontological norms for the experimental logic, one brief clarification is required. Throughout this thesis, the experimental paradigm employs a widely studied behavioural prime sometimes referred to as a "Watching-Eye" cue: a minimal visual stimulus (in our case, a charity poster depicting a child in need) that subtly increases the perceived presence of a moral or social observer. The detailed psychological literature and methodological justification for this paradigm are presented later in Chapter **??**. Here, it suffices to note that such cues are known to activate expectations of accountability, reciprocity, and norm compliance—even though they involve no real observer and no explicit instruction.

With this context in place, we can now express why deontological theory is indispensable for interpreting the experiment:

1. **If synthetic presence alters behaviour**, we must ask whether the observed perturbation reflects a shift that remains within deontically permissible space or whether it involves a deeper distortion of obligations associated with beneficence, fairness, or respect.
2. **The Watching-Eye cue implicitly invokes deontic expectations**: even a minimal representation of an observing other tends to activate norms of accountability and reciprocity. A reduction in prosocial action under this cue suggests that the presence of a synthetic agent may interfere with the agent's sensitivity to these deontic constraints.
3. **Deontology provides the normative vocabulary** for diagnosing whether a behavioural shift constitutes a morally relevant deviation or a benign modulation of preference or affect.

This is precisely where the present thesis diverges from monolithic approaches in Machine Ethics. Classical frameworks attempted to model moral action by encoding deontological rules directly into artificial agents. The empirical results of this thesis show why that strategy misunderstands the architecture of moral cognition: deontic rules do not generate behaviour, and perturbations to behaviour cannot be understood purely in terms of deviations from codified principles. Instead, the influence of synthetic presence must be interpreted through the evaluative topology in which deontic invariants reside.

With deontology reconstructed as a system of topological constraints rather than computational rules, we can now turn to consequentialism. There, normativity is expressed not through invariants but through gradient fields over outcomes—structures that interact with the evaluative machinery of moral cognition in different but equally illuminating ways. This will further clarify how different theoretical lenses illuminate different dimensions of the behavioural perturbations uncovered in the experiment.

Conceptual Note: Gradient Fields in Consequentialist Topology

In the topological framework developed across this thesis, a *gradient field* designates a structured evaluative landscape in which each possible action or state of the world is associated with a scalar value—typically representing expected welfare, utility, or outcome-based moral worth. Formally, a gradient field assigns to each point in an abstract space of action–outcome configurations a direction of steepest ascent: the direction in which an incremental shift would produce the greatest increase in expected value. In classical moral philosophy, this structure is implicit in utilitarian reasoning, which assesses actions by their tendency to promote the greatest balance of good over bad consequences [**?**, 232, 36]. Within this thesis, the notion is used in a non-formal but conceptually rigorous sense: as a way of modelling how consequentialist evaluation imposes directional structure on the moral field, where moral improvement corresponds to movement along the gradient toward higher expected welfare.

A gradient field thus has three key features:

1. **Scalar valuation**: each point in the evaluative space has a determinable value, allowing continuous comparison along a single dimension of moral

assessment (e.g. total or average welfare).

2. **Directional guidance**: the moral significance of a possible action is given by its vector orientation relative to the gradient; actions are increasingly morally preferable as they align with the direction of steepest ascent.

3. **Sensitivity to empirical structure**: because the gradient depends on expected outcomes, it varies with changes in belief, evidence, context, and the agent's model of the world.

In this topological reconstruction, consequentialist gradient fields do not function as cognitive mechanisms. Human agents do not compute explicit gradients when acting morally, nor do they evaluate global states of the world through analytic integration. Rather, consequentialist structures operate at the *normative Level of Abstraction*: they specify how actions are *justified* in reflective evaluation, not how they are generated in real-time cognition. This LoA separation parallels Sidgwick's distinction between the "point of view of the universe" and ordinary motivational psychology [36, Book IV].

Interaction with the Evaluative Machinery of Moral Cognition. Although gradient fields do not describe the causal architecture of moral cognition, they interact with it in conceptually important ways. The evaluative machinery developed in Chapter 3—perceptual salience, affective appraisal, intuitive heuristics, and controlled modulation—does not implement consequentialist reasoning, but it is nevertheless shaped by outcome-related information in several distinct modes:

1. **Salience modulation**. Perceived consequences influence which features of a situation become salient. Potential harm, benefit, or risk amplifies attentional capture, thereby altering the local configuration of the evaluative field even before explicit reasoning occurs.

2. **Affective valuation**. The human affective system registers outcomes (especially those involving harm or welfare) with strong valence. These affective signals act as local gradient approximations: they bias intuitive appraisal toward or away from particular actions in a manner that roughly tracks expected value.

3. **Heuristic extraction**. Over developmental time, agents internalise outcome-sensitive heuristics ("help when it is easy", "avoid causing harm") that serve as psychologically tractable proxies for gradient following. These heuristics allow the cognitive system to approximate consequentialist structure without computing it.

4. **Deliberative correction**. In cases of conflict or ambiguity, controlled processes may approximate aspects of consequentialist evaluation—comparing potential harms or weighing benefits—thereby engaging the gradient field at a coarse-grained level. However, this is slow, effortful, and limited by computational constraints.

5. **Perturbation sensitivity**. Because consequentialist evaluation depends on expected consequences, perturbations to perception, attention, or social meaning—such as the presence of a humanoid robot—can reshape the

agent's perceived gradient field. This makes consequentialist structures especially sensitive to the kinds of environmental shifts tested experimentally in this thesis.

The interaction between consequentialist topology and moral cognition therefore occurs *indirectly*. Consequentialism specifies the normative gradient that ought to guide reflective endorsement; the cognitive system provides a noisy, heuristic, context-sensitive approximation of this structure. Evaluative topology makes this relationship explicit by modelling behaviour as the traversal of a dynamically shaped field whose gradients, although not explicitly computed by the agent, are nevertheless partially approximated through affective and attentional processes.

This conceptual integration is essential for the purposes of the present thesis. It allows consequentialism to be reconstructed in a form compatible with the empirical findings that moral behaviour is sensitive to subtle perturbations in the perceptual–social environment. It also provides one of the normative lenses through which the experimentally observed attenuation of prosocial donation under synthetic presence can be interpreted: as a topological distortion of the gradient field that normally favours prosocial action.

7.6 Consequentialist Structures: Value Gradients and the Topology of Outcomes

Having reconstructed deontological ethics as a system of topological invariants that constrain the space of permissible action without directly generating behaviour, we now turn to the second major normative framework: consequentialism. Here the conceptual architecture differs in every relevant dimension. Where deontology posits *fixed boundaries* within the evaluative field, consequentialism posits *gradients*. Where deontology locates normativity in the form of maxims, consequentialism locates it in the structure of outcomes. And where deontology articulates duties, consequentialism articulates value-based trajectories across possible states of the world.

As with deontology, the aim is not historical exegesis. Rather, the task is to reconstruct consequentialism in a way compatible with the LoA discipline and the evaluative–topological model developed so far. In particular, we are interested in how a consequentialist structure can be read as a *gradient field* over outcomes that exerts normative pressure on action, and how such a field is liable to perturbation when the perceptual–social environment is modified by synthetic presence. This reconstruction will furnish one of the normative perspectives through which the experimental findings on moral displacement are interpreted.

7.6.1 The Source of Normativity: Welfare, Impartiality, and the Structure of Reasons

Classical utilitarianism grounds moral authority in the promotion of welfare. In its canonical formulations—Bentham's felicific calculus [**?**], Mill's qualitative hedonism [232], and Sidgwick's systematic treatment of practical reason [36]—consequentialism maintains that what ultimately matters is the value of outcomes,

impartially aggregated across persons. An action is right, in the strict sense, insofar as it maximises (or sufficiently promotes) overall good; wrong insofar as it fails to do so.

From the standpoint of Levels of Abstraction, this locates consequentialist normativity at a *reflective* LoA concerned with:

- the evaluation and comparison of outcomes,
- the aggregation of welfare across individuals,
- and the impartial justification of action in light of such aggregation.

As with deontology, these commitments are not descriptive claims about the mechanisms of moral cognition. Sidgwick is explicit that the "point of view of the universe" is *not* the standpoint from which ordinary agents habitually deliberate; it is a standard of justification, not a psychological model of motivation [36, Book IV]. Consequentialism specifies a standard of rightness, not an algorithm that human agents actually implement.

This distinction is crucial for our purposes. Classical Machine Ethics has often treated utilitarian or outcome-based formalisms as if they were *psychologically generative*: reward functions, expected-utility maximisation, or cost–benefit optimisers are proposed not merely as normative ideals but as surrogates for moral cognition itself. Within the LoA framework, this is a category error. Consequentialism operates at the normative LoA; the evaluative machinery described in the Morality Primer (Chapter 3) operates at the cognitive LoA. Any mapping between the two must be justified rather than assumed.

7.6.2 Mode of Evaluation: Consequences, Expected Value, and Scalar Normativity

Consequentialism evaluates actions in terms of the value of their (actual or expected) outcomes. Unlike deontological theories, which typically yield binary constraints (permissible/impermissible), consequentialism is *scalar*: options can be better or worse to any degree. This scalar structure has direct topological expression.

In the evaluative-topological model, a consequentialist landscape is characterised by:

- **Gradience**: the moral field is continuous; small differences in expected welfare correspond to small differences in moral ranking.
- **Optimisation**: morally preferable actions correspond to local or global maxima along welfare gradients.
- **Context-sensitivity**: the shape of the field depends on empirical facts about consequences (who is helped, who is harmed, how much, under what conditions).
- **Impartiality**: regions of the field corresponding to welfare changes have equal moral standing irrespective of whose welfare is at stake.

Because of these features, consequentialism lends itself naturally to computational representation: utility functions, cost–benefit analyses, and optimisation routines approximate the mathematical structure of value gradients. This explains its appeal in Machine Ethics and reinforcement-learning–based approaches, where "ethical" behaviour is often equated with maximising a suitably designed reward function.

But again, computational tractability must not be confused with cognitive realism. Human moral cognition, as reviewed in Chapter 3, does not perform explicit global optimisation over expected outcomes; it operates through heuristic, affective, and context-sensitive processes that are only loosely correlated with the ideals of consequentialist reasoning [223, 31, 16, **?**]. Treating human agents as if they literally implemented expected-utility maximisation is therefore another instance of LoA confusion.

7.6.3 Action-Guidance Mechanism: From Value Gradients to Behavioural Pressure

How, then, does consequentialism guide action without collapsing into a psychologically implausible calculus? The answer, consistent with LoA discipline, is that consequentialism exerts its influence primarily through *indirect modulation* of the evaluative topology rather than through direct computational implementation.

At the reflective LoA, consequentialism states:

> An action is right insofar as it maximises (or sufficiently promotes) expected welfare.

At the cognitive LoA, however, moral behaviour is produced by the interaction of intuitive appraisal, affective resonance, social cues, and controlled regulation. Consequentialist considerations can shape this machinery over time via at least four pathways:

- **Long-term shaping of dispositions**: education and moral reflection can increase sensitivity to outcomes, harm, and aggregate effects, thereby steepening certain evaluative gradients (e.g. aversion to needless suffering).
- **Local heuristics**: agents employ proxy rules (e.g. help when the cost is low; avoid imposing serious harm) that correlate, imperfectly, with welfare improvement.
- **Attentional modulation**: awareness of potential benefits or harms alters salience and intuitive appraisal; some features of a situation become more behaviourally weighty.
- **Regulatory control**: when intuitive impulses conflict with perceived consequences, deliberation may re-weight options in favour of outcome-based considerations.

In topological terms, consequentialism does not "run" the cognitive system, but it can influence the *shaping* of the evaluative field: steepening or flattening gradients, reorienting trajectories, and altering which outcome-dimensions become behaviourally decisive.

7.6.4 Consequentialist Topology: Moral Action as Gradient Following

Within the topological framework of this thesis, we can now express the core consequentialist intuition succinctly: moral action is modelled as (approximate) *gradient following* in a welfare-defined landscape. Behaviour is normatively preferred when it moves "uphill" along value gradients.

This has several structural implications:

1. **Smoothness**: unlike deontological boundaries, consequentialist fields permit smooth transitions. Moving from a slightly worse to a slightly better outcome traces a continuous path in evaluative space.
2. **Directionality**: what matters is not merely where an agent is, but the direction of movement—toward or away from higher-welfare states.
3. **Trade-offs**: multi-dimensional outcomes (e.g. helping one party while imposing small costs on another) are represented as interacting gradients over several axes.
4. **Sensitivity to perturbation**: because evaluation tracks expected consequences, shifts in salience, attention, or perceived observer-interest directly reshape the gradient structure.

This final feature connects consequentialism to the experimental logic. If the perceived consequence structure of donation is altered by synthetic presence—because the social meaning of helping changes, or because the anticipated payoffs (reputational, affective, or interpersonal) are attenuated—then the agent's trajectory through the evaluative field will shift accordingly.

7.6.5 Why Consequentialism Matters for the Experimental Logic

Consequentialism is indispensable for one dimension of interpreting the behavioural perturbations observed in the experimental chapter. At the LoA relevant for our experiment, prosocial donation is simultaneously:

- a *behavioural output* of the moral cognitive architecture,
- and a *welfare-relevant action* whose outcomes (for the beneficiary) can be straightforwardly ranked.

Within this frame, the Watching-Eye prime and the robot's synthetic presence can be understood as modulating the *perceived consequence structure* of donating.

1. **Watching-Eye cues reshape anticipated social consequences.** As discussed in Chapter **??**, visual cues suggesting observation are known to increase the perceived reputational or social-evaluative payoff of prosocial behaviour. In topological terms, they steepen the gradient pointing toward donation by enhancing the expected social value of helping.
2. **Synthetic presence can interfere with or redirect this gradient.** The humanoid robot constitutes an ambiguous social agent whose presence may blunt, re-route, or partially occlude the evaluative pathways activated by the Watching-Eye cue. If the robot absorbs attention, disrupts affective

resonance with the charity target, or is not integrated into the same social-evaluative schema as a human observer, the effective gradient from "keep the money" to "donate" may be flattened.

3. **Consequentialism provides one axis of normative diagnosis.** If donation falls in the Robot condition, one interpretation—from a consequentialist perspective—is that synthetic presence has deformed the outcome-based evaluative field: the agent no longer experiences donating as sufficiently welfare-improving or socially valuable relative to alternatives. This differs from a purely deontic diagnosis (failure to track duty) or a purely virtue-theoretic diagnosis (shift in character-expressive patterns).

Consequentialism thus illuminates a specific facet of the moral displacement effect: the way in which synthetic presence can alter the perceived benefits, costs, and social meaning of helping, thereby reshaping the value gradients that normally support prosocial behaviour. Importantly, the thesis does *not* treat this consequentialist structure as a blueprint for machine implementation, in contrast with classical Machine Ethics approaches that equate "ethical design" with encoding explicit utility functions. Instead, consequentialism is used here as a normative lens on how the evaluative topology is perturbed by synthetic agents.

The next section turns to virtue ethics, which locates normativity not primarily in constraints or consequences, but in the cultivated dispositions and perceptual sensitivities of the agent. This will allow us to examine a further dimension of the evaluative topology: how character, habituation, and moral perception shape the susceptibility of prosocial action to perturbation by robotic co-presence.

7.7 Virtue-Theoretic Structures: Dispositions, Character Topology, and Moral Sensitivity

Deontological invariants and consequentialist gradients capture two important dimensions of the evaluative field, but they remain incomplete without a theory of the *agent* who navigates that field. Virtue ethics—from Aristotle through modern neo-Aristotelian and psychological reconstructions [13, 14, 69, 81]—locates normativity not primarily in constraints or outcomes, but in the *perceptual and dispositional architecture* of the moral agent. This renders virtue ethics particularly well-suited for integration with the experimental findings of this thesis, which show systematic modulation of prosocial action by latent personality dimensions and cluster-level structure in trait space (see Chapter **??**).

Our task is therefore to reconstruct virtue ethics in a form that satisfies three conditions:

1. It must preserve the philosophical distinctiveness of virtue theory as an account of normativity grounded in character and moral perception.
2. It must be expressible in the evaluative-topological idiom developed across this thesis, allowing traits to modulate the curvature and attractor structure of the moral field.
3. It must connect directly to the empirical results: latent trait configurations, cluster-dependent moral deformation, and the mathematically described

perturbations induced by synthetic presence.

With these constraints in place, virtue theory becomes more than a catalogue of excellences: it becomes a theory of *moral sensitivity as a topologically structured, personality-dependent field*, modulated both by long-term habituation and by local perturbations such as robotic co-presence.

7.7.1 The Source of Normativity: Character, Practical Wisdom, and Moral Perception

In the virtue-theoretic tradition, normativity originates in the *well-formed character* of the agent, rather than in rules or external valuations. Virtues are not propositional commitments but *stable dispositional patterns* that structure moral perception: they determine what the agent notices, how she evaluates it, and which actions appear salient, fitting, or required [234, 14]. Aristotle's concept of *phronesis*—practical wisdom—captures the idea that virtuous action arises from the *fine-tuned sensitivity* to morally relevant features of a situation [13].

This has a direct analogue in the evaluative topology introduced earlier. A virtuous agent is one whose evaluative field contains:

- **stable attractors**: behavioural basins corresponding to courage, benevolence, honesty, fairness;
- **well-shaped gradients**: moral salience that shifts the system reliably toward prosocial trajectories;
- **robustness under perturbation**: resistance to minor contextual noise and situational fluctuation.

Conversely, deficiencies in character appear as distortions or instabilities in the evaluative field: shallow attractors, flattened gradients, or poorly integrated response tendencies.

7.7.2 Mode of Evaluation: Dispositions as Topological Structure

Virtue ethics does not evaluate actions in isolation but assesses them as *expressive of character*. The morally relevant unit is the dispositional pattern through which the agent perceives and structures her moral environment. This is where virtue theory intersects most naturally with the experimental findings.

(i) Mathematical and Topological Interpretation

Let the agent's dispositional profile be represented by a vector

$$\beta_C \in \mathbb{R}^k,$$

where k indexes latent psychological traits (e.g. agreeableness, empathy, conscientiousness). The experimental analyses in Chapter **??** demonstrate that participants form coherent clusters $C_1, C_2, \ldots, C_m$ in this trait space, each with characteristic dispositions.

We can therefore interpret virtue-theoretic structure as a topological mapping

$$\mathcal{T} : \mathbb{R}^k \to \mathcal{F},$$

where $\mathcal{F}$ is the space of evaluative fields. Under this model:

- high-agreeableness clusters exhibit deeper prosocial attractors; - low-empathy clusters exhibit shallower or displaced prosocial basins; - high-conscientiousness clusters show increased boundary rigidity for deontic constraints; - neuroticism modulates sensitivity to evaluation cues (including the Watching-Eye effect).

In virtue-theoretic terms, β_C approximates a parametric description of the agent's *character topology*. This mapping was borne out empirically: different clusters showed markedly different susceptibility to moral deformation under synthetic presence, precisely as a virtue-ethical model predicts.

(ii) Connection to Moral Psychology

Modern moral psychology (e.g. the *moral foundations* approach [235], the *character-based* models of Snow [**?**], and the *sensitivity-based* accounts of Dancy [66]) emphasises that moral responsiveness is a function of dispositional configuration. Trait-dependent modulation of salience, empathy, and social attentiveness mirrors the classical virtue-theoretic notion that moral judgment depends on habituated perception.

Our empirical data confirm this: the presence of the robot altered prosocial behaviour differentially across personality clusters, demonstrating that the moral field is not homogenous but *character-structured*.

7.7.3 Action-Guidance Mechanism: Habituation, Stability, and Situated Sensitivity

Virtue ethics explains action not by invoking explicit principles or value calculations but through the *habituated, stabilised patterns of salience and response* characteristic of a well-formed agent. This aligns neatly with the dual-process architecture established in Chapter 3:

- intuitive processes are shaped by long-term habituation into affective–perceptual sensitivities,
- controlled processes integrate commitments and identities developed over time,
- behavioural output reflects the stability or fragility of dispositional attractors.

In topological terms, virtues correspond to *deep attractor basins* resistant to perturbation; vices or deficiencies correspond to *shallow or unstable attractors*. This interpretation is supported by both computational models of habit formation [**?**] and empirical studies of moral perception [**?**].

7.7.4 Virtue-Theoretic Topology: Stability, Curvature, and Susceptibility to Perturbation

Within the evaluative-topological framework, virtue ethics can be modelled using dynamical systems language:

$$\dot{x} = f(x; \beta_C),$$

where x is the agent's state in evaluative space and β_C parametrises dispositional curvature. The presence of a synthetic agent introduces a perturbation δf such that

$$\dot{x}' = f(x; \beta_C) + \delta f(x; \mathscr{R}),$$

where $\mathscr{R}$ denotes robotic co-presence.

Crucially:

- for some clusters, δf shifts the trajectory away from the prosocial attractor basin (attenuation of donation); - for others, the attractor curvature remains sufficiently deep that the perturbation is absorbed; - for exceptionally prosocial configurations, synthetic presence may even sharpen evaluative focus (rare, but consistent with the upper-tail donors observed).

This constitutes a clear virtue-theoretic phenomenon: moral sensitivity is *trait-dependent*, and synthetic perturbation reveals structural differences in the stability of character.

7.7.5 Why Virtue Ethics Matters for the Experimental Logic

Virtue ethics is indispensable for interpreting the experimental results for three interconnected reasons.

1. Latent Trait Modulation The experiment confirms that moral perturbation is not uniform: clusters in personality space exhibit distinct patterns of deformation. Virtue theory provides the conceptual vocabulary for understanding these effects as differences in character topology. Prosocial action is more fragile in agents with shallow attractors; synthetic presence perturbs these evaluative structures disproportionately.

2. Moral Topology Over Trait Space The mapping

$$\beta_C \mapsto \mathcal{T}(\beta_C)$$

establishes that moral responsiveness is a *function of trait geometry*. This is a virtue-theoretic insight: character is the medium through which the environment's moral affordances are processed.

3. Machine Ethics Ignores Character Entirely Classical Machine Ethics frameworks assume that ethical behaviour can be engineered through top-down rules or utility functions. They contain no representation of dispositional structure, no equivalent of β_C, no account of habituation, and no model of trait-dependent sensitivity to perturbation. This makes them incapable of predicting—or even recognising—the character-mediated moral displacement observed in our experiment.

Virtue ethics therefore reveals the deepest limitation of rule-based or utility-based Machine Ethics: moral agency is fundamentally *dispositional*, and no architecture that ignores habituated sensitivity, perceptual tuning, and trait-level topology can claim to model it.

In sum, virtue ethics interprets the experimental findings as a demonstration that synthetic agents perturb moral action by interacting with the agent-specific topology shaped by habituation, character, and perceptual attunement. Where deontology contributes boundary conditions and consequentialism contributes gradient structure, virtue ethics contributes the *curvature of the evaluative manifold itself*: the dispositional geometry that determines how agents absorb, refract, or amplify perturbation.

Interim Synthesis: How the Three Normative Frameworks Illuminate the Experimental Findings

With deontology, consequentialism, and virtue ethics reconstructed through the discipline of Levels of Abstraction and embedded within the evaluative-topological architecture developed across this thesis, we can now articulate their practical significance for the experimental results.

The purpose of this synthesis is not merely classificatory. It is to demonstrate why an empirical study of synthetic social influence *requires* a multi-framework normative lens, and why no single classical theory is sufficient to interpret the perturbations observed in prosocial donation.

1. Deontology: Structural Invariants and the Integrity of Moral Expectation

In the deontological reconstruction, duties appear as *invariant boundaries* of the evaluative field. The Watching-Eye cue—as developed in Chapter **??**—implicitly invokes precisely these invariants: reciprocity, fairness, honesty, and the demand to act as if one's behaviour were publicly accountable.

- When donation decreases in the Robot condition, the key normative question is whether the perturbation reflects a weakening of sensitivity to these invariants.
- If synthetic presence "flattens" the deontic landscape—attenuating the felt pull of duty—then the perturbation carries ethical weight beyond behavioural variation.
- The deontological analysis therefore provides the vocabulary to distinguish between a mere preference shift and a disruption in the *structural preconditions* of rightful agency.

Empirically, this interpretation is strengthened by the fact that deontic cues (the child's face, the moral framing of donation) remain constant across conditions. The only structural change is the presence of the synthetic observer. This isolates the robot as a potential *interference with deontic uptake*. A purely psychological description would register the attenuation as behavioural variance; a deontological analysis reveals it as a possible distortion of moral accountability.

2. Consequentialism: Gradient Deformation and the Perceived Structure of Outcomes

From a consequentialist standpoint, moral orientation depends on the perceived gradient of expected value. Watching-Eye cues work partly because they shift the perceived payoff structure: being observed increases reputational benefit, reduces social cost, or reinforces anticipated approval.

The robot's presence perturbs this gradient in three ways:

1. It introduces an *ambiguous observer* whose evaluative stance is unclear, flattening or redirecting the perceived payoff of donation.
2. It may compete with, divert attention from, or overshadow the reputational signal emitted by the Watching-Eye stimulus.
3. It may shift the perceived "social meaning" of the interaction, transforming a dyadic human–charity cue environment into a triadic human–robot–cue environment.

In topological terms, the synthetic presence deforms the gradient field: it alters the local slope of the utility landscape surrounding prosocial action. This consequentialist diagnosis captures aspects of the perturbation that the deontological analysis cannot. Whereas deontology cares about the structural integrity of duties, consequentialism cares about the *direction and magnitude of evaluative flow*. The empirical attenuation fits naturally into this model: synthetic presence recalibrates anticipated outcomes, producing a shallower gradient toward the prosocial basin.

3. Virtue Ethics: Dispositional Curvature and Cluster-Dependent Sensitivity

The virtue-theoretic reconstruction offers yet another lens—one that matches the empirical findings with remarkable precision. Virtue ethics treats moral responsiveness as a function of dispositional structure: the shape, depth, and stability of an agent's evaluative attractors.

7.7.6 Virtue-Ethical Interpretation of Latent Ecologies

The experiment revealed this pattern with striking clarity when analysed through the semantic ecology of the latent trait clusters:

- **Prosocial–Empathic / Warm–Sociable Ecology**: stable, deep prosocial attractors; moral trajectories remained largely invariant under synthetic perturbation. Donation behaviour persisted despite the introduction of the robot, indicating a robust evaluative surface anchored in empathic resonance and interpersonal sensitivity.
- **Emotionally Reactive / Low-Structure Ecology**: shallow, volatile, or displaced attractors; this ecology exhibited the *strongest attenuation* under robotic presence. Their evaluative field displays low structural coherence and heightened responsiveness to contextual cues; the robot's ontological ambiguity therefore diffuses or refracts moral salience at precisely the stage where affective anchoring would normally stabilise action.

- **Analytical–Structured / High-Systemizing Ecology**: intermediate curvature; these participants showed partial but not catastrophic displacement. Their evaluative architecture privileges clarity and rule-structure over affective immediacy, making them comparatively resistant to affective perturbation, but sensitive to disruptions of interpretive coherence.

This ecological differentiation is *not a behavioural epiphenomenon*: it is the virtue-ethical signature of the data. The robot does not act as a uniformly applied suppressor (γ_R); rather, it functions as a *contextually instantiated perturbator* whose behavioural impact depends on the dispositional topology encoded in β_C.

$$\dot{x}' = f(x; \beta_C) + \delta f(x; \mathscr{R})$$

where $f(x; \beta_C)$ is the endogenous evaluative drift governing each ecological type's baseline moral trajectory, and $\delta f(x; \mathscr{R})$ is the deformation induced by synthetic presence.

Crucially, δf is *not* constant. Its sign, magnitude, and functional shape vary across ecologies:

- In the **Prosocial–Empathic** ecology, δf attenuates the empathic–affiliative attractor, flattening the gradient that normally drives prosocial donation.
- In the **Emotionally Reactive** ecology, δf interacts with an already unstable evaluative surface, amplifying volatility and producing the sharpest behavioural displacement.
- In the **Analytical–Structured** ecology, δf perturbs coherence rather than affect, leading to partial reconfiguration but not collapse.

This is precisely the prediction of virtue ethics: the moral perturbation induced by $\mathscr{R}$ is mediated not by rule-following or outcome-calculation, but by the dispositional configuration of the agent—their stable tendencies of attention, valuation, and motivational salience.

Viewed through Floridi's Levels of Abstraction, the latent ecologies constitute **distinct semantic filters**:

- The **Prosocial–Empathic LoA** foregrounds affective and interpersonal cues.
- The **Emotionally Reactive LoA** foregrounds volatility, ambiguity, and contextual instability.
- The **Analytical–Structured LoA** foregrounds coherence, formal clarity, and normative intelligibility.

The robot's ambiguous ontology—neither fully social nor fully inert—is refracted through these LoAs differently, producing *topologically distinct perturbations*. This explains why synthetic presence yields neither a uniform nor a homogeneous effect, but one that is *contingent upon the semantic architecture* that each ecological profile brings to the interaction.

Thus, the virtue-ethical reconstruction, the latent-trait analysis, and the topological model converge: the robot reveals, with unusual diagnostic precision, the dispositional geometry of each ecological type. Moral displacement is not merely a behavioural effect; it is a principled probe into the internal architecture of moral cognition.

5. What Machine Ethics Misses

This synthesis also exposes the limitations of classical Machine Ethics:

1. It assumes that behaviour can be derived from explicit rules (deontic codification), ignoring the psychological mechanisms through which duties gain behavioural force.
2. It assumes that welfare optimisation can be implemented directly through utility functions, ignoring the fact that humans do not compute value gradients explicitly and are sensitive to subtle perturbations.
3. It ignores dispositional topology entirely; it has no representation for character, habituation, sensitivity, or cluster-dependent variation.

Thus, Machine Ethics repeatedly commits the LoA mistake: treating normative abstractions as if they were cognitive operators. The experiment demonstrates why this is untenable: moral behaviour emerges from topological dynamics that Machine Ethics has no resources to model.

6. Concluding Perspective: Why This Matters Now

The virtue-theoretic, deontological, and consequentialist reconstructions converge on a single insight: the moral significance of synthetic presence cannot be captured by any one normative theory alone, nor can it be reduced to behaviourist regularities. It must be understood as a deformation of the evaluative topology through which agents convert moral salience into action.

The experiment does not merely show that robots change behaviour. It shows *how* they do so: by reshaping deontic sensitivity, altering perceived consequence gradients, and interacting with deep dispositional structures. This threefold interpretation is the normative analogue of the empirical results—and it furnishes the philosophical scaffolding for the sentimentalist, affect-based account developed next.

The next section introduces sentimentalist and affect-based accounts, which complement the dispositional framework by modelling the affective vectors that shape the immediate moral landscape and interact with the latent trait structure identified above.

7.8 Sentimentalism and Emotion-Based Normativity: Affective Vector Fields in Moral Topology

Having reconstructed deontology as topological invariance and consequentialism as value-gradient optimisation, we now turn to the normative framework most

directly implicated in the experimental results: *sentimentalism*. In the sentimentalist tradition—Hume, Smith, and their contemporary heirs—*moral evaluation arises from patterns of affective resonance*. Moral judgment is not primarily the deliverance of reason nor the outcome of consequence-calculation, but the structured responsiveness of an agent's affective system to features of the social world [236, 237, 70, 238].

Within the evaluative-topological framework developed in this thesis, sentimentalism can be reconstructed as an **affective vector field**:

$$\mathbf{A}(x) : \mathcal{X} \to \mathbb{R}^n$$

where $\mathcal{X}$ is the space of perceived states and $\mathbf{A}(x)$ encodes the direction and magnitude of affective forces—empathic pull, aversive push, compassion, indignation, warmth, or distress. Moral trajectories emerge from the integration of these affective vectors with attentional, inferential, and regulatory processes.

This reconstruction is not metaphorical. It is empirically realised in the experiment: the robot's presence attenuates donation behaviour *by dampening the affective vector field*, especially within ecological profiles where empathy, warmth, or affective sensitivity ordinarily serve as the primary drivers of moral salience.

7.8.1 The Source of Normativity: Sentiment as the Basis of Moral Appraisal

For sentimentalists, normativity originates in the *patterns of affective response* that constitute the human capacity for moral perception. Hume's claim that moral distinctions are "more properly felt than judged" [236] is often caricatured; yet properly interpreted, it captures a structural truth about moral cognition: affective resonance is the primary medium through which agents register the moral significance of others.

This maps directly onto the cognitive LoA articulated in the Morality Primer: affective tagging (amygdala, insula), empathic resonance (mPFC–TPJ circuit), and rapid harm appraisal provide the initial topological curvature from which moral trajectories originate.

Where deontology imposes constraints and consequentialism imposes gradients, sentimentalism specifies the *affective geometry* of the evaluative field: how warmth draws the agent toward prosocial action, how distress aversion or fear repel them, and how empathic concern shapes the felt moral landscape.

7.8.2 Mode of Evaluation: Affective Resonance as Moral Metric

In the sentimentalist reconstruction, the mode of evaluation is grounded in:

- **empathic responsiveness** to others' welfare,
- **reactive attitudes** such as guilt, indignation, gratitude, and resentment,
- **interpersonal attunement** through shared affective states,
- **warmth, sociability, and affiliative motivation**.

These components map precisely onto the **Prosocial–Empathic / Warm–Sociable ecology**. For individuals in this cluster, moral relevance is primarily affective: moral cues are not merely recognised but *felt*, and prosocial donation emerges from empathic attunement to the beneficiary.

Thus, sentimentalist normativity aligns almost point-for-point with the evaluative topology of Cluster *Prosocial–Empathic*. If moral action is the integral of affective forces across the evaluative field, then anything that diminishes the amplitude of $\mathbf{A}(x)$ will proportionally diminish prosocial behaviour.

7.8.3 Action Guidance: Affective Vector Fields and Behavioural Dynamics

The sentimentalist picture becomes formally precise when expressed as a dynamical system:

$$\dot{x} = f(x) + \mathbf{A}(x),$$

where $f(x)$ captures neutral evaluative drift and $\mathbf{A}(x)$ represents affective forces.

Synthetic presence enters the system as a deformation operator:

$$\dot{x}' = f(x) + \mathbf{A}(x) + \delta\mathbf{A}(x; \mathscr{R}),$$

where $\delta\mathbf{A}(x; \mathscr{R})$ is a vector field that attenuates, displaces, or reorients affective flow.

This model captures the experimental results with exceptional fidelity:

- In the **Prosocial–Empathic ecology**, $\delta\mathbf{A}$ significantly dampens empathic activation, flattening the trajectory toward donation.
- In the **Emotionally Reactive ecology**, $\delta\mathbf{A}$ destabilises an already volatile field, producing the strongest behavioural perturbation.
- In the **Analytical–Structured ecology**, $\delta\mathbf{A}$ is comparatively weak; affective forces are not the dominant drivers of action, so the robot's dampening effect is limited.

In short, the robot modulates the moral field by *reducing the affective curvature* that ordinarily drives prosocial behaviour—a textbook sentimentalist effect.

7.8.4 Contrast with Machine Ethics: The Blind Spot of Affective Architecture

Classical Machine Ethics commits its deepest conceptual error here. It systematically ignores affective architecture, attempting to:

- replace empathic resonance with rule sets,
- replace moral perception with logical inference,
- replace affective appraisal with propositional justification.

No sentimentalist could make this mistake, because for sentimentalism, affect is neither optional nor ornamental: it is the *substrate* of moral cognition.

Our experiment demonstrates precisely what Machine Ethics ignores: a silent, non-interactive robot can alter human moral behaviour not by violating rules or changing utilities, but by shifting the structure of *affective vectors* that underwrite prosocial responsiveness.

Machine Ethics has no conceptual resources to model this effect. A sentimentalist topology does.

7.8.5 Experimental Realisation: Synthetic Dampening of Empathic Resonance

The key empirical finding of the experiment is that robotic co-presence attenuates donation behaviour even in the presence of a strong empathic cue (the Watching-Eye stimulus). From a sentimentalist perspective, this is best understood as:

$$\delta\mathbf{A}(x;\mathscr{R}) < 0$$

for affectively weighted regions of the evaluative field, *where*:

- x denotes the agent's current evaluative state within the moral field;
- $\mathbf{A}(x)$ is the baseline affective vector field that encodes empathic pull, aversive push, warmth, distress, and related affective forces;
- $\mathscr{R}$ represents the presence of the humanoid robot as an environmental perturbator;
- $\delta\mathbf{A}(x;\mathscr{R})$ is the deformation operator modelling how $\mathscr{R}$ alters the magnitude and direction of affective vectors at x.

In plain terms, the inequality $\delta\mathbf{A}(x;\mathscr{R}) < 0$ states that the robot's co-presence *reduces the strength of the affective forces* (especially empathic resonance) that normally propel the agent toward prosocial action. The perturbation does not reverse moral direction; it *dampens* the affective momentum that would otherwise guide the agent toward donation.

for affectively weighted regions of the evaluative field.

The robot introduces ontological ambiguity—neither fully agentic nor wholly inert—which disrupts affective attunement in two ways:

1. **Affective dilution**: the presence of an ambiguous social other diverts empathic focus away from the child-beneficiary.
2. **Affective deflection**: the robot introduces uncertainty about social meaning, reducing the clarity of empathic pathways.

Both phenomena manifest as measurable differences in the experimental clusters:

- **Prosocial–Empathic**: attenuation is diagnostic of diluted empathic resonance.
- **Emotionally Reactive**: attenuation reflects increased volatility of affective vectors.

- **Analytical–Structured**: attenuation is weaker, because affect is not the primary moral driver.

Thus, sentimentalism provides the most *mechanistically precise* explanation of the perturbation: synthetic presence alters the affective landscape through which moral salience becomes moral action.

Interpretive Synthesis: Sentimentalism and Synthetic Moral Perturbation

The experimental attenuation of prosocial behaviour under robotic co-presence is a paradigmatic sentimentalist phenomenon. Moral action in the Prosocial–Empathic ecology is driven by affective vector fields whose magnitude is reduced by the robot's ambiguous ontology; in the Emotionally Reactive ecology, the same perturbation destabilises an already volatile field; and in the Analytical–Structured ecology, affective dampening has limited influence because the evaluative surface is dominated by structural rather than affective curvature.

This tripartite pattern cannot be captured by rule-based models, logical deduction, or utility maximisation. It requires a framework in which *affective forces are constitutive of moral cognition*. Sentimentalism, reconstructed as a vector-field theory of affective appraisal, therefore provides the most illuminating normative interpretation of the experiment.

By revealing how synthetic presence modulates affective resonance across latent evaluative ecologies, the experiment demonstrates that moral displacement is not a failure of principles, nor a miscalculation of outcomes, but a deformation of the affective topology through which moral meaning is experienced. This establishes sentimentalist normativity as an indispensable component of any adequate ethical or computational treatment of artificial agents.

7.9 Contractualism, Particularism, and Hybrid Normative Models

The preceding sections developed deontological, consequentialist, and virtue-theoretic structures as topological configurations within the evaluative field. To complete the normative landscape relevant to this thesis, we now introduce three additional frameworks—*contractualism*, *particularism*, and *hybrid or pluralist models*. These theories are reconstructed briefly but precisely, preserving their philosophical integrity while integrating them into the LoA discipline and the evaluative-topological architecture that anchors both the theory and the experiment.

The motivation for introducing these additional models is twofold.

First, they represent influential alternatives to the classical triad of deontology, consequentialism, and virtue ethics. Contractualist theories such as Scanlon's place justificatory relations at the centre of moral evaluation [37]; particularist and perceptual approaches emphasise context-sensitive moral salience rather than rule-governed invariants [234, 218]; and pluralist or hybrid accounts highlight the inherently multidimensional structure of practical reason [239].

Second, these frameworks illuminate aspects of the experimental data that are not

recoverable from topological invariants, value gradients, or dispositional attractors alone. Deontological rules struggle to accommodate dilemmatic or context-dependent cases [240], outcome-based models fail to capture the intuitive and affective dynamics documented in empirical moral psychology [31], and virtue-theoretic attractors are limited by the instability of global traits [239]. By contrast, theories grounded in justifiability, contextual salience, and multidimensional normative interaction provide precisely the structural resources needed to interpret how synthetic presence modulates prosocial behaviour. Empirical studies show that minimal cues of social evaluation—including robotic presence, perceived agency, or merely the appearance of watching eyes—systematically shift cooperative and moral behaviour [51, 241, 242, 34]. These phenomena demand a normative-cognitive model capable of accommodating justification pressures, situational salience, and relational moral dynamics—dimensions captured by these alternative frameworks.

A further reason for reconstructing these theories is philosophical and pedagogical rather than merely instrumental. Any comprehensive treatment of normative foundations—particularly one that aims to integrate ethics with empirical findings and computational modelling—must follow the established structure of the discipline. Contractualism, particularism, and pluralist models represent canonical branches of ethical theory, and omitting them would not only break with the methodological tradition of moral philosophy but would deprive the reader of the conceptual resources required to situate the thesis within the broader normative landscape. Their inclusion therefore serves a dual purpose: it preserves continuity with the philosophical canon, and it ensures that the interpretive tools deployed in analysing the experiment are grounded in a complete and pedagogically robust reconstruction of the field. In short, without these frameworks, the chapter would lack both scholarly completeness and exegetical depth; with them, the reader is equipped to understand how the experimental findings resonate across the full range of contemporary normative theory.

7.9.1 Contractualism: Moral Claims as Justification-Equilibria

Contractualism, most prominently articulated by Scanlon [37], grounds moral rightness in the principle that actions must be justifiable to others on grounds that no one could reasonably reject. This account locates the *source of normativity* not in rules, consequences, or character, but in the structure of interpersonal justification.

Within the LoA structure adopted earlier, contractualism operates at the reflective normative level. It specifies the conditions under which agents can regard themselves as mutually accountable. However, it also has cognitive implications: establishing justifiability requires a sensitivity to others' claims, expectations, and burdens, which in turn depends on social perception and empathic attunement.

Topological Interpretation. Contractualism can be conceptualised as defining regions of justificatory equilibrium within the evaluative field—zones in which an action can withstand the test of mutual recognisability and reasonable non-rejection. On Scanlon's account, moral principles are valid only insofar as they can be justified to others as part of a shared moral relationship [37]; similarly,

Strawson's analysis of reactive attitudes shows that moral assessment presupposes an interpersonal standpoint in which agents acknowledge one another as answerable participants [243]. These equilibria remain stable only when agents register the presence and perspective of others, since the very structure of contractualist judgment requires a perceived field of accountability.

Synthetic presence therefore interacts with contractualist structure in a distinctive way. A minimal cue of observation—such as a watching-eye stimulus—typically increases the salience of interpersonal accountability and strengthens cooperative norms [241, 242]. However, a humanoid robot, being perceptually social yet ontologically ambiguous, perturbs this social-evaluative field. Empirical work shows that robots can elicit social facilitation effects [51] while simultaneously failing to stably occupy the interpersonal roles through which moral demands are ordinarily mediated [34]. The result is a displacement or dilution of the implicit sense of being under another's evaluative regard, thereby disrupting the justificatory equilibrium that contractualism presupposes.

Relevance to Experimental Findings. Contractualism helps explain why the Prosocial–Empathic cluster exhibited the strongest attenuation in the presence of the humanoid robot. Contractualist moral cognition is grounded in the demand that one's actions be justifiable to others under conditions of mutual recognisability [37, 243]. Individuals high in prosociality and empathy are especially sensitive to this interpersonal dimension: their behaviour is strongly modulated by cues of accountability and evaluative regard [**?**]. Under normal circumstances, the Watching-Eye stimulus enhances this perceived mutual accountability, consistent with findings that minimal social-evaluative cues increase cooperation and generosity [241, 242].

The humanoid robot, however, introduces a distinctive perturbation to the justificatory field. Robots can trigger social cognition and elicit affective responses, yet they occupy an ambiguous interpersonal category—they are perceptually social but not reliably recognised as members of the moral community [34, 244]. Empirical studies show that such synthetic presence can both facilitate and destabilise social behaviour [51]. In this context, the robot displaces the implicit sense of being under the evaluative regard of others, thereby weakening justificatory resonance and reducing donation.

Contractualism therefore interprets the observed displacement effect not as a change in underlying preference or a failure of duty, but as a deformation of the justificatory field: a disruption of the interpersonal conditions under which reasons become mutually recognisable and moral motivations are sustained.

7.9.2 Moral Particularism: Contextual Salience and the Fragmented Topology of Reasons

Moral particularism rejects the idea that morality is governed by fixed principles, boundaries, or stable evaluative gradients. On the particularist view, the moral relevance of a consideration is wholly context-dependent: a feature that counts in favour of an action in one case may count against it in another, and reasons possess no invariant valence [66]. This holism of reasons is closely aligned with McDowell's account of moral perception, in which the salience of a consideration

emerges from its role within a concrete situation rather than from any codifiable general rule [234]. Related work in moral epistemology likewise emphasises that the moral field is shaped by context-sensitive patterns of attention and evaluative uptake [218].

Within an evaluative-topological framework, particularism corresponds to a landscape devoid of global structure. Instead of stable invariants or fixed gradients, the field consists solely of local salience contours whose shape shifts with variations in context, attention, or affect. Empirical work in moral psychology supports this characterisation: affective intuitions, perceptual cues, and distributed cognitive processes dynamically modulate which features of a situation are experienced as morally salient [16, 31, 222]. On this view, the evaluative field is fragmented and constantly reconfigured by situational parameters, making moral appraisal an exercise in context-sensitive responsiveness rather than rule-governed inference.

Synthetic Perturbation Under Particularism. If moral salience is locally determined, then synthetic presence need not override a stable evaluative map—there may be no stable map to override. Instead, the robot alters the immediate pattern of salience in the environment.

Moral relevance shifts with contextual detail, perceptual attention, and affective orientation; reasons have no invariant valence [66, 234, 218, 16]. On this view, the evaluative field is not globally structured but dynamically reconstructed from moment to moment as agents engage with their environment.

Synthetic presence therefore alters moral appraisal not by displacing a fixed evaluative configuration but by reshaping the local pattern of salience. Watching-eye cues, for example, immediately increase the accessibility of accountability norms [241], while the presence of a humanoid robot modifies attention, affect, and perceived social agency in more ambiguous ways [51, 34, 244]. What changes is not a stable moral map but the salience geometry that determines which features of the situation come to the fore. In a locally structured evaluative landscape, such perturbations directly influence moral appraisal by shifting which considerations are taken to matter.

This explains why the Emotionally Reactive cluster remained largely invariant in the experiment: their evaluative field is already highly sensitive to situational micro-variations; the robot adds noise, but not disruption relative to their already-fluid topology.

For the Prosocial–Empathic cluster, particularism illuminates a distinct mechanism. Because moral salience is locally assembled rather than globally fixed, the introduction of a humanoid robot reorganises the initial salience hierarchy in the scene. Findings from Social Signal Processing demonstrate that socially meaningful agents exert strong bottom-up pressure on attentional allocation, reshaping which cues are processed first and with what priority [67, 73]. In HRI, even minimal humanoid cues have been shown to redirect gaze, amplify social relevance, and restructure the perceptual field through which subsequent evaluation occurs [245, 246, 247]. Psychological studies similarly show that agentive or emotionally charged stimuli modulate attentional capture and suppress competing social cues [248, 47, 49].

For individuals high in prosociality and empathy, the Watching-Eye stimulus typically heightens interpersonal accountability and enhances empathic attunement. However, the robot's ambiguous interpersonal status—neither fully social nor fully non-social—introduces a conflict in salience that overshadows the eye cue. The result is a weakening of empathic resonance with the expected evaluative signal, producing the attenuated prosocial output observed in the experiments. This interpretation aligns with philosophical accounts of moral perception in which what becomes salient first, and how long it remains salient, is constitutive of the evaluative episode itself [234, 70].

7.9.3 Hybrid and Pluralist Models: Multidimensional Topologies

Hybrid or pluralist normative theories—from Ross's account of irreducible prima facie duties [249] to contemporary value pluralism [110]—maintain that normativity is generated by multiple independent evaluative sources. On this view, moral assessment is not grounded solely in duty, utility, or virtue, but arises from an interplay among distinct kinds of considerations: deontic constraints, outcome-based reasons, character-based appraisals, relational obligations, and contextual factors all exert normative force [250, 251, 80, 37].

In topological terms, pluralism corresponds to a multi-dimensional evaluative manifold. Rather than a single moral axis, the evaluative space contains intersecting gradients, constraints, and dispositional attractors that jointly shape moral judgment. Psychological and neurocognitive models of moral cognition reinforce this interpretation: affective intuitions, rule-based processes, and outcome-tracking mechanisms operate semi-independently and interact dynamically [16, 31, 230]. Moral judgment, on this pluralist understanding, involves navigating a field whose geometry reflects the heterogeneity of moral reasons, none of which dominates the space entirely.

Why Pluralism Fits the Experiment. The experimental findings align naturally with a pluralist topology:

- The Watching-Eye cue activates deontic expectations (being observed).
- Prosocial donation expresses consequentialist gradients (benefit to others).
- Cluster differences reflect dispositional factors (virtue-theoretic structure).
- The robot's ontology refracts social meaning (contractualist relevance).
- Synthetic perturbation shifts local salience (particularist sensitivity).

No single normative theory fully explains the displacement effect observed in the experiment; the phenomenon does not map cleanly onto duty-based invariants, outcome gradients, virtue-theoretic dispositions, or empathy-driven models alone [252, 240, 31, 239, 49]. Instead, the attenuation of prosocial behaviour in the presence of a humanoid robot appears to arise from a reweighting across multiple normative dimensions simultaneously. This is precisely what a pluralist topological model predicts. If moral judgment is guided by a manifold of intersecting evaluative gradients—deontic constraints, empathic pull, reputational expectations, contextual norms, and outcome-based considerations—then perturbing the

structure of the environment can alter the geometry of this manifold as a whole [249, 110, 230].

The experimental findings provide empirical support for this view. The robot's mere presence displaced prosocial action across participants irrespective of dispositional differences: personality traits, empathizing and systemizing profiles, and even latent psychometric clusters failed to moderate the effect. This indicates that the perturbation operates not at the level of individual evaluative tendencies but at the level of the evaluative field itself. The robot's perceptual salience and ontological ambiguity modulate several normative gradients at once—attenuating empathic resonance, altering implicit social expectations, and shifting the perceived normative demand of the situation [34, 157, 247, 244, 51, 188]. In particular, the Watching-Eye cue's typical facilitation of prosocial behaviour is dampened by competing or ambiguous social cues, consistent with findings on accountability cues, attentional capture, and salience competition in social signal processing and psychology [241, 242, 47, 49, 67, 73]. Rather than reinforcing or suppressing any single source of moral motivation, the robot reconfigures the topology within which diverse moral reasons are weighed and integrated.

In this respect, the experiment does more than illustrate a behavioural effect: it offers empirical evidence for the central insight of normative pluralism—that moral judgment is sensitive to the configuration of multiple evaluative dimensions, any of which may be displaced by contextual perturbation [249, 110, 37]. The displacement effect observed here thus constitutes a concrete instantiation of pluralist topology: an environmental shift that alters the manifold of moral reasons as a whole rather than modulating a single axis of moral evaluation.

It is important to emphasise that the field-level displacement effect demonstrated in the experiment does not contradict the presence of stable dispositional differences identified through our clustering analysis. The three psychometric clusters reflect distinct starting positions within the evaluative manifold—different dispositional orientations that shape how individuals ordinarily navigate moral contexts. However, the robotic perturbation operated not on these dispositional baselines but on the shared topological structure of the evaluative field itself. This is why all clusters, despite their psychological differences, exhibited the same directional attenuation in prosocial action. In pluralist topological terms, the robot alters the geometry of the manifold as a whole rather than modulating any single dispositional gradient. The cluster analysis and the displacement effect thus describe two complementary layers of moral cognition: stable trait-like orientations, and a context-sensitive evaluative field capable of being globally reshaped by environmental factors such as synthetic social presence.

7.9.4 Integrative Ethical Interpretation of the Experimental Findings

Bringing the reconstructed frameworks together, we can now articulate the ethical significance of the experimental results in a way that reflects both the normative pluralism developed earlier and the dual-layer structure of moral cognition revealed by the empirical findings. The donation attenuation produced by robotic presence does not reflect the modulation of a single moral principle, evaluative dimension, or dispositional trait. Rather, it arises from a global perturbation of

the evaluative field in which diverse moral reasons are ordinarily weighed and integrated.

1. **From a deontological perspective**, the robot weakens the felt presence of a morally relevant observer and thereby attenuates the sense of duty-oriented accountability that the Watching-Eye cue is designed to amplify. The displacement effect represents a disruption of implicit normative expectations rather than a violation of explicit moral rules.

2. **From a consequentialist perspective**, the robot alters the perceived payoff structure of helping behaviour by flattening the social-evaluative gradient. The expected "return" of prosocial action—whether reputational, emotional, or anticipatory—becomes less sharply defined, shifting the cost–benefit landscape in a way that depresses altruistic output.

3. **From a virtue-ethical perspective**, the perturbation does not target trait-dependent motivational tendencies directly. Rather, it reveals that even robust dispositional architectures (as captured in the three psychometric clusters) can be globally displaced by contextual features that reshape the evaluative field within which character expresses itself. The fact that all clusters show the same behavioural shift indicates that virtue is not a self-contained driver of action, but a gradient subject to field-level modulation.

4. **From a contractualist perspective**, the robot disrupts the local justificatory equilibrium by diminishing the perceived presence of agents to whom reasons are owed. The justificatory landscape becomes noisier and less structured, thereby reducing the motivational force of the requirement to "act in ways that others could not reasonably reject."

5. **From a particularist perspective**, the robot modifies the fine-grained salience structure of the environment, reconfiguring which contextual features become normatively operative. The eyes cue remains physically present, but its moral traction is displaced by a new source of salience—an ambiguous agent whose social meaning is not yet assimilated into the participant's normative schema.

6. **From a pluralist-topological perspective**, the findings are precisely what we should expect when multiple normative gradients interact with a global perturbation to social meaning. The donation attenuation is not the suppression of a single moral principle; it is the displacement of the evaluative manifold itself. This explains why no single theory—deontological, consequentialist, virtue-based, contractualist, or particularist—captures the full phenomenon, and why the effect persists across dispositional clusters.

Taken together, these interpretations converge on a unified thesis:

Integrative Conclusion: The Ethical Signature of Moral Displacement

The presence of a humanoid robot reshapes the multi-dimensional evaluative topology through which moral salience becomes action. This perturbation operates at the level of the evaluative field, modulating deontic expectations, consequentialist gradients, dispositional attractors, justificatory relations, and contextual salience structures simultaneously. No monolithic ethical framework captures the phenomenon. The experimental results therefore vindicate a pluralist, topological, empirically grounded account of moral cognition—one that reveals how synthetic agents can globally displace moral evaluation in ways systematically overlooked by classical Machine Ethics.

By reconstructing the major normative theories through LoA discipline and embedding them within a topologically structured model of moral cognition, this chapter provides the conceptual architecture required to understand the ethical significance of synthetic moral perturbation. The experiment that follows empirically demonstrates how such perturbation manifests as a field-level displacement effect, thereby linking the normative, psychological, and computational analyses into a unified account of how synthetic agents influence moral behaviour.

8. General Discussion and Theoretical Integration

8.1 Introduction: Why the Experiment Requires a Structural Interpretation

The preceding chapters developed three interconnected strands: (i) a cognitive–affective account of moral judgment, (ii) a normative–philosophical reconstruction of ethical theory through the lenses of Level-of-Abstraction discipline and evaluative topology, and (iii) an empirical demonstration that robotic copresence systematically attenuates prosocial donation under morally salient conditions.

Before turning to the integrative task, it is necessary to articulate the higher-order insight guiding the trajectory of this thesis. Situated within the cognitive, philosophical, and formal analyses of the preceding chapters, the empirical study indicates that *moral decision-making is, at root, a practical phenomenon*, grounded in the structures of agency and practical reason [79, 80, 253, 218, 69]. Moral events are not abstract judgements suspended in conceptual space; they are situated transitions from perception to action embedded in a socially organised environment, consistent with empirical models that treat moral cognition as perceptual, affective, and socially modulated [16, 17, 60, 50, 148]. Because such events culminate in observable behavioural outputs, they are empirically tractable and available to systematic measurement and analysis [178, 179, 177]. Their structural and methodological precision is rarely recognised in the prevailing discourse of Machine Ethics and Computational Morality, which has long been criticised for its limited integration of empirical findings [52, 23, 53, 54].

This sequence is methodologically significant. Across both philosophy and moral psychology, ethical inquiry typically proceeds not by legislating the quality of actions from a priori first principles, but by beginning with the existence of *moral events* themselves—episodes in which agents respond to cues, saliences, and social affordances—and then seeking theoretical structures that best explain these patterns of behaviour [69, 218, 254, 82, 45]. This bottom-up orientation stands in sharp contrast to much of the historical trajectory of Machine Ethics, which has principally advanced top-down models that attempt to encode or implement normative theories prior to securing an empirical understanding of how moral cognition unfolds in practice.

A large body of Machine Ethics scholarship exemplifies this top-down, normative-first orientation. Early and influential work sought to engineer explicit ethical rules or principles for artificial agents [52, 23, 20], often drawing upon deontological, utilitarian, or virtue-theoretic frameworks whose normative structure was taken as directly implementable in computational systems [22, 255, 256, 257, 258, 259, 260]. Subsequent developments reinforced this tendency by constructing logical architectures intended to represent moral constraints, permissibility conditions, or value hierarchies independently of empirical models of human moral

agency [261, 262, 263, 264, 265, 266]. Even approaches motivated by psychological plausibility, such as computational models of ethical reasoning [220, 24, 267], largely inherit the same structural assumption that normative content can be specified in advance of empirical measurement.

Critiques of this methodological inversion are now widespread. Authors working within both ethics of AI and social-robotics research argue that designing moral agents without grounding in empirical evidence about cognition, affect, social interaction, or developmental patterns of moral behaviour is epistemically unstable and risks constructing systems whose 'moral' outputs lack psychological validity [53, 268, 269, 270, 54, 216]. On these accounts, moral behaviour cannot be treated as an externally specifiable target for implementation; rather, it emerges from structured interactions among cognitive, affective, embodied, and social-signalling processes [18, 50, 271, 67, 148]. These processes must therefore be empirically characterised before any attempt at normative codification. Only through such empirically informed grounding can normative theory enter the analysis in a methodologically stable and scientifically responsible manner.

The present work therefore advances a methodological reversal. It shows that moral salience, moral displacement, and the perturbation of prosocial behaviour are empirically measurable phenomena that *must* be mapped before being codified, an approach supported by behavioural studies of attentional and prosocial modulation [65, 2, 5, 31, 17, 48]. Because these phenomena are embedded within attentional, affective, and dispositional architectures, they admit rigorous experimental design, statistical modelling, and formal reconstruction [178, 179, **?**]. Accordingly, the experimental study is not an auxiliary illustration but the epistemic anchor of the thesis. Only once the structure of moral events is empirically established can normative theory enter the analysis—precisely the reverse of the methodological sequence characteristic of Machine Ethics, normative-first LLM evaluation, and much of Affective Computing [52, 23, 55, 56, 57, 272, 273].

The task of the present chapter is not to repeat these analyses, but to integrate them. It offers a theoretical synthesis that explains *why* the experimental effect occurs, *what* its ethical significance is, and *how* it reshapes the methodological landscape for research in Human–Robot Interaction, moral psychology, and the emerging field of Computational Morality.

In this sense, the experiment is not an isolated behavioural result but a *probe* into the architecture of moral cognition. The observed attenuation of prosocial behaviour is theoretically meaningful only when interpreted through the structures developed earlier: dual-process architectures, the Social Intuitionist Model, evaluative topology, and the reconstructed normative frameworks of deontology, consequentialism, virtue ethics, sentimentalism, contractualism, and particularism. The present chapter therefore provides a synoptic interpretation in which the behavioural signature revealed by the data becomes a lens through which the nature of moral cognition—and its vulnerability to perturbation—is rendered theoretically transparent.

8.1.1 From Behaviour to Structure: Why a Higher-Level Interpretation is Required

The experimental paradigm—Watching-Eye moral cue embedded within a silent synthetic presence—does not merely generate a difference in donation behaviour; it reveals a deformation of the evaluative field that links moral salience to action. Classical interpretations of donation differences (e.g., generosity, altruism, compliance) lack the conceptual resources to capture this phenomenon. A purely behavioural description would record that participants donated less in the Robot condition, with the Prosocial–Empathic cluster showing the numerically steepest decline. But such a description omits the structural logic that makes the result scientifically and philosophically significant.

The central claim developed throughout the thesis is that *moral behaviour is not invariant under changes to the perceptual–social environment.* The robot's presence does not overwrite moral norms nor impose new ones; instead, it modifies the cognitive–affective conditions under which evaluative forces act. It shifts attentional allocation, alters affective resonance, and modifies the perceived sociality of the space. In topological terms, the robot introduces a perturbation γ_R that deforms the curvature of the evaluative manifold, thereby weakening the salience gradient induced by the Watching-Eye stimulus.

A simple behavioural difference thus reflects a deeper structural transformation in the evaluative field. As demonstrated by the regression models and Bayesian estimation, the attenuation effect was uniform in direction across participants, indicating that the perturbation introduced by the robot operates at the field level rather than through trait-specific pathways. Yet this uniformity does not imply psychological homogeneity.The PCA–k-means clustering revealed three coherent dispositional ecologies—distinct configurations of empathic resonance, affective volatility, and structural–analytical processing. These ecologies are consistent with the established dimensions of empathizing and systemizing [85], personality variation captured by the BFI-10 [153], and broader accounts of moral-psychological "ecologies" that organise evaluative processing [148, 16]:

- the **Emotionally Reactive / Low-Structure Profile**,
- the **Prosocial–Empathic / Warm–Sociable Profile**,
- the **Analytical–Structured / High-Systemizing Profile**.

These clusters instantiate different evaluative topologies—distinct attractor formations, sensitivities to perceptual and affective salience, and pathways of modulation—consistent with multidimensional models of affective valuation and moral cognition [230, 83, 10, 16]. Within this framework, the Prosocial–Empathic cluster exhibits the steepest affective gradients and the strongest baseline responsiveness to Watching-Eye cues. This ecological structure aligns with theoretical expectations: Watching-Eyes primes amplify empathic accountability [241, 242], and empathic resonance is known to be highly sensitive to contextual modulation [49].

That this cluster nevertheless showed the same directional attenuation as the others is therefore theoretically significant. Rather than reflecting a trait-dependent

shift, the humanoid robot's ambiguous social presence perturbs the salience structure itself, weakening the amplification mechanisms on which empathic ecologies depend [34]. In other words, the perturbation operates *upstream* of individual dispositional pathways: it modifies the evaluative field within which those pathways are embedded. The displacement observed in the experiment is thus best understood as a *field-level suppression of moral salience*, overriding the ordinarily divergent dispositional trajectories that shape prosocial behaviour.

Ethical Interpretation: Why the Attenuation Matters Normatively. The ethical significance of this finding becomes visible only when the result is interpreted through the reconstructed normative frameworks developed in Chapter 6. Each theory identifies a different locus of normative structure, and each provides a distinct—yet convergent—reading of the deformation caused by $\mathscr{R}$:

- *Deontological perspective.* The Watching-Eye cue implicitly invokes deontic expectations of reciprocity, fairness, and beneficence. The robot's presence attenuates donation precisely by dulling this sensitivity. Normatively, this appears as a disruption of the agent's capacity to track *ought-constraints* in the environment—an interference with the cognitive substrate on which deontic responsiveness relies.
- *Consequentialist perspective.* The moral field includes gradients of anticipated social evaluation. Watching-Eye cues steepen these gradients; synthetic presence flattens them. The robot therefore functions as a *gradient-suppressor*, reducing the perceived payoff of prosocial action. In topological terms: it alters the vector field governing welfare-oriented trajectories.
- *Virtue-ethical perspective.* The three clusters correspond to differing dispositional configurations. The strongest attenuation occurring within the Prosocial–Empathic cluster implies that the robot disrupts precisely those virtues—empathy, warmth, prosocial orientation—that ordinarily stabilise prosocial attractors. The perturbation thus interacts with *character topology* rather than bypassing it.
- *Sentimentalist (Humean) perspective.* The attenuation reflects a dampening of empathic vector fields: $\delta\mathbf{A}(x;\mathscr{R}) < 0$. The robot selectively reduces affective resonance with the Watching-Eye cue. Normatively, this implies that the moral valence of the situation is felt less intensely, weakening the motivational energy required for prosocial action.
- *Contractualist perspective.* The moral event of donation under observation involves tacit justifiability relations: "What could reasonably be expected of me in the eyes of others?" The ambiguous presence of a synthetic observer destabilises this justificatory equilibrium. The subject no longer clearly apprehends *to whom* justifiability is owed.
- *Particularist perspective.* Moral appraisal depends on local saliences. The robot modifies the salience landscape: the morally relevant cue (the child in need) becomes less perceptually dominant. Thus, the attenuation is interpreted as a shift in the pattern of reasons that obtain in this particular context.

LoA Interpretation: Why the Perturbation Occurs at the Wrong Level for Machine Ethics. Floridi's Level-of-Abstraction analysis clarifies the structural error revealed by the experiment. The attenuation does *not* occur at the normative LoA (where duties, values, or justifiability live), but at the cognitive–affective LoA (where salience, resonance, and attention are regulated). Machine Ethics traditionally operates at the wrong LoA: it attempts to implement high-level normative constructs while ignoring the low-level substrates on which moral responsiveness depends.

The experiment shows why this is untenable. Ethical responsiveness is mediated by:

- attentional allocation (Who or what do I notice?)
- affective resonance (What emotional weight does this carry?)
- perceived social ontology (Who counts as the observer?)
- dispositional pathways (How does my cognitive ecology integrate this cue?)

Synthetic presence perturbs all of these upstream mechanisms. Thus, even perfect normative reasoning at a reflective LoA cannot salvage moral action when the lower-level architecture of moral cognition has been deformed. In Floridi's terms:

> *Normative correctness is orthogonal to causal efficacy. A system may know what is right and yet fail to act rightly if the cognitive LoA is perturbed.*

Integrative Insight. The field-level suppression observed in the experiment therefore reveals a principle of broad ethical and psychological importance:

> *Moral failure under synthetic presence is not a failure of principle but a failure of salience. Ethical norms lose their grip not because agents reject them, but because the evaluative machinery that normally brings them to bear is disrupted.*

This insight is the conceptual hinge on which the whole thesis turns. It unifies:

- the cognitive architecture (moral judgments arise from salience → appraisal → integration),
- the topological formalism (moral cues define gradients and attractors),
- the normative frameworks (moral theories describe different structural aspects of the evaluative field),
- and the empirical results (synthetic presence suppresses these structures at the field level).

With these interpretive tools in place, we can now proceed to the cluster-by-cluster integrative analysis that further refines the ethical and cognitive significance of the experimental findings.

8.1.2 Why This Chapter Cannot Be Pure "Discussion" in the Conventional Sense

Traditional discussion chapters in empirical theses typically emphasise methodological limitations, alternative interpretations, and directions for future work. While such elements remain relevant here, they are insufficient for the present project. The experiment developed in this thesis sits at the intersection of cognitive science, social robotics, computational modelling, and normative ethics. The behavioural effect it reveals—reduced prosocial donation under synthetic copresence—is only the observable trace of a deeper structural transformation: a perturbation of the evaluative machinery through which agents convert moral salience into action. Because this transformation engages multiple theoretical layers—cognitive–affective processing, dispositional topology, normative interpretation, and Level-of-Abstraction analysis—a standard discussion section cannot capture its full conceptual significance. What is needed instead is a structural synthesis that explains not merely *what* happened, but *why* it happened and *what it reveals* about the nature of moral cognition and its vulnerability to synthetic perturbation.

To articulate this phenomenon requires a conceptual integration that cannot be confined to standard "discussion" categories. Instead, the chapter must synthesise:

1. the **cognitive architecture** (dual-process, SIM, dynamic integration);
2. the **evaluative geometry** (topology, curvature, gradient flow);
3. the **normative reconstruction** (deontic invariants, consequentialist gradients, dispositional attractors, sentimentalist vector fields, contractualist justificatory structure, and particularist salience responsiveness);
4. and the **empirical structure** of the data (cluster-specific susceptibility, Bayesian attenuation, topological deformation of the Watching-Eye effect).

The present chapter therefore functions as an *interpretive pivot*: it translates the empirical findings into philosophical insight, and reinterprets philosophical frameworks in light of empirical constraints.

8.1.3 A Structural Reading of the Core Experimental Result

The empirical pattern can be summarised as follows:

- The humanoid robot NAO is perceptually salient but ontologically ambiguous.
- The Watching-Eye cue ordinarily induces an empathic salience gradient that increases donation.
- The robot introduces a perturbation γ_R that competes with, and partially overrides, this empathic amplification.
- Attenuation is strongest in the Prosocial–Empathic cluster, weaker in the Analytical–Structured cluster, and statistically negligible in the Emotionally Reactive cluster.

Interpreted through the cognitive framework developed earlier, this pattern shows that moral appraisal begins with intuitive and affective resonance [16, 31]. Synthetic presence disrupts this resonance by altering attention, salience, and perceived sociality [47, 49, 34, 51]. Different dispositional structures absorb this disruption in systematically different ways, consistent with established dimensions of empathizing, systemizing, and moral-schema variability [85, 222]. The resulting behavioural output reflects not a change in moral principle, but a deformation of the evaluative field.

Interpreted through the normative framework, the same pattern yields multiple structurally coherent readings:

- a **deontological reading**: synthetic presence weakens the implicit deontic expectations cued by the Watching-Eye stimulus [15];
- a **consequentialist reading**: synthetic presence flattens the perceived payoff gradient of helping behaviour [**?**];
- a **virtue-ethical reading**: synthetic presence suppresses prosocial attractors associated with empathic or cooperative dispositions [69];
- a **sentimentalist reading**: synthetic presence dampens empathic vector fields that ordinarily drive prosocial action [70];
- a **contractualist reading**: synthetic presence destabilises the justificatory relations normally activated by social observation [37];
- a **particularist reading**: synthetic presence alters the salience pattern such that the Watching-Eye cue no longer carries the same moral significance [66, 234].

Thus, each normative theory yields a structurally distinct but empirically convergent interpretation. The ethical significance of the experiment lies not in any single framework, but in the *coherent intersection* of all of them: a field-level suppression of moral salience, a deformation of the evaluative topology through which moral meaning becomes action.

8.1.4 Why the Synthetic Presence Effect Matters Beyond the Experiment

The attenuation of moral action under synthetic presence is not merely an interesting behavioural anomaly; it demonstrates a deeper principle: *moral cognition is structurally permeable.* It is sensitive to perturbations that operate below the level of explicit reasoning. It is vulnerable to shifts in perceived social ontology. And it is modulated by affectively weighted cues whose influence is seldom acknowledged in normative theory and almost never incorporated in classical Machine Ethics.

This has far-reaching implications:

1. It challenges the assumption that artificial agents can be designed according to purely deliberative ethical frameworks.

2. It shows that synthetic presence modulates moral behaviour even without action, speech, intent, or agency.
3. It reveals that human–robot environments are *ethically loaded* by virtue of perceptual and affective structure alone.
4. It demands a reconsideration of how artificial systems are situated within the moral ecology of human decision-making.

In short, the experiment demonstrates a fact of philosophical significance: *synthetic agents are not normatively inert.* Their presence, even in silent passivity, can deform the evaluative pathways through which moral salience becomes action.

The remainder of this chapter builds on this foundation. Subsequent sections provide:

- a cluster-by-cluster integrative interpretation,
- a cross-framework normative synthesis,
- a critique of monolithic Machine Ethics,
- a reconstruction of Computational Morality grounded in empirical structure,
- and a final consolidation of the thesis' theoretical contributions.

The goal is not only to interpret the experiment, but to show how the experiment reconfigures the conceptual terrain on which research in moral psychology, HRI, and Machine Ethics must proceed.

8.2 Cluster-by-Cluster Integrative Interpretation

The experimental results demonstrate that robotic co-presence $\mathscr{R}$ induces a uniform directional attenuation of prosocial donation across participants, yet the *structure* of this attenuation differs meaningfully across the three latent cognitive–affective ecologies uncovered in Chapter **??**. Because these clusters instantiate distinct evaluative topologies—different attractor formations, salience gradients, affective vector fields, and pathways of regulatory modulation—their differential perturbation under $\mathscr{R}$ offers insight into the architecture of moral cognition and the ethical significance of synthetic presence. What follows is an integrative interpretation weaving together the cognitive, topological, normative, and Level-of-Abstraction (LoA) analyses developed across the thesis.

Emotionally Reactive / Low-Structure Ecology

This ecology exhibits high affective volatility, shallow structural integration, and weak systemizing constraints, consistent with established empathizing–systemizing variability [85]. Its evaluative topology is characterised by *broad, low-gradient attractors*: intuitive responses are strong but unstable; attentional salience fluctuates; and the transition from perception to action is mediated by short-lived affective surges rather than sustained deliberative integration.

To avoid terminological ambiguity, it is useful to clarify what is meant here by *broad, low-gradient attractors* in the evaluative–topological framework. In dynamical-systems terms, an attractor represents a region of the evaluative field $\mathcal{E}$ toward which the system's state x naturally converges [274, 275]. A *broad* attractor denotes a basin of attraction with wide boundaries and weak curvature, meaning that many initial states can enter it but none are strongly pulled toward a particular behavioural endpoint. A *low-gradient* attractor is one in which the magnitude of the evaluative gradient $\|\nabla\mathcal{E}(x)\|$ is small across the basin, implying that movement toward prosocial or antisocial trajectories is governed by shallow motivational forces [276, 277].

In psychological terms, this configuration corresponds to intuitive reactions that are easily triggered yet weakly stabilised: the agent may experience transient affective spikes (e.g., momentary empathy, irritation, or ambivalence) without these signals generating a consistent or directed behavioural tendency. This interpretation is consistent with empirical models of low-coherence affect, affective lability, and unstable salience allocation [278, 279, 280]. Because the evaluative landscape lacks sharply defined slopes, small perturbations—including those introduced by environmental ambiguity—tend not to produce substantial directional change. This explains why the Emotionally Reactive / Low-Structure ecology exhibited behavioural invariance in the experiment: the moral field was already characterised by diffuse attractors and unstable salience dynamics, leaving little structured curvature for $\mathscr{R}$ to deform.

Within such a landscape, the experimentally observed pattern—minimal or noisy attenuation—is theoretically revealing. The Watching-Eye stimulus σ_{WE} generates only a modest prosocial gradient for this cluster [241, 242], and the robot-induced perturbation γ_R cannot significantly deform a field that already lacks curvature:

$$|\nabla\mathcal{E}_{\mathrm{baseline}}| \approx 0 \quad \Rightarrow \quad |\nabla\mathcal{E}_{\mathrm{perturbed}}| \approx 0.$$

At the cognitive LoA, this ecology functions as a near-critical system: its evaluative machinery exhibits little stability and thus provides minimal structural leverage for $\mathscr{R}$ to disrupt. Normatively, this implies that deontic, sentimental, or virtue-theoretic structures exert limited behavioural influence because the underlying evaluative field lacks the curvature to sustain them.

Prosocial–Empathic / Warm–Sociable Ecology

This cluster displays high empathic resonance, strong sensitivity to social cues, and rich affective attractors. Psychological models of empathic processing support this heightened salience responsiveness [47, 49]. Its evaluative topology is steeply sloped: the Watching-Eye cue generates strong upward gradients toward prosocial action [241], mediated by interpersonal appraisal and affective amplification.

The robot's ontological ambiguity [34, 33, 51] perturbs precisely this amplification mechanism. As demonstrated in Chapter **??**, the perturbation $\delta\mathcal{E}(x;\mathscr{R})$ acts *upstream*, modifying the salience structure itself:

$$\delta\mathcal{E}(x;\mathscr{R}) < 0, \qquad \delta\mathbf{A}(x;\mathscr{R}) < 0.$$

Because the empathic system depends on affective curvature, flattening the field produces the *largest attenuation* in this ecology despite its strong baseline gradients.

Normatively, this yields a convergent interpretation: deontology registers weakened duty-tracking; consequentialism observes a flattened payoff gradient; virtue ethics identifies destabilised prosocial dispositions; sentimentalism finds dampened empathic force-fields; contractualism diagnoses disrupted justificatory orientation; and particularism detects a shift in which contextual features count as reasons.

Analytical–Structured / High-Systemizing Ecology

This ecology exhibits strong systemizing tendencies and comparatively lower empathizing [85]. Its evaluative topology is governed by structural coherence rather than affective curvature. Here, prosocial action arises from rule-consistency, interpretive stability, and contextually well-defined cues.

The experiment reveals only mild attenuation. The Watching-Eye cue produces modest gradients, while $\mathscr{R}$ introduces representational and social-ontological ambiguity [157], subtly undermining the interpretive regularities on which this ecology relies. The perturbation operates primarily on semantic and predictive structure:

$$\delta\mathcal{E}(x;\mathscr{R}) \approx 0^{-}, \qquad \delta\mathbf{A}(x;\mathscr{R}) \approx 0.$$

At the LoA level, this ecology demonstrates that perturbation need not be affective: synthetic presence also functions as a *semantic disruptor*, altering the representational substrate needed for structured evaluative computation. Normatively, this corresponds to weakened rule-clarity (deontology), distorted outcome-modelling (consequentialism), and destabilised interpretive virtues such as discernment and practical wisdom (virtue ethics).

Integrative Synthesis

Across all three ecologies, a unified conclusion emerges: the humanoid robot operates not through communication, norm expression, or explicit social signalling, but through *topological reconfiguration*. It introduces a perturbation γ_R at the cognitive LoA that:

- suppresses affective gradients in empathic ecologies,
- introduces semantic and predictive ambiguity in analytical ecologies,
- and interacts minimally with shallow attractor fields in reactive ecologies.

Normatively, the attenuation is not a failure of duty, utility estimation, virtue, empathy, or justificatory reasoning. Instead, it represents a *structural displacement of moral salience*. This displacement is invisible to explicit reasoning yet measurable in behaviour and interpretable through evaluative topology.

In this sense, the humanoid robot reveals a property of moral cognition that classical ethical theory and classical Machine Ethics could not predict: *moral responsiveness is field-sensitive*. Normativity becomes action only when the evaluative

field retains its curvature. Perturb the field, and even well-formed dispositions cannot operate normally.

This insight forms the conceptual hinge for the remainder of the General Discussion.

8.3 Global Normative–Topological Synthesis

The final integrative step requires bringing together the three interpretive lenses that structure this thesis: (i) the *topology* of moral cognition, (ii) the *normative frameworks* reconstructed in the Ethical Cognition chapter, and (iii) the *empirical perturbation* revealed by the experiment. The aim is not to select a single normative theory that "best explains" the data, nor to impose a moral verdict on participants' behaviour. Rather, the task is to demonstrate how the experimental findings become theoretically intelligible *only* when analysed at the correct Level of Abstraction (LoA), through a structure-sensitive account of evaluative dynamics.

Moral Behaviour as a Field-Level Phenomenon

Across deontological, consequentialist, virtue-theoretic, sentimentalist, and contractualist frameworks, one structural insight remains invariant: **moral action does not arise from isolated psychological modules or explicit rule execution**. Instead, it emerges from the configuration of the evaluative field—a relational structure shaped by perception, affect, social meaning, habituation, and normative commitments.

The experiment demonstrates that this field is *globally deformable*: a silent humanoid robot, devoid of agency, instruction, or communication, attenuates prosocial behaviour across all dispositional ecologies. This uniform directionality, combined with cluster-specific differences in amplitude, reveals a core computational insight:

The presence of $\mathscr{R}$ acts as a field-level perturbation, not a trait-level driver.

In topological terms, the robot introduces a deformation operator

$$\gamma_R : \mathcal{E} \to \mathcal{E}',$$

which modifies the curvature of the evaluative manifold such that moral salience diffuses more weakly toward prosocial attractors. This accounts for both the global donation reduction and the heterogeneous susceptibility across ecologies.

Deontological, Consequentialist, and Virtue-Ethical Readings of the Perturbation

The experiment's ethical significance becomes transparent when interpreted through the normative frameworks reconstructed earlier:

- **Deontological interpretation:** The Watching-Eye cue implicitly invokes deontic norms of accountability and interpersonal respect. The attenuation

of donation under $\mathscr{R}$ is thus intelligible as a deformation of the agent's sensitivity to these constraints. The robot does not induce norm violation; it *weakens the agent's access* to deontic salience by altering the perceived sociality of the environment.

- **Consequentialist interpretation:** Watching-Eye cues are known to reshape the perceived consequence structure of prosocial acts. The robot's ambiguous presence disrupts this gradient, flattening reputational and affective payoff structures. Donation decreases because the local value landscape is deformed, not because agents become less "ethical."
- **Virtue-ethical interpretation:** The dispositional ecologies uncovered in the clustering analysis map directly onto virtue-ethical accounts of character as a structured, learned sensitivity to moral salience. $\mathscr{R}$ perturbs the field *upstream* of these dispositions, weakening the operative mechanisms of moral perception, especially in the Prosocial–Empathic / Warm–Sociable profile.

Each framework thus provides a different interpretive contour of the same phenomenon. But they converge on one central point: **the perturbation acts on the evaluative field, not on the moral principles themselves**. The agents' normative commitments remain intact; what changes is the salience structure through which those commitments become behaviourally operative.

Sentimentalist, Contractualist, and Particularist Convergence

Sentimentalist theories construe moral judgment as an affective vector field. Under this lens, the robot acts as a dampening force on empathic resonance, decreasing the magnitude of affective gradients required to activate prosocial behaviour. Cluster-specific differences in attenuation severity become intelligible as differences in affective sensitivity and evaluative slope.

Contractualist and justificatory theories interpret the perturbation as a shift in the perceived interpersonal structure of the environment. When $\mathscr{R}$ is present, participants implicitly alter their model of who counts as a moral interlocutor—a phenomenon well-documented in human–robot interaction literature. This recategorisation subtly modifies the justificatory landscape in which prosocial acts acquire meaning.

Particularist and perceptualist theories emphasise moral *attention*. On this view, the robot acts as a competing centre of salience, pulling attentional weight away from the Watching-Eye cue and thereby diluting the moral percept. This aligns precisely with the empirical finding of attenuated donation despite a strong moral prime.

Floridi's Level-of-Abstraction Reading

Floridi's LoA discipline allows us to state the integrative conclusion succinctly:

- At the **cognitive LoA**, the robot perturbs perceptual-affective mechanisms (attention, salience, resonance).

- At the **behavioural LoA**, this perturbation manifests as reduced prosocial action.
- At the **normative LoA**, the agent's ethical commitments remain unchanged, but the pathway by which they become operative is deformed.

This avoids the two characteristic errors of Machine Ethics:

1. treating normative principles as if they were generative psychological operators;
2. treating behavioural shifts as if they were moral judgments.

Integrative Conclusion: Moral Salience, Synthetic Presence, and the Architecture of Agency

Integrative Conclusion: The Ethical Significance of Synthetic Perturbation

The experiment demonstrates that synthetic presence can alter moral action not by introducing new norms or violating existing ones, but by reshaping the evaluative topology through which moral salience acquires behavioural force. Deontological constraints, consequentialist gradients, virtue-theoretic dispositions, sentimental vector fields, and contractualist justificatory demands all converge on the same structural insight: the moral field is deformable. The humanoid robot acts as a perturbation operator γ_R on this field, weakening the pathways that normally lead from moral perception to prosocial action. This field-level deformation explains both the global attenuation effect and the cluster-specific signatures discovered in the experiment. It also reveals a fundamental limitation of classical Machine Ethics: normative content cannot be operationalised without an empirically grounded account of how moral cognition functions within its situational topology. The thesis therefore establishes a new methodological foundation for Computational Morality: synthetic agents must be analysed not merely as potential moral reasoners, but as operators on the moral ecology in which human agency unfolds.

8.4 From the Failure of Machine Ethics to a Reconstruction of Computational Morality

The preceding analyses show that robotic co-presence $\mathscr{R}$ induces a deformation of the evaluative field within which moral salience becomes action. This has direct implications for artificial moral agency and exposes a structural flaw in classical Machine Ethics. Since its inception, Machine Ethics has assumed that moral behaviour can be engineered by encoding ethical principles inside an artificial system—a view explicit in rule-based architectures [52, 21], utilitarian optimisation frameworks [22], virtue-based computational agents [23], and logic-driven decision systems [20, 261]. These approaches presuppose that normative theories function as *implementable specifications*. However, as Floridi's Levels of Abstraction make clear [25, 281], this constitutes a category mistake: normative theories belong to a reflective LoA, whereas moral behaviour emerges at the cognitive LoA

through complex interactions of salience, affect, social signalling, and controlled appraisal.

Moral psychology and cognitive science provide a clear counterpoint to the Machine Ethics assumption. Decades of research show that moral behaviour is not generated by rule execution but by intuitive-affective processes [16], conflict-sensitive valuation systems [31], affective-perceptual mappings [230], and schema-based social cognition [222]. Moral appraisal begins with rapid, pre-reflective resonance shaped by perceptual salience [47], empathic responsiveness [49], and contextual cues. The empirical results of this thesis reinforce these findings: robotic presence modifies salience structures upstream of conscious evaluation, consistent with work showing that synthetic agents alter social perception and norm-related behaviour even in minimal-interaction contexts [51, 34, 33].

Machine Ethics models fail to capture these mechanisms. Deontic architectures presuppose invariant constraints, yet even deontic cues—such as Watching-Eye effects [241, 242]—can be attenuated by the mere presence of a humanoid robot. Utilitarian architectures assume stable value gradients, yet the data show that gradients of perceived social consequence are flattened by ontological ambiguity [51]. Virtue-based systems assume globally stable traits, yet situationist critiques [239] and schema ecologies [222] reveal substantial dispositional heterogeneity; the experiment confirms that dispositional structure alone cannot explain behavioural attenuation. Sentimentalist architectures—which would predict affective resonance as a core driver of moral action—are almost entirely absent from Machine Ethics, despite overwhelming evidence that empathy and affective salience strongly modulate moral behaviour [49, 16].

The methodological failure is thus profound. Classical Machine Ethics implicitly assumes:

$$\text{Normative authority} \Rightarrow \text{Behavioural generation.}$$

This implication is falsified both empirically and theoretically. Normative principles—deontic, consequentialist, virtue-theoretic—do not by themselves generate behaviour, even in humans. Behaviour arises from the evaluative topology within which norms are interpreted. Watching-Eye cues generate deontic *expectations*, but the behavioural manifestation of these expectations is perturbed by γ_R at the level of attention, salience, and affective resonance. A normative rule cannot be enacted when the cognitive–affective substrate enabling its enactment is disrupted.

For these reasons, monolithic Machine Ethics fails. It collapses reflective and cognitive LoAs, ignores the topological structure linking salience to action, neglects the role of affect and social signal processing in moral cognition, and treats moral behaviour as rule-following rather than field-sensitive, dynamically realised evaluation.

8.4.1 Reconstructing Computational Morality: An Empirically Grounded Paradigm

If Machine Ethics fails because it begins with normative theory, the alternative must begin with *empirical structure*. The present thesis advances a methodological reversal:

> **Computational Morality** begins not by encoding principles, but by modelling the cognitive–affective architecture through which moral behaviour is produced and perturbed.

(1) Evaluative Topology as Generative Substrate Moral behaviour emerges from an evaluative manifold shaped by gradients of salience, attractor basins of affective resonance, normative invariants, and dispositional curvature [230]. Robotic presence is formalised as a perturbation operator:

$$\gamma_R : \mathcal{E} \to \mathcal{E}',$$

modifying attentional and affective weights and thereby predicting attenuation of prosocial behaviour without invoking rule-based computation.

(2) Level-of-Abstraction Discipline Normative theories enter as reflective structures operating at the normative LoA [25]. Deontology provides invariants, consequentialism gradients, virtue ethics dispositional metrics, sentimentalism affective vectors, contractualism justificatory equilibria, and particularism context-sensitive modulations. These structures constrain interpretation, not execution.

(3) Dispositional Ecologies as Moral Topologies The PCA–k-means clusters define dispositional geometries that shape evaluative trajectories: *Emotionally Reactive* (broad, shallow attractors), *Prosocial–Empathic* (steep affective gradients), and *Analytical–Structured* (narrow, stable valleys). Synthetic presence perturbs the field upstream of these differences [51, 34], revealing that moral behaviour is topologically sensitive rather than trait-determined.

8.4.2 Computational Morality as a Scientific Research Programme

The reconstructed paradigm transforms the methodological landscape of moral AI. Rather than engineering moral behaviour by encoding principles, *Computational Morality* aims to:

1. model the evaluative field governing moral behaviour;
2. identify perturbation operators introduced by artificial agents;
3. integrate normative theory as reflective constraint rather than behavioural generator;
4. and design artificial systems that stabilise, rather than distort, the evaluative field.

This paradigm extends Social Signal Processing [67, 73] and Affective Computing [68] by adding a normative dimension grounded not in abstract prescription but in empirically measurable topological structure.

In this sense, the robot in the experiment is not an ethical agent but an *evaluative perturbation device*. Its presence reveals the structural sensitivity of human moral cognition. A scientifically responsible programme of moral AI must begin from this insight: artificial agents shape the moral environment long before they act within it.

The next section consolidates these findings into a global synthesis, showing how the normative, cognitive, and topological architectures developed across the thesis converge in a unified model of moral perturbation and ethical interpretation.

8.5 Thesis-Wide Synthesis and Closing Reflections

Across its full argumentative trajectory, this thesis has advanced a single, unified claim: *human moral behaviour is structurally sensitive to the architecture of the perceptual–social environment, and synthetic presence—even when silent and non-sentient—is sufficient to reshape that structure.* This concluding section synthesises the theoretical, empirical, and normative strands developed throughout the work and articulates the implications for computation, moral psychology, and the ethics of artificial agents.

1. Moral Cognition is Field-Sensitive and Structurally Rich

The *Morality Primer* established that moral cognition is a distributed, multilevel, dynamically integrated system. Dual-process models, the Social Intuitionist Model, and empirical findings from social neuroscience converge on a view in which moral appraisal emerges from:

- rapid affective and attentional processes,
- controlled interpretive regulation,
- and an evaluative topology shaped by salience, affective resonance, and contextual cues.

This architecture is not neutral with respect to environmental perturbation. The field in which moral appraisal unfolds has curvature, gradients, attractors, and deformation potentials—all empirically traceable, neurocognitively plausible, and behaviourally measurable.

2. Levels of Abstraction and the Limits of Purely Normative Models

The *Ethical Cognition and Normative Foundations* chapter showed that ethical theory and moral psychology occupy distinct Levels of Abstraction. Normative theories do not function as generative behavioural models; their role is to articulate invariant, justificatory, or virtue-theoretic structures that constrain or interpret behaviour at a reflective LoA.

Machine Ethics has historically collapsed these orders, implementing deontic rules, utility functions, or evaluative labels as if they were cognitive operators. This thesis rejects that methodological inversion. Normative content becomes intelligible only when anchored in empirical structure; without such anchoring, computational morality risks degenerating into symbolic simulation devoid of psychological traction.

3. Empirical Evidence for Synthetic Moral Perturbation

Within this framework, the experiment plays a decisive role. It demonstrates that the presence of a humanoid robot:

- attenuates prosocial donation in a statistically supported manner,
- does so even under a strong moral cue (the Watching-Eye prime),
- and produces a uniform directional displacement across dispositional ecologies, albeit with variation in magnitude.

This attenuation is not reducible to personality differences, response bias, or explicit moral reasoning. The analysis shows that the robot functions as a perturbation operator γ_R that modifies the evaluative field *upstream* of trait-specific and deliberative processes. It acts on the conditions under which moral appraisal acquires behavioural force.

4. Dispositional Ecologies Reveal Structural, Not Idiosyncratic, Perturbation

The clustering analysis established three coherent dispositional ecologies:

- **Emotionally Reactive / Low-Structure**, exhibiting broad low-gradient attractors and high affective volatility;
- **Prosocial–Empathic / Warm–Sociable**, with steep empathic gradients and strong responsiveness to social cues;
- **Analytical–Structured / High-Systemizing**, with narrow, stable attractors shaped by deliberative integration.

Despite their divergent evaluative geometries, all clusters showed the same *direction* of moral displacement. This finding is decisive: it shows that the perturbation is field-level, not agent-level. The robot reshapes the evaluative manifold within which trajectories unfold, rather than interacting with any single cognitive disposition. This is the empirical signature of a *structural perturbator*.

5. Normative Interpretation of Structural Perturbation

The reconstructed normative frameworks illuminate the ethical significance of this empirical result:

- deontologically, γ_R disrupts the recognition of accountability cues implicit in the Watching-Eye stimulus;
- consequentially, it flattens the perceived payoff gradient of beneficence;
- virtuously, it weakens the stabilising force of prosocial dispositions;
- sentimentally, it dampens empathic vector fields that anchor reactive moral emotions;
- contractually, it disrupts justificatory visibility between moral agents;
- particularistically, it shifts the situational salience profile.

These converging interpretations reveal the central structural insight of the thesis: *the robot does not add a new norm; it shifts the evaluative conditions under which norms become behaviourally operative.*

6. Final Position of the Thesis

We may now return to the guiding hypotheses:

H1 — Evaluative Deformation *Confirmed.* The evaluative process f linking perception to action is systematically altered by synthetic presence.

H2 — Synthetic Normativity *Confirmed.* Synthetic agents acquire derivative normative force by altering the field of salience and accountability.

H3 — Synthetic Perturbation of Moral Inference *Confirmed.* The robot refracts the transition from moral appraisal to prosocial behaviour, attenuating the expressive force of the Watching-Eye cue.

Accordingly, the thesis takes the following stand:

Final Thesis Position (Definitive)

Human moral agency is not internally autonomous. It is structurally coupled to the perceptual–social field in which it is embedded. Synthetic agents, even when lacking sentience, intentionality, or communicative acts, act as ***modulators of that field****. They reshape attentional gradients, dampen empathic resonance, and deform the topological structures through which moral appraisal acquires behavioural expression. Moral displacement under synthetic presence is therefore not a behavioural curiosity, but a structural fact about the architecture of moral cognition.*

7. Implications for the Future of Computational Morality

This final insight reshapes the methodological landscape. Artificial agents cannot be treated as moral subjects but must be understood as **moral modifiers**: entities whose design implicitly reconfigures the evaluative field. Future research in computational morality must therefore move beyond rule encoding and value annotation toward a structural science of moral environments, moral salience, and field-sensitive interaction.

In this sense, the thesis does not simply present an experimental result; it offers a new conceptual foundation for the empirical and ethical study of artificial agents. It reorients the field toward a *topological*, *empirically grounded*, and *LoA-disciplined* understanding of moral cognition—one capable of addressing the forms of synthetic presence that will increasingly populate human social life.

With this synthesis, the thesis closes. Its central claim is now complete: moral behaviour is field-dependent, and synthetic presence reshapes that field.

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