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REVIEW ARTICLE

Imagining and Enacting Futures: The Anticipatory Politics of Algorithmic Governance

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ABSTRACT

This review article synthesizes social science scholarship on algorithmic governance through the lens of anticipation. Building on research in the sociology of expectations, Science and Technology Studies, and futures studies, we lean on the concept of anticipatory assemblages to conceptualize algorithmic governance as a politics of the future. Constituted through representational and socio-material practices, algorithmic governance provisionally stabilizes particular futures as objects of anticipatory knowledge and intervention. This narrative review yields three central insights. First, research on socio-technical imaginaries shows how states and digital elites frame algorithmic systems as inevitable, while civil society actors and affected publics often occupy more reactive positions. Second, studies of socio-material practices demonstrate how design choices, affordances, and calibration work establish anticipatory knowledge as actionable truth claims. Third, existing research has largely focused on how algorithmic governance produces "empty futures," which flatten social complexity into quantifiable indicators, risk scores, predictive categories, and optimized pathways. Meanwhile, the literature points to emerging efforts to recompose "lived futures." By foregrounding anticipation, this review complements existing accounts of algorithmic inequality and shows how algorithmic governance configures not only present decision-making but also the unequal capacities to imagine, enact, and refuse possible futures.

1 | Introduction

We live in a society of algorithms (Burrell and Fourcade 2021). Across laboratories, platforms, and public agencies, there is a growing imperative to anticipate and act upon the future. The production of anticipatory knowledge is central to algorithmic governance, defined as "a form of social ordering that relies on coordination between actors, is based on rules and incorporates particularly complex computer-based epistemic procedures" (Katzenbach and Ulbricht 2019, 2). The anticipatory capacities of algorithms are constructed through design choices and artifacts (Fuchs and Bauer 2026; Heimstädt and Egbert 2025), embedded within specific institutional contexts (Katzenbach and Ulbricht 2019), and legitimized through socio-technical imaginaries (Bareis and Katzenbach 2022).

This article presents a narrative review of social science scholarship on algorithmic governance through the lens of anticipation. The sociology of expectations[1] (Borup et al. 2006; Brown and Michael 2003), Science and Technology Studies (STS) (Aykut et al. 2019; Konrad et al. 2017), and futures studies (Granjou et al. 2017; Groves 2017) have theorized the politics of

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knowing and governing futures. In discussing algorithmic governance as future-oriented interventions in the present (Anderson 2010), we lean on the concept of anticipatory assemblages (Alvial-Palavicino 2015; Groves 2017). Assemblages, as theorized by Deleuze and Guattari (1987, 88), refer to processual arrangements in which "a *machinic assemblage* of bodies, of actions and passions" and "a *collective assemblage of enunciation*, of acts and statements" are brought into provisional, reciprocal relation. Central to assemblages are movements of territorialization, deterritorialization, and reterritorialization (Deleuze and Guattari 1987). Assemblages thus "establish territories as they emerge and hold together but also constantly mutate, transform and break up" (Müller 2015, 29). Applying assemblage thinking[2] to anticipation, Groves (2017) highlights how heterogeneous compositions of representational (e.g., future expectations and imaginaries) and socio-material elements (e.g., technologies, knowledge practices, affective relations, and institutional arrangements) unevenly distribute actors' capacities to anticipate the future. This resonates with social studies of algorithmic governance that conceptualize algorithms as contingent arrangements shaped by the interplay between human and non-human actors (Gillespie 2014; Gritsenko and Wood 2022).

Existing reviews of algorithmic governance have mapped its institutional forms and normative challenges (Issar and Aneesh 2022). Our intervention lies in problematizing algorithmic governance as a politics of future-making. As Cooper (2020, 40) contends, "algorithmic control institutes a temporal framework indexed on anticipatory machinations". We ask: How is algorithmic governance configured through representational and socio-material anticipatory practices? What competing futures do these practices produce? How are the capacities to shape those futures distributed?

We begin by discussing the current state of research and explicating how anticipatory assemblage informs the review. After outlining our methodological approach, we discuss the representational and socio-material practices that make algorithmic futures knowable and actionable, the competing future horizons that they produce, and the power relations embedded in these processes. We conclude by outlining directions for future research informed by this anticipatory lens.

2 | Background

2.1 | Current State of Research on Algorithmic Governance

Algorithmic governance has emerged as an interdisciplinary inquiry across sociology (Burrell and Fourcade 2021; Issar and Aneesh 2022), communication studies (Katzenbach and Ulbricht 2019), STS (Ziewitz 2016), and policy studies (Yeung 2018). The term "algorithms" spans data-intensive systems, including rule-based encoded procedures, machine learning, artificial intelligence (AI), and predictive analytics (Gillespie 2014; Issar and Aneesh 2022). We treat algorithms as a sensitizing concept (Ziewitz 2016) to examine how research discusses their anticipatory dynamics and implications for governance.

Existing reviews from a sociological lens identify three central themes. First, algorithmic governance perpetuates social inequalities (Barocas and Selbst 2016; Benjamin 2019; Eubanks 2018; Issar and Aneesh 2022; Zajko 2022). Racial, gender, and cultural biases appear in datasets used to train and evaluate facial recognition (Benjamin 2019; Buolamwinim and Gebru 2018), search engines (Noble 2018), and large language models (Bender et al. 2021; Ferrara 2023). Algorithmic discrimination and inequalities manifest across institutional domains, including predictive policing (Brayne 2017; Kim and Chung 2025), social welfare (Eubanks 2018), commercial surveillance (Zuboff 2019), education (Jarke and Macgilchrist 2021), border control (Amoore 2013), healthcare (Cruz 2020), and employment (Dubal 2023).

Second, social science research conceptualizes algorithmic governance as "part of a governance assemblage where the space for immediate negotiability has been reduced in algorithmically managed input-output systems" (Issar and Aneesh 2022, 5). This reduced negotiability, shaped by degrees of algorithmic transparency and automation (Katzenbach and Ulbricht 2019), restricts individuals' ability to challenge algorithmic decision-making (Issar and Aneesh 2022; Yeung 2018).

Third, sociologists of work discuss how algorithmic technologies transform labor processes and exacerbate precarity in low-wage (Vallas and Schor 2020) and professional occupations (Kellogg et al. 2020). There are also broader processes of class-making (Burrell and Fourcade 2021), notably the divide between Global North coding elites and Global South data workers (Casilli 2025; Gray and Suri 2019).

Although these studies offer a robust account of how algorithmic inequalities are rooted in and reinforce systems of stratification and discrimination, we shift attention to the temporal dimension of algorithmic governance for two reasons. First, algorithmic governance operates through an anticipatory logic which "acts not strictly to prevent the playing out of a particular course of events on the basis of past data tracked forward into probable futures but to pre-empt an unfolding and emergent event in relation to an array of possible projected futures" (Amoore 2013, 9). Rouvroy et al. (2013, 171) characterize algorithmic governmentality as "(a)normative or (a)political rationality founded on the automated collection, aggregation and analysis of big data so as to model, anticipate and preemptively affect possible behaviors". Second, public and policy discourses surrounding algorithmic systems have become saturated with competing future-oriented narratives.

Questions of power and inequality, we argue, remain central to understanding the anticipatory politics of algorithmic governance, especially when considering the underlying practices that differentially structure the capacities and possibilities of anticipating algorithmic futures.

2.2 | Anticipation and Future-Making in Technological Governance

Sociologists and STS scholars have long problematized the future as a critical site for examining collective sensemaking,

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environmental and technological governance, and power (Beckert and Suckert 2021; Groves 2017; Suckert 2022). In contemporary society, the future is framed as "an open set of endless possibilities" that is at once threatening and generative (Anderson 2010, 793). This pervasive uncertainty demands anticipation to manage anxiety, sustain capitalist dynamics, and prepare for looming threats (Adams et al. 2009; Anderson 2010; Beckert 2016). Anticipation is related to, but analytically distinct from, expectations, imaginaries, and prediction. Expectations and imaginaries denote representations of possible futures, while prediction projects future events probabilistically from available evidence or data. Anticipation, by contrast, encompasses both a lived orientation and socio-material practice through which futures are brought into the present as objects of concern, preparation, and intervention (Adams et al. 2009; Alvial-Palavicino 2015; Anderson 2010). It carries a sense of urgency and moral imperative: actors feel obligated to act upon the present to "secure their best possible futures" (Adams et al. 2009, 256), "as if the emergency has already happened" (249; see also Bryant and Knight 2019; Konrad et al. 2017). Anticipation therefore shapes which futures are deemed desirable, which threats require action, and which actors are authorized to intervene in the present (Adams et al. 2009; Aykut et al. 2019; Granjou et al. 2017).

Emerging technologies are a central arena for future-making, as social groups struggle to define and negotiate what the future should look like (Brown et al. 2000). Algorithmic governance can be productively analyzed through the concept of anticipatory assemblage (Alvial-Palavicino 2015; Groves 2017). Central to such assemblages are anticipatory practices, defined as "the work involved in thinking, debating, and preparing for future (s)" (Fuchs and Bauer 2026, 2). Among the more explicit representational forms of anticipation are expectations (statements about probable future conditions), visions (localized future projections of smaller collectives like corporations), and socio-technical imaginaries (collectively held visions of desirable futures) (Bazzani 2023; Chan 2021; Hilgartner 2015; Jasanoff 2015; Urueña 2022). They can be understood as "becoming expressive" in the Deleuze-Guattari sense: beyond signifying possible futures, they have "a performative function" that transforms the social world they instantiate (Buchanan 2021, 127; see also Deleuze and Guattari 1987). This performative force does not stem from individual intentions but operates through the circulation of statements and the commitments they generate (DeLanda 2016). This account echoes sociological and STS analyses of how anticipation governs future-making through performativity (Beckert 2016; Borup et al. 2006; Konrad et al. 2017; Selin 2008). Representational anticipatory practices function as "storylines" that "reduce the unknowability and openness of the future to more manageable proportions" (Oomen et al. 2022, 261). They mobilize resources, coordinate actors across innovation networks, and legitimize self-governance (Borup et al. 2006; Brown and Michael 2003; Tutton 2021; Van Lente 2012). Future-making is cast as a terrain of interpretive struggles where different social actors compete to shape which futures are pursued and which are precluded (Beckert and Suckert 2021; Suckert 2022).

Yet anticipation is not reducible to representation. The implicit, socio-material dimension of anticipation creates the conditions under which futures are produced and enacted (Aykut et al. 2019; Esguerra 2019; Granjou et al. 2017; Groves 2017). Producing anticipatory knowledge involves assembling heterogeneous resources, such as narratives, modeling, and digital traces, to project and manage the future (Flyverbom and Garsten 2021; Fuchs and Bauer 2026). Futuring techniques standardize knowledge practices, define relevant risks, and constitute anticipatory expertise (Aykut et al. 2019). This dimension connects with STS and Human-Computer Interaction (HCI) scholarship that understands design practices as sites where particular visions of users, actions, and futures are inscribed into artifacts (Akrich 1992; Steinhardt and Jackson 2015; Woolgar 1991). Designers engage in anticipation work to channel "users' expectations of the future, design pathways into those imaginations, and maintain those visions in the face of a dynamic world" (Steinhardt and Jackson 2015, 443). Representational and socio-material elements of anticipation may interact through knowledge production, design practices, and use. For example, future-oriented representations are materialized through design choices, generating affordances that "allow, encourage, discourage, or refuse certain actions" (Fuchs and Bauer 2026, 3). Users of algorithmic technologies also continuously interpret and contest anticipatory knowledge as they engage with these affordances (Kwok and Chan 2024a, 2024b).

Anticipatory assemblages exhibit particular styles of anticipation—underlying rules or "grammars" that organize temporal horizons (Alvial-Palavicino 2015; Groves 2017). Following Groves (2017), we distinguish between empty and lived futures. Empty futures are rendered calculable through the abstraction of possibilities, often for instrumental purposes, whereas lived futures "set up future narratives around a multiplicity of lived experiences of place and community, interpreting potential futures through histories told at various levels" (Groves 2017, 35). Although Groves does not explicitly discuss them in terms of deterritorialization and reterritorialization, these processes help clarify how empty and lived futures might interact and come into conflict. Empty futures may be superimposed on lived ones. Deterritorialization occurs as possible futures are disembedded from their relational contexts. This disembedding is accompanied by reterritorialization (Deleuze and Guattari 1987). Rather than constructing the future simply as "a totality of possible events" (Groves 2017, 34), calculative practices reorganize anticipation around a bounded field of intervention by flattening uncertainty into quantitative measures, predictable trajectories, and decision points. Efforts to recompose lived futures may deterritorialize dominant anticipatory assemblages and reterritorialize them through new social relations and practices, creating space for open-ended possibilities. Such tensions reveal the politics of anticipation in algorithmic governance: whose future is rendered calculable, whose uncertainty is acted upon, and whose lived possibilities are constrained or displaced.

Neither the distinction between representational and socio-material anticipatory practices nor that between empty and lived futures should be understood in mutually exclusive terms. By making the assemblage lens explicit (Figure 1), we explore how anticipatory assemblages of algorithmic governance are (re)composed and how they unevenly distribute anticipatory capacities.

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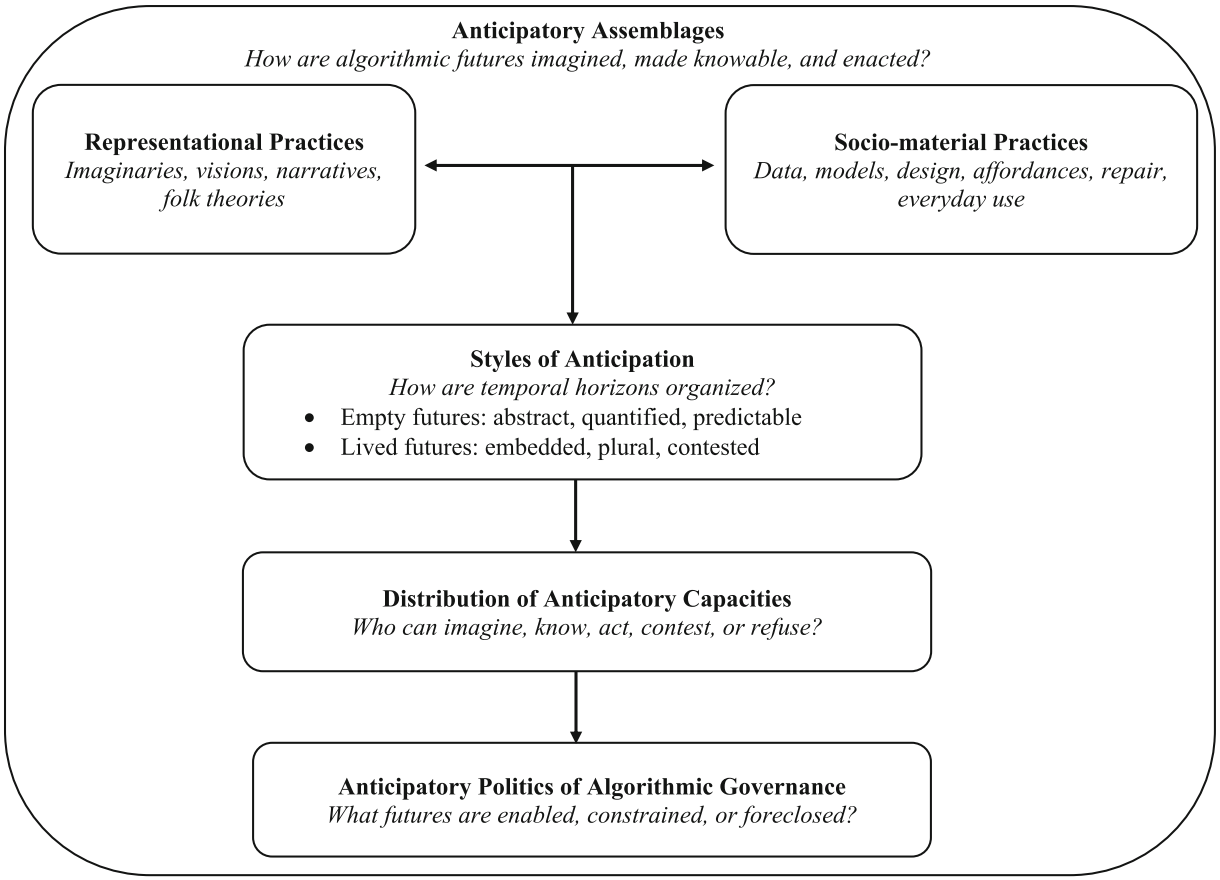


FIGURE 1 | Anticipatory assemblages in algorithmic governance.

3 | Methodological Approach

Because anticipation is often relegated as inherent to algorithmic systems, we adopted the narrative review approach (Cronin and George 2023; Toronto and Remington 2020) to synthesize how anticipatory dynamics are conceptualized across interdisciplinary research on algorithmic governance.

The literature search proceeded in three phases (see Supporting Information S1: Appendix A for details). In Phase 1, we conducted keyword searches using Web of Science (WoS) in February 2026 to locate publications across social science fields ($n = 641$). In Phase 2, we removed non-English-language publications and screened abstracts to assess their relevance. We included publications that explicitly addressed the temporal dimensions of algorithmic governance, the predictive power of algorithms, or future imaginaries and visions of algorithms, along with existing reviews ($n = 71$). In Phase 3, we read these publications to assess their analytical relevance ($n = 36$). We further identified related research through the included publications' bibliographies and a manual review of publications in ACM conference proceedings (FAccT, CHI, and CSCW) published between 2023 and 2025. The latter helps capture recent HCI and adjacent scholarship on anticipatory algorithmic practices. In total, 82 publications formed the basis for the review (Supporting Information S2: Appendix B).

Two limitations are worth noting. First, the WoS database is skewed toward English-language journal articles (Wilder and Walters 2021). Second, a keyword-based search strategy might have excluded studies that address similar phenomena but employ different conceptual vocabularies. Accordingly, this article should not be read as an exhaustive review of the literature.

Our synthesis was guided by an abductive approach, an iterative process of moving between the reviewed studies and the concept of anticipatory assemblage. We considered different types of algorithmic systems under study to reflect on variations in anticipatory dynamics. As individual studies often foregrounded specific dimensions of anticipation, we organized the review accordingly while remaining attentive to their connections and tensions.

4 | Anticipatory Practices and Politics in Algorithmic Governance

4.1 | Imagining Algorithmic Futures

One prominent strand of research on algorithmic governance, particularly within STS and communication studies, employs the concept of socio-technical imaginaries to analyze how technological futures are "collectively held, institutionally stabilized, and publicly performed" (Jasanoff 2015, 4). In contrast to "frames" or "narratives," imaginaries "guide future expectations" and "mobilize resources to help this future come into being" (Richter et al. 2023, 211). This concept highlights how normative ideals of techno-development and collective life are reproduced and stabilized (Jasanoff 2015).

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State actors are cast as the primary architects of algorithmic futures. Governments portray algorithms as cost-effective, ostensibly "objective" solutions to social problems, from predicting child abuse and detecting welfare fraud to allocating elderly care resources (Eiermann 2024; Cozza 2024; Whelan 2020). Citizens are envisioned as data subjects whose access to rights and benefits depends on algorithmic classification rather than civic membership (Fourcade 2021).

AI imaginaries also extend beyond welfare governance into long-term national modernization and geopolitical competition. AI policies, as a prominent object of analysis, can be understood as assemblages (Buchanan 2021; Su and Chan 2026). They territorialize AI development by provisionally stabilizing particular national visions—such as international competitiveness, digital sovereignty, and responsible innovation (Richter et al. 2023)—and enrolling actors and resources around them. Bareis and Katzenbach (2022) found that the governments of China, France, Germany, and the United States frame AI development as both inevitable and desirable while positioning themselves as leaders capable of mitigating "worst-case scenarios." This legitimizes the state as a central authority for setting rules and guiding AI development without committing to a fixed technological trajectory. Similar imaginaries appear across the European Union (Richter et al. 2023), the UK (Bennani-Taylor 2024), Singapore (Chung 2026), and Brazil (Cavalcante Silva 2025), where national visions are materialized through funding and regulatory priorities.

Scholarship on AI imaginaries remains geographically uneven, with disproportionate attention to the United States, China, and Western Europe (Richter et al. 2023). A growing body of research grounded in Latin America and Asia reveals the contingency of anticipatory assemblages. In Latin America, imaginaries are shaped by colonial legacies, dependence on foreign technologies, neoliberal rationalities, and authoritarian trajectories (Ricaurte et al. 2024). Across Singapore, Taiwan, and Hong Kong, governments frame AI as essential to socioeconomic survival and the management of uncertain futures in developmental societies (Chung 2026).

Digital elites are equally central to the discursive construction of algorithmic futures. Cheney-Lippold (2025, 4170) develops the concept of "silicon future" to denote "a temporal paternalist claim to authority that validates itself not according to argument or empiricism, but to temporal supremacy—to be from the future is to already know what happens". This orientation defines Silicon Valley culture: pitching a startup from a projected future and working backward; announcing algorithmic systems before they are fully built; and using loss-leading strategies to build a dominant user base (Cheney-Lippold 2025; Hong 2022). Digital elites position algorithmic and AI systems as solutions to social problems, including content moderation (Katzenbach and Ulbricht 2019), smart city governance (Sadowski and Bendor 2019), and social media misinformation (Apiola and Pope 2025). Nagy and Neff (2024), for example, depict OpenAI as performing like a magician by staging the spectacle of ChatGPT while concealing the harm and human labor that underwrites generative models. Paradoxically, AI safety warnings are mobilized to justify further investment (Leaver and Srdarov 2023) and normalize algorithmic risks and harms as short-term costs on the path to a far-future utopia (Gebru and Torres 2024). Silicon futurists position themselves as already living in the future ahead of our present (Cheney-Lippold 2025). Following assemblage thinking, this entails deterritorializing human experiences from their lived contexts and reterritorializing them as proprietary terrain for datafication and profit-maximization (see also Zuboff 2019).

Different temporal horizons of algorithmic governance authorize distinct anticipatory interventions. Wijermars and Makhortykh's (2022) comparison of FinTech and online disinformation policy imaginaries in the European Union offers an exemplar. FinTech is imagined as a driver of technological innovation and global competitiveness in the long run, whereas disinformation policy portrays algorithms as both problems and solutions requiring immediate crisis response (Moleón 2025; Wijermars and Makhortykh 2022). In public administration, predictive analytics and automated decision-making systems are imagined as near-future improvements with promise to identify risks and deliver efficient services in real time (Esko and Koulu 2023; Lazaro and Rizzi 2023).

A smaller body of research has examined how civil society actors (Bakiner 2023), activists (Chan et al. 2025; Kazansky 2021), social media users (Ruckenstein 2023; Savolainen 2022; Schellewald 2022), and content creators (Bishop 2019; Duffy and Meisner 2023; Issar 2024; MacDonald 2023) articulate algorithmic imaginaries, circulate folk theories, and engage in anticipatory tactics. Imaginaries and folk theories capture how individuals variously encounter, interpret, and feel about invisible and opaque algorithms, which might, in turn, inform their everyday practices (e.g., Bucher 2017; Schellewald 2022). Yet studies of folk theories emphasize how lay understandings of algorithms are communally produced and circulated (Bishop 2019; Ruckenstein 2023; Schellewald 2022). On one hand, these interpretive practices may reinforce dominant platform assemblages by placing responsibility on individuals to learn how algorithms work and continually optimize their conduct (MacDonald 2023). On the other hand, they may transform individual feelings of fear and frustration into resources for collective agency (Ruckenstein 2023). They intersect with anticipatory tactics when actors mobilize such lay understandings to assess and resist threats posed by algorithmic surveillance (Chan et al. 2025; Kazansky 2021). Even so, these actors often have limited influence over algorithmic outcomes (Richter et al. 2023). Their interpretive and tactical practices are largely reactive, grounded in experiential encounters with algorithmic systems rather than access to their design. This speaks to a wider concern over who possesses the epistemic, material, and institutional resources to anticipate and shape algorithmic futures.

4.2 | Socio-Material Anticipatory Practices in Algorithmic Governance

While Section 4.1 primarily considers algorithmic systems as objects of future-oriented representations, it leaves open the question of what renders certain imagined futures performative (Oomen et al. 2022) beyond the structural positions of the state and digital elites. Flyverbom and Garsten's (2021) work is useful for theorizing how informational resources are assembled to

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render future affairs knowable and governable through algorithmic systems. They delineate four ideal-type templates for organizational action, which might overlap in practice: (1) "indicative snapshots" that render the present legible through statistical reports; (2) "prognostic correlations," where algorithmic profiling and data visualizations produce predictions meant to pre-empt or modulate near-term behavior; (3) "projected transformations," as in think-tank forecasts that map scenarios and forces of change to reduce uncertainty; and (4) "phantasmagoric fictions," speculative imaginaries that cast the future as radically uncertain and create urgency for intervention. As in the discussion of representational elements, policy reports are artifacts through which narratives, digital traces, and other informational resources are assembled to constitute imaginaries. The hope and fear surrounding distant futures mobilized by states and digital elites resemble phantasmagoric fictions by creating urgency that legitimizes technological development, while deferring accountability.

The performativity of algorithmic futures goes beyond stories about algorithmic systems to knowledge generated by their socio-technical configurations, that is "performative and therefore, inventive, enabling certain practices—but also inhibiting others" (Egbert 2024, 275). Although not all algorithms predict, many studies have examined how predictive analytics intervene in the social fields they promise to anticipate, including policing (Brayne 2017; Egbert and Krasmann 2020; Heimstädt and Egbert 2025; Jansen 2024), education (Jarke and Macgilchrist 2021), tenant screening (Rosen et al. 2021), child protection (Ratner and Elmholdt 2023), and risk governance (Fuchs and Bauer 2026). Egbert (2024, 276) discusses prediction regimes as a subtype of algorithmic regimes to highlight the "production and implementation of *explicitly* future-related knowledge devices".

Central to this literature is how algorithmic systems afford particular ways of seeing, problematizing, and managing risk, that is, how anticipatory practices establish and legitimize certain truth claims (Flyverbom et al. 2017; see also Foucault 1991). For example, Fuchs and Bauer (2026) argue that the affordances of the SUN Decision Support System (SUNDS) guide industrial users toward nano risk assessment within a narrowed scope of regulatory and sustainability criteria. The tool enables users to estimate life cycle impacts based on measurable indicators such as employment and R&D expenditure, whereas broader ethical and cultural impacts are excluded. In education, Jarke and Macgilchrist (2021) show that Brightspace's machine-learning-based analytics dashboards position teachers as "managers" responsible for monitoring student progress and intervening when necessary. Infrequent in-platform interactions are problematized as a lack of sociality—a key risk indicator—and the resulting visualizations hint at causal relationships between behavioral data and academic performance. Similarly, in predictive policing, color-coded maps (Egbert and Krasmann 2020) and risk scores (Brayne 2017; Jansen 2024) turn abstract crime problems into place-, person-, and network-based risk indicators drawn from historical and real-time data. More than probabilistic prediction, these tools enable police to draw connections between data points and pre-emptively guide resource allocation, producing feedback loops that entrench racial disparities and appear to confirm the model's forecasts (Brayne 2017). Across these cases, algorithmic classifications and predictions facilitate "incorporeal transformations" (Deleuze and Guattari 1987), assigning new social attributes (e.g., lacking sociality or being potentially dangerous) to data subjects and reshaping how they should be governed in specific institutional contexts.

Two tensions warrant further consideration. First, as algorithmic systems frequently encounter moments of friction and breakdown, they require those governing and the governed to continuously repair and sustain the systems they rely on (Andrejevic et al. 2020; Schwennesen 2019; Zenkl 2025). Heimstädt and Egbert's (2025, 5) ethnography of predictive policing in Germany illustrates how designers' everyday calibration work sustains anticipatory assemblages. Designers "adjust the form of algorithmically calculated predictions ... to their ideas of actionable knowledge about the future" by calibrating the volume, temporal validity, and spatial dimensions of predictions to ensure outputs are statistically sound and aligned with frontline officers' operational routines. Similarly, Fuchs and Bauer (2026) show how regulatory compatibility is encoded into the design of SUNDS, shaping what industrial users can and cannot assess.

Meanwhile, HCI researchers have increasingly framed algorithmic impact assessment as a site where designers and stakeholders should anticipate potential harms, rather than relying narrowly on technical performance metrics, before deployment (Awumey et al. 2024; Metcalf et al. 2021). Such approaches can make future harms, affected publics, and accountability relations visible. Nevertheless, the extent to which impact assessments deterritorialize established design priorities and reterritorialize them around meaningful accountability mechanisms remains an empirical question.

A second tension concerns how algorithmic governance is entangled with decision-makers' moral judgment and practical needs in contexts of use. For example, Rosen et al. (2021) show that professionalized landlords tend to use screening algorithms to assess prospective tenants' eligibility, whereas smaller landlords rely on home visits and "gut feelings." But both arrangements may reproduce racialized exclusion based on landlords' moral judgments about which social groups are deemed trustworthy. In policing, predictive algorithms reinforce officers' belief in data-driven authority (Brayne 2017; Egbert and Krasmann 2020) and provide institutional "fixes" like blame avoidance (Jansen 2024). In child welfare services, Ratner and Elmholdt (2023) demonstrate how similar predictive algorithms can produce different "risk objects" depending on the valuation of professional expertise and human-machine configurations (e.g., algorithmic decision support or decision generation).

Furthermore, algorithmic governance includes other modalities such as recommendation, ranking, selection, moderation, and event detection. Yet their anticipatory dynamics remain relatively understudied. Public relevance algorithms encode assumptions about what counts as relevant, implicitly anticipating and reinforcing user engagement in self-referential loops (Gillespie 2014). Together with content moderation, which determines what is permissible, these algorithms shape what users see (Just and Latzer 2017), potentially replacing active choice

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with curated selections that appear to be the user's own (Schwarz 2025). In the case of earthquake event detection, Finn and Ananny (2025) show how anticipation emerges through arrangements of sensor infrastructures, automated reporting, and editorial expertise that shape when and how events become publicly meaningful.

In brief, algorithmic governance constructs futures through socio-material arrangements that make some possibilities visible, measurable, and actionable while rendering others marginal or invisible. Representational and socio-material practices interact when future-oriented assumptions and narratives are built into algorithmic systems that organize perception, intervention, and accountability.

4.3 | The Politics of Anticipation in Algorithmic Governance

Central to the politics of anticipation is the question of what kinds of futures algorithmic governance produces and for whom. As Section 4.1 shows, certain state actors and digital elites have disproportionate capacities to define the future of algorithmic governance, whereas affected communities occupy constrained roles in agenda-setting. Assemblage thinking shifts attention beyond representational struggles to the coexistence of multiple and often contradictory styles of anticipation (Groves 2017).

A common thread across the reviewed literature is a critique of how algorithmic governance produces and certifies empty futures (Groves 2017). The concept of algorithmic governmentality captures this "new regime of digital truth" (Rouvroy et al. 2013, 163; see also Aradau and Blanke 2017; Cooper 2020; Egbert 2024). Like earlier statistical and probabilistic techniques of governing, algorithmic governance derives its legitimacy from mechanical objectivity, though it remains selective and partial, driven by particular interests (Egbert 2024). This is evident in the structural biases that permeate the development and deployment of machine learning algorithms (e.g., Barocas and Selbst 2016). Meanwhile, algorithmic governance reconfigures older problems of forecasting. As Esposito et al. (2024) argue, probabilistic forecasting has been criticized for its performativity, individualization, and opacity, but algorithmic governance recasts them as opportunities. It "shifts from describing the future to intervening in the future" through actionable and individualized data-driven predictions (18; see also Rona-Tas 2020). In this sense, algorithmic governance empties the future by turning calculable probabilities into grounds for present intervention.

Moreover, machine learning algorithms may conflate correlation with causation when predicting future outcomes and justifying pre-emptive interventions (Amoore 2013; Egbert 2024; Esposito et al. 2024; McQuillan 2015; Rouvroy et al. 2013). By looking "for correlations in data to find patterns inductively" rather than testing causal hypotheses (Egbert 2024, 274), these systems extrapolate algorithmic futures from past and present data. Whether one is targeted as a potential welfare fraudster may be inferred from mechanical projection of past welfare payments and income data onto the future (Whelan 2020). Predictive policing presumes that historical arrest and crime rate data can anticipate future offending (Brayne 2017). These presumptions not only reduce qualitative differences into quantifiable data points but also overlook the fact that people can intentionally act to change their circumstances (Rona-Tas 2020). The logic of prioritization narrows the future-oriented decision-space. For instance, educational platforms prioritize cognitive performance and datafied social interactions over socio-emotional learning (Leaton Gray and Scott 2026), prompting teachers to intervene based on behavioral metrics (Jarke and Macgilchrist 2021). In elderly care, algorithms prioritize age-related capabilities over social needs to optimize resource allocation (Cozza 2024). Yet prioritization must also be legitimized. Here, representational and socio-material practices converge: techno-solutionist imaginaries legitimize the encoded priorities by framing algorithmic governance as a necessary and rational response to social problems and uncertainties.

This critique of algorithmic predictions has prompted calls for incorporating counterfactuals into machine learning, especially when algorithms are used to automate or assist in decision-making that may affect individuals' life chances (Kusner et al. 2017). Pinpointing how discrimination can persist even when protected attributes are not used as observed variables, Kusner et al. (2017, 2) introduce counterfactual fairness, "which enforces that a distribution over possible predictions for an individual should remain unchanged in a world where an individual's protected attributes had been different in a causal sense". Although counterfactuals might help identify potential biases (Kusner et al. 2017), Kasirzadeh and Smart (2021) caution that uncritical uses of counterfactuals may essentialize social categories and detach them from lived realities. Hence, counterfactuals risk reproducing empty futures by reterritorializing possibility around bounded and value-laden models.

The reviewed studies have paid relatively less attention to "lived futures" (Groves 2017): futures embedded in social relations, histories, places, communities, and situated experiences. Rethinking lived algorithmic futures requires more than technological fixes or abstract formulations of transparency and fairness. Against the accelerated empty futures enacted by algorithmic governance, Andrejevic et al. (2020) advocate slowness as a reorientation of temporality that restores conditions for human agency. Refusal may offer a more direct challenge: the deliberate rejection of participation in harmful or exploitative algorithmic systems (Benjamin 2019; James et al. 2023). It takes various forms, including opting out, institutional bans, and collective organization (e.g., data co-operatives) (James et al. 2023; Zong and Matias 2024), but all share an insistence on generating more just and equitable alternatives. By attending to how socio-material arrangements constrain affected communities' capacities to recognize and contest the anticipatory logics imposed on them, refusal-informed design practices inscribe mechanisms that enable these communities to challenge or withdraw from algorithmic predictions (e.g., consent frameworks) (Zong and Matias 2024). There have also been attempts to adopt participatory futuring methods to engage the public in incorporating their imaginaries in the design process (Jarke and Manchester 2025).

Both empty and lived futures entail movements of deterritorialization and reterritorialization. Nevertheless, deterritorialization

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may produce change without necessarily being revolutionary (Deleuze and Guattari 1987; Nail 2017); instead, it is often "overlaid by reterritorialization, which amounts to saying it is a form of change in order to remain the same" (Buchanan 2021, 89). Understanding the anticipatory politics of algorithmic governance therefore requires examining whether and how specific interventions redistribute capacities to represent, contest, and intervene in algorithmic futures.

5 | Conclusion

This article contributes to debates on algorithmic governance by highlighting its anticipatory practices and politics. The synthesis of the literature, while not exhaustive, yields three interconnected insights. First, existing research offers rich accounts of the representational and socio-material dimensions of anticipation in algorithmic governance, yet often analyzes them separately. Research on socio-technical imaginaries documents how state and corporate actors frame algorithmic governance as inevitable and desirable, thereby constructing an obligation to pre-emptively intervene in the future, whereas civil society actors and individuals are often portrayed as engaging in near-term sense-making and tactical responses to algorithmic systems. Yet this literature often assumes the effects of these imaginaries without tracing how they become performative. Studies of socio-material practices, in turn, detail how design choices, affordances, and calibration work establish anticipatory knowledge as actionable truth claims, but pay less attention to the representational struggles that legitimize them. Second, the entanglement of these dimensions reveals that normative claims about the necessity of anticipation authorize certain actors to define algorithmic futures, whereas socio-material practices give these claims material force by structuring who can produce, access, and contest anticipatory knowledge. Third, the reviewed studies highlight the production of "empty futures" (Groves 2017) by demonstrating how algorithmic predictions may extend historical patterns and foreclose alternative futures. Emerging efforts to recompose lived futures, however, may be constrained by hegemonic frames of technological inevitability (Markham 2021) and other socio-material forces.

Understanding algorithmic governance as a politics of the future calls for a geographically and historically situated research agenda attentive to variation across algorithmic systems and oriented toward lived futures. We identify four research directions.

First, algorithmic systems are embedded in different anticipatory assemblages, composed of distinct actors, affordances, institutional arrangements, and temporal orientations. Yet variation among these assemblages remain comparatively undertheorized, as research on imaginaries has largely focused on AI governance while socio-material studies have centered on predictive analytics. Esguerra's (2019, 964) typology of future objects help explain this pattern. As predictive analytics become stabilized and institutionalized, they often operate as "solid and ready to use" knowledge objects that secure the present and inform decision-making on relatively well-defined policy problems. AI systems, by contrast, remain formative objects whose uncertain futures generate more public debate and, consequently, more research on competing AI imaginaries. Conceptualizing algorithmic systems as different knowledge objects helps analyze how their surrounding assemblages are (re)configured. Future research should consider both predictive and non-predictive algorithmic modalities.

Second, studies remain disproportionately focused on algorithmic and AI imaginaries of the United States, China, and Western Europe, a pattern that mirrors the concentration of socio-political and economic power in global technology governance. Assemblage thinking suggests two complementary moves. First, as DeLanda (2016, 3) argues, "at all times we are dealing with assemblages of assemblages". Anticipatory assemblages are nested within and composed of other assemblages that may predate them and come with distinct dynamics (e.g., languages and geopolitical entities). Critical research has begun to theorize how colonial legacies, social asymmetries, and geopolitical positioning shape the anticipatory politics of algorithmic governance (e.g., Chung 2026; Ricaurte et al. 2024). Even "the future" carries different meanings across societies (Qing and Chan 2026). In this vein, decentering Euro-American assumptions about anticipatory politics of algorithmic governance means treating perspectives grounded in the Global South as generative of theory-building and empirical inquiry rather than as extensions of, or exceptions to, dominant frameworks. Relatedly, research, including this review, is an assemblage in-the-making that territorialize particular problem spaces (Fox 2024; Fox and Alldred 2015; Zenkl 2026). It involves not only researchers' choices about how to study the anticipatory politics of algorithmic governance but also scholarly infrastructures and conventions (e.g., publication languages and disciplinary boundaries) that condition whose knowledge becomes valorized. These moves call for multiplying our frames of reference (Chen 2010): all knowledge is necessarily partial, and therefore, no single frame can fully explain algorithmic governance and the resulting inequalities.

Third, recent research raises important questions about the social construction of algorithmic actionability (Heimstädt and Egbert 2025). Future research should examine how actionability is provisionally sustained, repaired, and renegotiated through design practices, institutional routines, professional judgment, and everyday encounters between algorithmic systems and their users.

Fourth, the critique of empty algorithmic futures raises pressing normative questions about what kinds of futures algorithmic governance should produce and for whom. Refusal as a design practice (Zong and Matias 2024) offers a particularly productive starting point for examining the conditions under which refusal reconfigures socio-material arrangements and redistributes the capacities to reimagine alternative futures in design processes. Future research can specify when and how such design practices reinforce empty futures and create space for lived futures.

Overall, approaching algorithmic governance through the lens of anticipatory assemblages complements existing accounts of algorithmic inequality by making visible the temporal politics through which futures are produced and foreclosed.

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The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

This review article does not contain any original data. All information discussed in the manuscript is derived from previously published studies, which are cited throughout the text.

Endnotes

[1] Brown and Michael (2003) originally termed it as the sociology of futures and anticipation.

[2] We use assemblage thinking as an umbrella term to describe relational and processual approaches that take inspiration from and variously interpret Deleuze and Guattari's concept of assemblage (Buchanan 2021). These approaches often challenge dualisms (e.g., nature/society and agency/structure) and emphasize "more than human" and non-representational theorizing (Groves 2017, 30; see also Alvial-Palavicino 2015; Müller 2015).

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