The Science of Function

Functional logic as a methodological basis of an interdisciplinary knowledge architecture

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Short description:
This essay presents functional logic as a universal classification architecture that connects scientific disciplines through the common causal structure of reality. Instead of separating knowledge by topic, functional logic organizes all empirical and theoretical variables along three functional axes –**Strength**, **Moral** and **To know**– thus allowing systemic comparability between physical, biological, psychological, and social processes. The goal is to overcome disciplinary fragmentation in favor of a coherent, functionally calibrated scientific logic.

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Introduction:

Contemporary science operates in an environment that is paradoxically both data-rich and category-poor. Data volumes are growing exponentially in all disciplines, yet the semantic order that determines which data type represents which systemic function is rarely explicit. In practice, this leads to two recurring problems: First, variables are often categorized by discipline ("psychological," "economic," "biological"), not by their direction of impact within the system.

Second, measurements that are thematically related but functionally represent different things (e.g., affective appraisals alongside cognitive judgments and physiological response data) are combined without the resulting analyses properly accounting for the heterogeneity of the underlying functions. This leads to empirical projects losing precision—not because the measurements are poor, but because the preliminary clarification of their functional role is insufficient.

The methodological framework proposed here addresses this point: It organizes empirical data not according to subject areas, but according to their functional orientation within the system. It is based on the triad of strength, morality, and knowledge, understood as three complementary axes of action in any perception of reality: Strength represents stimulus, energy, and immediate response; morality represents evaluation, meaning, and relationship; and knowledge represents analysis, structure, and rule formation. The methodological core is this: Each data set has a dominant functional orientation that results from its functional context.

A pulse rate is – regardless of disciplinary boundaries – a strength signal; an emotional self-description is a moral signal; and a deductive test for causal analysis constitutes a knowledge signal. This pre-classification acts as a semantic adapter that makes heterogeneous measurements compatible before evaluation. This creates a functional pre-structure for hypothesis formation, operationalization, data aggregation, and validation – interdisciplinary consistent and empirically compatible.

Methodological starting point

The canonical sequence of scientific work—observation → theory → operationalization → data collection → analysis → conclusion → replication—implicitly assumes that the variables used have already been selected in a functionally appropriate manner. In textbooks, this step is usually referred to as "operationalization"; in fact, it involves two closely intertwined but distinguishable tasks: (1) the linguistically precise definition of the construct under investigation and (2) the functional assignment of specific measurement variables to this construct.

In practice, the first part often succeeds, but the second often remains taxonomic rather than functional: variables that are traditionally common in a discipline are chosen instead of variables that demonstrably reflect the same effect function. This creates methodological friction: affective, cognitive, and physiological data are summarized under a single umbrella term without clearly distinguishing their different effects.

This is precisely where the functional logic approach comes in, making the implicit step explicit: Before data collection (and again before analysis), each variable is classified

according to its system effect. The key question is not "Which discipline does the variable originate from?" but "What function does it perform in the process?" This shift is small in form but large in impact: It prevents heterogeneous signals from being inadvertently mixed (e.g., emotional judgments with reaction time and rule knowledge), and it allows for the meaningful bundling of similar functions from different disciplines (e.g., stress hormone, heart rate, and muscle tone as strength clusters; guilt judgment, empathy score, and norm preference as moral clusters; hypothesis fidelity, error correction, and rule induction as knowledge clusters).

The result is pre-analytic functional coherence: data become not only measurable, but also comparable. This comparability is the prerequisite for rigorous testing of hypotheses, accurate attribution of effects, and replications that truly examine similar phenomena—regardless of whether the data come from physics, biology, psychology, or economics.

Principle of functional logic

The foundation of functional logic lies in the assumption that every observable reality – whether physical, psychological, or social – operates along three complementary functional axes: strength, morality, and knowledge. This triad does not describe a moral or cultural hierarchy, but rather an ontological structure of effectiveness. Strength represents everything that reacts, moves, or transforms energy immediately – it is the dynamic axis of action. Morality describes the ability of a system to generate relationships, values, and contexts of meaning – it is the axis of integration. Finally, knowledge represents analysis, recognition, and formative processes – the axis of order. Together, these three functional directions form a closed functional architecture in which every element of reality can be located without relying on interpretive attributions.

In contrast to disciplinary classifications (e.g., "biological," "economic," "psychological"), functional logic distinguishes according to the type of effect, not according to its observational context. The same action can therefore be assigned to different axes depending on its function in the process: a physical defensive reaction belongs to strength, an empathic reaction to morality, and the subsequent reflection on causes to the knowledge axis. What is crucial is not the object, but the logic of effect. This creates a model that does not describe phenomena interpretively, but rather maps them functionally. It does not ask what something means, but how it works – and it is from this direction of effect that meaning is derived.

Functional logic is thus a structured semantics of reality. Its order is not static, but dynamic: Strength generates stimuli, morality integrates them, and knowledge abstracts them. The system only remains stable when these three axes are in functional balance—in a 70/30 calibration, in which each subsystem operates predominantly freely (70%) and to a lesser extent in an ordering capacity (30%). This dynamic balance ensures that knowledge does not devolve into dogma, action into chaos, and morality into ideology.

Allocation mechanism of empirical data

The practical relevance of functional logic is demonstrated by its ability to pre-analytically classify empirical data. Every data set, regardless of its origin, has a functional direction that reveals which of the three axes it activates. This is done by asking a simple but precise guiding question: What effect does this variable describe in the overall process?

An example:

- A measurement of heart rate or cortisol levels captures a physiological response – it clearly belongs in the strength column because it reflects immediate activity in the system.
- A self-report about emotional states, satisfaction or guilt is moral because it describes the system's value and relationship balance.
- An analytical performance, such as solving a problem, justifying a decision, or adhering to logical rules, belongs to the knowledge pillar.

This assignment is not interpretive, but functionally based: It results from the observable direction of effect and can be mathematically represented using weighting functions in the Strüver formula. The advantage lies in interdisciplinary comparability: Variables from completely different fields—such as neurobiology, sociology, and economics—can be related to each other based on their direction of effect because they fulfill the same system function.

Methodologically, this means that functional logic replaces disciplinary categories with function-based metadata. Instead of grouping variables by source or measurement type, they are labeled according to their systemic role—for example, with S, M, or W. A data table that previously contained only numbers thus acquires a deep functional structure. This makes it possible to identify patterns and correlations that remain invisible in conventional analyses because different functional directions are unnoticed.

The mechanism also allows for algorithmic automation: An AI can use the variable description or context to determine which functional direction dominates and classify the data independently. This creates a consistent, machine-readable order of the empirical world—a step that transcends the boundaries between qualitative and quantitative research.

Methodological significance

The methodological strength of functional logic lies in the fact that it functions not only as a theory, but as a universal classification architecture for empirical research. While traditional systems such as the DSM in psychology, ISO standards in technology, or taxonomies in biology are primarily descriptive or nomenclatural, functional logic operates dynamically. It describes not what something belongs to, but how it works.

In classical scientific logic, categories are based on characteristics and similarities: A phenomenon is categorized because it resembles another. This taxonomic method creates order, but not explanation. Functional logic replaces this order of similarity with an order of effect—it does not focus on outward appearance, but rather on function within the system. This has far-reaching consequences: Knowledge is no longer gained from consensus, but from coherence.

For example, in psychology, emotion, motivation, and action are considered separate fields of study. According to functional logic, they are three manifestations of the same dynamic—they follow a causal chain from strength (impulse) via morality (evaluation) to knowledge (integration). This allows experiments that were previously considered isolated to be functionally linked. A hormonal stimulus (strength) creates an emotional pattern (morality) and leads to a conscious decision (knowledge). This threefold structure is empirically verifiable, regardless of the respective field of research.

Methodologically, this leads to a new quality of interdisciplinarity: it no longer arises through comparison, but through translation. When data from physics, sociology, and psychology are described along the same functional axes, the research speaks a common language. Thus, functional logic becomes the first metascientific framework that allows empirical data to be not only aggregated but also structurally integrated.

The result is a clear reduction in semantic vagueness. Terms like "force," "motivation," or "pressure" lose their disciplinary dependence and become functional constants that carry the same systemic meaning everywhere. This creates a precise, transferable scientific language—the prerequisite for reproducible, scalable, and epistemologically sound research.

Interdisciplinary application

The applicability of functional logic is demonstrated by its ability to integrate data from diverse disciplines into a common model of action. In physics, strength can be described as energy input, morality as stabilization or balance, and knowledge as pattern recognition or mathematical form. In biology, strength is represented by cellular activity or hormonal response, morality by homeostasis—the maintenance of balance—and knowledge by genetic coding or neural adaptation.

In the **Psychology**the Triassic appears directly observable:

- **Strength:**emotional arousal, drive, affect.
- **Moral:**Evaluation, empathy, attribution of meaning.
- **Knowledge:**Reflection, learning, self-regulation.
  Here the functional logic allowsk, emotional and cognitive processesnot as opposites, but as dynamically coupledto understand levels.

In sociology, it describes social stability as the result of calibrated interactions between collective strength (power, action), collective morality (norms, ethics), and collective knowledge (institutions, structure). A society remains stable only when these three forces

mutually limit and promote each other—just as an organism only survives when energy, balance, and information are synchronized.

Finally, in economics, the triad translates into productive mechanisms: Strength corresponds to capital and labor, morality stands for trust and ethical frameworks, and knowledge for market analysis and innovation. A market that loses its moral axis tips into exploitation; one that neglects knowledge tips into inefficiency; one that exaggerates strength tips into instability.

This universal mapping creates a metadisciplinary unit of analysis: every data set, every variable, every key figure can be classified into a common semantic coordinate system based on its functional direction. This means that – theoretically and practically – a physics formula, a psychological questionnaire, and an economic statistic can be represented within the same functional matrix.

Functional logic thus opens not only a new scientific paradigm, but also a path to machine-understandable meaning: When systems, databases, or AI models are trained according to this structure, they learn not only content but functional principles. They learn how something works—and this is the crucial step from data collection to insight.

Epistemological reflection and validation

From an epistemological perspective, functional logic shifts the very concept of "validation." In classical science, validity is usually assessed methodically after the fact—that is, after data has been collected. It asks: "Are we measuring what we think we are measuring?" In functional logic, however, validity begins before data collection, as it is an ontological prerequisite of measurement. Something can only be measured if it exists functionally—that is, if it occupies a recognizable position of effectiveness within the triad. A signal without a functional assignment is not a data point, but noise.

Validation therefore takes place in three steps:

1. **Ontological validation:**Does the phenomenon exist functionally within the system? (e.g., is "emotion" a form of reaction or an attribution?)
2. **Semantic validation:**Is the chosen term functionally correct? (e.g., "aggression" as a form of energy or moral judgment?)
3. **Empirical validation:**Does the phenomenon in the experiment work as predicted by the functional logic?

This sequence closes the gap between theory and empiricism. While classical science bridges the gap between the two levels through hypotheses, functional logic forms a continuous bridge: theory and empiricism are connected by the same concept of function. The prediction is not whether something works, but how it works. Empiricism thus no longer serves to prove an idea, but to measure its intensity of effect.

In this understanding, validity is not an external testing mechanism, but an internal condition of coherence. When data and theory share the same functional architecture, they mutually

validate each other. Observation is then not proof, but a resonance phenomenon: reality confirms its own logic. This is the point at which functional logic transforms from mere methodology into an epistemological structure—it not only explains knowledge, but enables it.

Conclusion: The Science of Function

Functional logic opens up a new epistemological horizon: It replaces the fragmented multiplicity of scientific paradigms with a coherent functional model of reality. Isolated technical languages are replaced by a dynamic order in which each discipline can no longer describe its phenomena, but rather locate them. This localization represents the decisive advance—it makes knowledge comparable, calibratable, and integrable.

In an age where artificial intelligence processes billions of data sets, functional logic provides the necessary semantic infrastructure: a unified logic of effect that brings machines, humans, and models onto the same corridor of meaning. Because an AI that understands not just data but functional directions can, for the first time, distinguish between mere correlation and true causality—it recognizes why something works.

This brings us full circle to the methodological point: knowledge is not a random success, but a structural event. Those who understand the cause, direction, and effect of a phenomenon understand not only the world, but also the order by which it is formed. Functional logic is precisely this order—not as dogma, but as an open, dynamic system that validates itself through application.

Science, understood in light of this logic, is then no longer a collection of disciplines, but a single, systemically calibrated cognitive process. A process that no longer strives for agreement, but for truth. Not for confirmation, but for coherence. Not for power over knowledge, but for the knowledge of power—namely, how reality really works.