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Research article

Hermeneutics of Technology and the Anticipation of the Future in Law

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Abstract

This article explores the relationship between futures studies, institutional dynamics and technological development, with a particular focus on the role of hermeneutics in shaping the legal regulation of emerging technologies. Although scientific forecasting and foresight dominate the methodological framework of futures studies, these methods should be acknowledged as somewhat limited. Hermeneutics, with its emphasis on interpretation and the contextual embeddedness of meanings, offers a framework for analyzing how future visions influence technological trajectories and regulatory decisions. The article criticizes technological determinism, which often ignores the social and institutional factors that shape technological development. Instead, it promotes a coevolutionary perspective that recognizes the mutual influence of technology and society. The article discusses the idea of hermeneutic technology assessment in relation to the analysis of institutionalized ways of shaping future visions. It also analyzes the principle of anticipation in law, which aims to address the uncertainties and risks associated with new technologies by anticipating potential threats and taking into account the interests of various stakeholders. Four key institutional dimensions are identified – agents, control relationships, accountability, and resilience capacities – that shape regulatory decisions and influence the integration of different perspectives. A hermeneutic analysis that focuses on the ways in which temporal unity in the law is formed—the connection between past goals, current interests, and future concerns – can enhance the effectiveness and democratic legitimacy of regulatory decisions.

Keywords: Hermeneutics of technology; Legal hermeneutics; Future studies; Legal regulation of technologies; Anticipation in law

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Научная статья

Герменевтика технологий и антиципация будущего в праве

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Аннотация

Данная статья исследует взаимосвязь между исследованиями будущего, институциональной динамикой и технологическим развитием, уделяя особое внимание роли герменевтики в формировании правового регулирования новых технологий. Хотя научное прогнозирование и форсайт доминируют в методологических основах исследований будущего, эти методы следует признать несколько ограниченными. Герменевтика, с ее акцентом на интерпретацию и контекстуальную укорененность смыслов, предлагает основу для анализа того, как образы будущего влияют на технологические траектории и регуляторные решения. В статье критикуется технологический детерминизм, который часто игнорирует социальные и институциональные факторы, формирующие технологическое развитие, и вместо этого развивается коэволюционная перспектива, признающая взаимозависимость технологий и социальных институтов. В статье рассматривается идея герменевтической оценки технологий в отношении к анализу институализированных способов формирования образов будущего. Также анализируется принцип антиципации в праве, который направлен на решение неопределенностей и рисков, связанных с новыми технологиями, путем прогнозирования потенциальных угроз и учета интересов различных заинтересованных сторон. Выделяются четыре ключевых институциональных параметра – агенты, контрольные отношения, подотчетность и способности к сопротивлению, – которые формируют регуляторные решения и влияют на интеграцию различных перспектив. Герменевтический анализ, ориентированный на анализ способов формирования темпорального единства в праве – связь прошлых целей, текущих интересов и будущих проблем – может повысить эффективность и демократическую легитимность регуляторных решений.

Ключевые слова: Герменевтика технологий; Правовая герменевтика; Исследования будущего; Правовое регулирование технологий

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INTRODUCTION

This article explores the intersection between the hermeneutics of technology and legal hermeneutics, particularly as it applies to the regulation of technologies. Central to the discussion is the challenge of interpreting visions of the future. Unraveling these visions requires hermeneutic work, which is especially critical in the legal regulation of technologies, given its focus on the risks and uncertainties inherent in innovation. At the same time, the study of legal regulation offers valuable insights for the philosophical hermeneutics of technology, as it reveals hermeneutic practice not merely as an individual activity but as an institutionally differentiated process.

The concept of temporality in the study of technology regulation encompasses at least two dimensions. The first is the communicative dimension, within which (1) every regulatory decision is inherently temporal, deriving its meaning by retrospectively referencing past decisions and prospectively shaping future ones; (2) every decision structures a specific domain, creating a taxonomy of regulated objects and relationships; and (3) every decision is shaped by social expectations, which evolve depending on the stage of the regulatory process¹. These dimensions highlight the institutional aspect of temporality in technology regulation, an aspect often overlooked in future studies.

FUTURE STUDIES AND THE RELATIONSHIP BETWEEN INSTITUTIONS AND TECHNOLOGIES

The methodological foundations of futures research are primarily determined by scientific forecasting and foresight – a process of knowledge aggregation based on extended panel discussions involving scientists, business representatives, politicians, interested publics, and experts in the relevant fields. “Methods such as expert panels, Delphi surveys (two-stage expert surveys), SWOT analysis, brainstorming, scenario building, technology roadmaps, relevance trees, mutual influence analysis, big data mining and many others allow us to build alternative development scenarios that take into account not only possible or desirable events, but also so-called “wild cards” – unlikely events that can significantly affect the future of the studied area.”² Today, the creation of utopias and dystopias seems to play a significant role in shaping our view of the future. These narratives often depict the future as riddled with sudden, uncontrollable threats – whether technological or natural – for which humanity is struggling to prepare in advance. While such alarming scenarios resonate widely, especially through the media, they rarely offer accurate predictions. This epistemological perspective also reinforces the perception that the humanities occupy a secondary position, with the primary role in understanding and forecasting the future being assigned to scientists. Yet, a hermeneutic approach can address these gaps in the study of the future, highlighting the heuristic value of humanities research. In my view,

¹ In this regard, regulatory practices in law are shaped by the same temporal characteristics as communication in science (Antonovski, 2025).

² See https://unescofutures.hse.ru/en/futures_studies



one reason for this oversight lies in the insufficient attention given to the inertia of social institutions' development. This factor, however, plays a crucial role in shaping if not the emergence of challenges then certainly society's response to them.

Future studies are closely tied to understanding the extent of human influence on the trajectory of technological development. It is assumed that such influence – primarily at the institutional level – can affect the likelihood of particular scenarios coming to fruition. The thesis that social institutions significantly influence the development of technologies is central to the constructivist approach in Science and Technology Studies (see, e.g., Bijker et al., 1987). Building on this, the concept of the Social Construction of Technology posits that technologies are open to interpretation, and their trajectory is shaped by which interpretations gain dominance at any given stage (Bijker, 1995). Consequently, control over technological development hinges on our ability to select interpretations that align with preferred values and interests. This idea is closely linked to the principles of Value Sensitive Design (see, e.g., Friedman & Hendry, 2019), which seeks to embed specific ethical principles into the design of technologies.

The Social Construction of Technology provides an alternative to simplistic technological determinism which assumes that technological development unfolds autonomously. It is often accompanied by both optimistic hopes that innovations will improve institutions as well as pessimistic fears of technology completely dominating human life. One of the key limitations of this technological determinism is its tendency to make evaluative judgments about technological progress while lacking the conceptual tools to assess the degree of societal influence over such developments. In contrast, the co-evolutionary perspective, which emphasizes the dynamic interplay between society and technology, offers a far more nuanced understanding. According to this view, “the introduction of new technology is also a form of moral experimentation, in which we only along the way find out what the new moral issues created by a new technology are, and, along the way, (re)invent the moral standards and values by which to judge that technology” (Van de Poel, 2020, p. 506).

It appears that the co-evolutionary perspective on technological development aligns with the idea of hermeneutics as “the practical science directed towards this practical knowledge is neither theoretical science in the style of mathematics nor expert know-how in the sense of a knowledgeable mastery of operational procedures (poiesis), but a unique sort of science. It must arise from practice itself and [...] be related back to practice” (Gadamer, 2007, p. 231). The study of practices extends beyond the experiences of individual actors to include the institutional level. This level of analysis focuses on understanding the mechanisms that integrate the diverse experiences, knowledge, interests, and preferences of various stakeholders involved in technological decision-making.

The idea of hermeneutic technology assessment proposed by Nordmann and Grunwald (2023) overcomes the problem of uncertainty and suggests focusing on visions of the future as they are captured in existing cultural artifacts and textual sources: “Hermeneutic TA seeks to avoid this predicament and any attempt to evaluate emerging technologies by first imagining their consequences or implications. It



considers the future as it appears in human conversations, popular culture, and policy visions, as it appears in calls for proposals and research applications, but also in prototypes and proofs of principle. Hermeneutic TA thus focuses on ‘the future’ as it exists already” (Nordmann & Grunwald, 2023, p. 37). This approach posits that technologies can only be fully understood within a framework of continuous temporality, where the past, present, and future are deeply interconnected. This interconnectedness is reflected in the hopes, fears, risk perceptions, and conflicting evaluations uncovered through the hermeneutic analysis of texts. By emphasizing the role of philosophy and the humanities in futurological studies, this approach not only underscores their significance but also addresses a critical gap in the field.

What kind of practice can become the subject of inquiry in the hermeneutics of technology? I argue that this encompasses not only the practice of creating technologies but also the practice of regulating them. Here, the hermeneutics of technology intersects with legal hermeneutics. Their shared task becomes the study of practice through the lens of a set of institutional conditions that shape the form and content of the perspectives of various actors involved in the formulation of regulatory decisions. In the realm of science and technology, regulatory decisions take on an epistemological aspect, defining not just acceptable risk thresholds but also the extent to which scientists and engineers can intervene in nature. As illustrated by STS studies on stem cells (Polyakova et al., 2020) or nano-objects (Stokes, 2009), the placement of new regulated entities within the framework of legal norms and interpretive principles emerges from balancing various stakeholders' interests. This process is influenced not only by scientific perspectives but also by the necessity to achieve broad sociopolitical agreement, the epistemological foundation of which lies in the alignment of visions of the future.

ANTICIPATION OF THE FUTURE IN LAW

Therefore, a hermeneutic study of visions of the future, as a context that significantly shapes the trajectory of technological development, holds particular practical importance in the field of law. This is especially meaningful in areas related to the legal regulation of scientific and technological innovations, where progress is often associated with the emergence or escalation of uncertainty and risks. Legal decisions in this context are based on the principle of anticipation, which involves striving to predict potential risks and threats given the limitations of scientific knowledge and the inability to rely on existing cases and norms when making decisions. Anticipation in law becomes a democratic alternative to political decisionism—a regime based on the sovereign’s unilateral decisions under states of exception.

“Anticipation, both as an idea and as a framework for understanding contemporary modes of future-making, has untapped potential to widen the field of legal inquiry beyond the epistemological domain, to reveal a greater diversity of perspectives on law’s engagement with the ‘not yet.’ Instead of seeing the future primarily as a problem of unknown but in principle knowable quantities, it redirects attention to (...) ‘speculative forecast,’ which is less concerned with statistically



measurable outcomes than with threats and promises that are felt to be real even if they do not come to pass” (Stokes, 2021, p. 74).

Here, the primary focus of anticipation is the prediction and study of uncertainties and risks brought about by technologies. However, risks are not something directly given; rather, they should be understood as the result of theoretical construction. In this regard, uncertainties and risks provide ample space for hermeneutic practices. Hermeneutics, unlike positivist approaches to science, does not seek to eliminate the subjectivity of interpretation and, instead acknowledges its heuristic value. It is grounded in the thesis of the ontological embeddedness of interpretation—the idea that hermeneutic practice is significantly shaped by the biases and sociocultural (or historical) situatedness of the agent. In this sense, every interpretation is partial. However, this limitation is not viewed as an obstacle to achieving completeness but rather as a condition of its epistemic validity.

The anticipatory regime in law is deeply tied to the concept of envisioning the future. However, such visions must remain flexible and cannot be confined to the creation of a single, universal scenario. Managing uncertainty about the future is further complicated by the lack of sufficient knowledge about the consequences of specific legal interventions. This uncertainty stems not only from the unpredictability of external factors such as natural or environmental change, but also from the potential lack of societal consensus about which risks should be prioritized for regulation. For example, long-term global threats may be less relevant to local communities, while short-term risks and benefits that directly affect community members often take precedence. This focus on immediate concerns can divert public resources from addressing larger-scale problems, potentially increasing the likelihood of catastrophic consequences. The future emerges as a dynamic continuum, shaped by the interplay and conflict of goals and plans among various groups in the present. As a result, visions of the future are often fragmented, heterogeneous, and even mutually exclusive.

HERMENEUTICS IN THE LEGAL ANALYSIS OF RISKS AND UNCERTAINTIES

Hermeneutic analysis provides a robust framework for assessing the potential and limitations of adopting specific models of the future as a basis for legal decision-making. Its attention to the ontological presuppositions of interpretation, coupled with its refusal to ignore the subjective dimension of cognition, positions hermeneutics as a highly promising approach in this area.

Hermeneutics can be applied at two levels of analysis. First, it seeks to uncover the semantic nuances of the concepts of risk and uncertainty embedded in normative documents. Importantly, the goal of hermeneutic work here is not to uncover “pure” meaning—free from interpretative distortions – but rather to establish a temporal coherence that connects past goals, present interests, and future concerns. In this way, the goals of hermeneutic practices extend far beyond mere interpretation: they strive to create a meaningful dialogue across time, integrating historical context, current priorities, and anticipatory insights:



Whether we think of self-driving, autonomous vehicles or soft machines, grids for a wind- and solar-based energy system, in-vitro meat or ambient intelligence devices, these hopeful monsters are a product of their time and have their time inscribed in them, but – like artworks or archaeological artefacts – they cannot be seamlessly resolved into the background, they are continuous and discontinuous at once, they do not achieve unity or totality but expose tensions, dreams, desires, hopes, fears, conflict, and contradiction. As such they are inexhaustible and require an effort of listening and reading, that is, a hermeneutic analysis that opens them up – in contrast to an interpretation that closes them down. (Nordmann & Grunwald, 2023, p. 39)

On the other hand, the task of anticipation in law involves harmonizing the diverse hermeneutic perspectives that inform regulatory decision-making. A key aspect of this process is analyzing the institutional foundations that shape these perspectives. How is a particular perspective developed, and how is it determined which perspective should guide the formulation of regulatory measures? This question lies at the core of understanding how hermeneutic interpretations are integrated into legal frameworks. It requires an exploration of the mechanisms through which differing viewpoints are negotiated, prioritized, and ultimately institutionalized within the decision-making process. Answering this question demands an examination of the interplay between institutional structures, power dynamics, and the epistemic practices that influence the selection and validation of specific hermeneutic perspectives.

The institutional foundations of legal regulation in technology enable the coexistence of multiple perspectives, each represented by different interest groups. These foundations can be characterized by four key parameters:

1. Agents: Who is recognized as a hermeneutic subject, and what role do they play in the system of producing regulatory decisions?
2. Control-Relationships: The structures that impose constraints on communication between agents, such as the principle of hierarchical subordination.
3. Accountability: The mechanisms of accountability that shape both individual perspectives and the consensus viewpoint.
4. Resilience Capacities: The processes that facilitate conflict resolution and safeguard the decision-making system from collapse or disintegration.

Together, these parameters provide a framework for understanding how diverse perspectives are integrated, negotiated, and institutionalized within the regulatory process. However, hermeneutics can serve not only as a tool to facilitate understanding but also as a means of critiquing specific ways of imagining the future. In doing so, it can reveal biases, limitations, or oversights in the construction and application of future-oriented regulatory frameworks: “Hermeneutics as a methodological practice mobilizes the critical subject and producer of meaning against the implicit ‘we’ of institutional and symbolic orders” (Nordmann & Grunwald, 2023, p. 40).

By analyzing the interplay between these four parameters, we can better understand the institutional conditions that shape the hermeneutic perspectives of various actors. These interconnections also determine the likelihood of a particular perspective becoming dominant in a given case, thereby influencing the vision of the



future that underpins specific regulatory decisions. The selection of the most suitable perspective is a fundamental function of law as an institution, and the flexibility of this selection process directly impacts both the effectiveness and democratic legitimacy of the decisions made.

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