

**CONSEQUENCES OF TECHNO-DETERMINIST NARRATIVES OF ARTIFICIAL  
INTELLIGENCE IN LOGISTICS**

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By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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## LABOR SHORTAGES IN THE SUPPLY CHAIN

Perhaps no job has been condemned for its inevitable automation more than commercial truck driving. An analysis and ranking of logistics jobs in 2019 by susceptibility to automation marked commercial truck driving a dying trade with no growth potential (Han et al.). Andrew Yang's viral presidential campaign presented the imminent automation of truck driving as evidence for a need to start a universal basic income in America (Roose 2018). The concerns around truck driving reflect a greater trend in America of fear toward automation technologies. *The Pew Research Center* conducted polls that found 37% of Americans believe automation is a direct threat to their jobs (Parker et al. 2019). Academic estimates have ranged even higher and suggested 47% of jobs could be automated within two decades (Frey & Osborne, 2017).

Why then, has the past year experienced labor shortages in the logistics industry? In response to a nationwide estimated shortage of 68,000 truck drivers, California has started training programs for high schoolers (Franklin, 2021). Such a great discrepancy between predictions and immediate labor shortages begs the question, who is shaping the narrative of automation? Furthermore, how does the narrative affect the logistics industry and impact the workers within it?

This STS research paper aims to recontextualize how automation technologies fit within the socio-technical system of the logistics industry. It uses the framework of Actor-Network Theory (ANT) as described by Cressman (2009) in two ways. This paper uses Actor-Network both descriptively, as a diagnostic tool, and prescriptively to model possible solutions. The scope focuses on artificial intelligence, because of the topic's recurrence in literature in addition to its relevance to this paper's tightly coupled technical project. Within this paper, the terms artificial

intelligence (AI) and machine learning (ML) reference the same technologies and are used interchangeably.

The technical project begins work on a quantum computing system for transaction optimization at the Port of Virginia as outlined by Chowdhury's (2021) ARPA-E proposal. Amidst mythical narratives of "artificial intelligence," the project must avoid unfounded determinist expectations for the efficacy of neural net and other AI applications. Furthermore, one can imagine the use of "quantum" only compounds the potential overhype. Using ANT to critically analyze the narratives and power dynamics involving AI will enable a more thoughtful implementation of the technical proposal.

## **DREAMS AND NIGHTMARES OF SCI-FI FUTURES**

Coined by Harvard STS professor Sheila Jasanoff and mathematician Sang-Hyun Kim (2009), socio-technical imaginaries refer to "collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects" (para. 4). Science fiction stories are performative in constructing a variety of imaginaries involving automation and artificial intelligence ranging from apocalyptic villains in *Terminator* to the empathetic anti-heroes of *Blade Runner*, but they consistently imagine AI effective if not superhuman. J. Jesse Ramirez (2020), assistant professor of American Studies, critically examined such imaginaries in his book, *Against Automation Mythologies: Business Science Fiction and the Ruse of Robots*. Ramirez's (2020) deconstruction of mainstream symbology challenges both optimistic and pessimistic imaginaries, "both sides presume that technology is a force of nature—objective, apolitical, inexorable, automatic" (p. 1), and "this discourse simply shows us the other side of the techno-deterministic coin" (p. 3).

Determinist narratives of AI pervade everyday life and discourse such that separate myths crystalize into an imaginary. The previously mentioned study from *The Pew Research* (Roose, 2018) alone demonstrates the widespread concern surrounding automation. Additionally, a research survey on the expectations of AI (Kerr et al., 2020) resulted in split responses between positive and negative reactions, but both listed automation most frequently as the reason. Similar views can be witnessed in academia such as Frey & Osborne's (2017) dramatic predictions of job computerization and Han et al.'s (2019) classification of logistics jobs by future value. Additionally, scholars such as Wu (2020) stress the involvement of political, social, and regulatory actors in automation's use (p. 10) but presume technological competence.

Most concerningly, the determinist narratives penetrate the minds of the most powerful leadership in America. Ramirez (2020, p. 20) notes that Erik Brynjolfsson, author of *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, appeared on panels organized by the Obama Administration and received citations in the administration's report on AI and automation. Brynjolfsson's book describes an imminent second AI and automation fueled revolution in reference to the scale of the original Industrial Revolution (Ramirez, 2020). STS researchers Bareis & Katzenbach (2021) analyzed government policy documents for AI in the United States, Germany, France, and China, and found even more alarming results; while the imaginaries differ along purpose, they all agree upon AI inevitability and necessity. Additionally, the imaginaries are deemed performative in setting policy that has potential for irreversible lock-in effects (Bareis & Katzenbach, 2021).

## **DISILLUSIONED REALITY OF ARTIFICIAL INTELLIGENCE**

In analysis about AI discourse and rhetoric, the name itself must be examined. Kerr et al. (2020) describe usage of the term in three total hype waves beginning in 1956 with different

technological goals and implementations each time (para. 4). Hansen (2022) corroborates the timeline in an analysis of news media that found consistent personification of AI and use of language that implies AI autonomy and ability to act (p. 65). Additionally, depictions of AI in stock images, including those used in textbooks, tend toward digital humans or digital brains (Romele, 2022). Presentations of AI and the name itself contribute towards a misleading representation that has manifested in a concept of the Singularity, an ultimate and omnipotent machine-god, or as Ramirez (2020) describes, “the rapture for nerds” (p.3).

Such renderings enable ML models such as GPT-3 to masquerade as ‘intelligent’ language processors while not approaching anything deserving of the label (Bender et al., 2021). In the controversial paper, “On the dangers of stochastic parrots: Can language models be too big?” Bender et al. (2021) state, “the tendency of human interlocutors to impute meaning where there is none can mislead both NLP researchers and the general public into taking synthetic text as meaningful” (p. 611). The paper gained mainstream recognition in news when one of the authors, Timnit Gebru, was fired from her position as a co-leader of Google’s AI ethics team shortly after writing it (Metz & Wakabayashi, 2020).

Likewise, Corporate America is repeatedly disappointed when inaccurate models of technological change assume linear development towards some ultimate version. Ramirez (2020) describes the case of Rethink Robotics, whose hype surrounding the Baxter and Sawyer robots lured investments from Goldman Sachs and Jeff Bezos but failed within six years. Ramirez compares the example with Lawson’s safety bicycle design and quotes Bijker, “the focus on successful innovations suggests an underlying assumption that it is precisely the success of an artifact that offers some explanatory ground for the dynamics of its development” (2020, p. 49). Therefore, suggesting that AI is progressively approaches an ultimate form is no more reasonable

than suggesting the T-Rex linearly approaching the ultimate form of the chicken. Logistics companies such as Amazon are not replacing human workers with robots but are rather automating their management using AI, which counters the unrealistic expectations of the business sphere (Ramirez, 2020).

## **CONSEQUENCES IN LOGISTICS**

For analysis of the nexus of AI, imaginaries, expectations, and the logistics industry, this paper focuses Amazon for several reasons. First, Amazon's share of parcels delivered in the United States rose from 6% in 2018 to 21% in 2020, which places it on track to supersede UPS's dominant position of 24% (Garland, 2021). Furthermore, Amazon Web Services positions Amazon uniquely to harness emergent computing technologies before older and more stagnant companies do. Research into AI and automation in logistics has returned references to Amazon consistently whereas no other company has repeatedly appeared in literature. Thus, present applications of AI and consequences in logistics are best found within the company.

Despite the mania in predictions about AI and automation there is no apparent horizon for labor supplantation within the logistics industry. Frey & Delfanti's (2021) analysis of Amazon's recent patent applications determined a continuation of automating management instead of replacing laborers. The examples given focused on more thorough control and surveillance of workers, such as a patent for augmented reality glasses that assign instructions to employees (Frey & Delfanti, 2021). This does not mean that automation technologies are without consequences. Rather, the context is misunderstood, and consequences are unknown by most.

The automated management methods employed by Amazon have ties to techno-determinist narratives and the combination results in harm to employees. Investigative reporters from *Reveal News* examined the working conditions and published a Pulitzer finalist series of

articles of their findings (Evans, 2020). Amazon’s higher management claimed in interviews that automation of warehouses would allow workers to avoid tedious and dangerous jobs (Evans & Leon, 2020). The results of A.I. driven algorithmic optimization of worker productivity shown in Figure 1 below resulted in double injury rates compared to other Amazon warehouses (Evans, 2019).

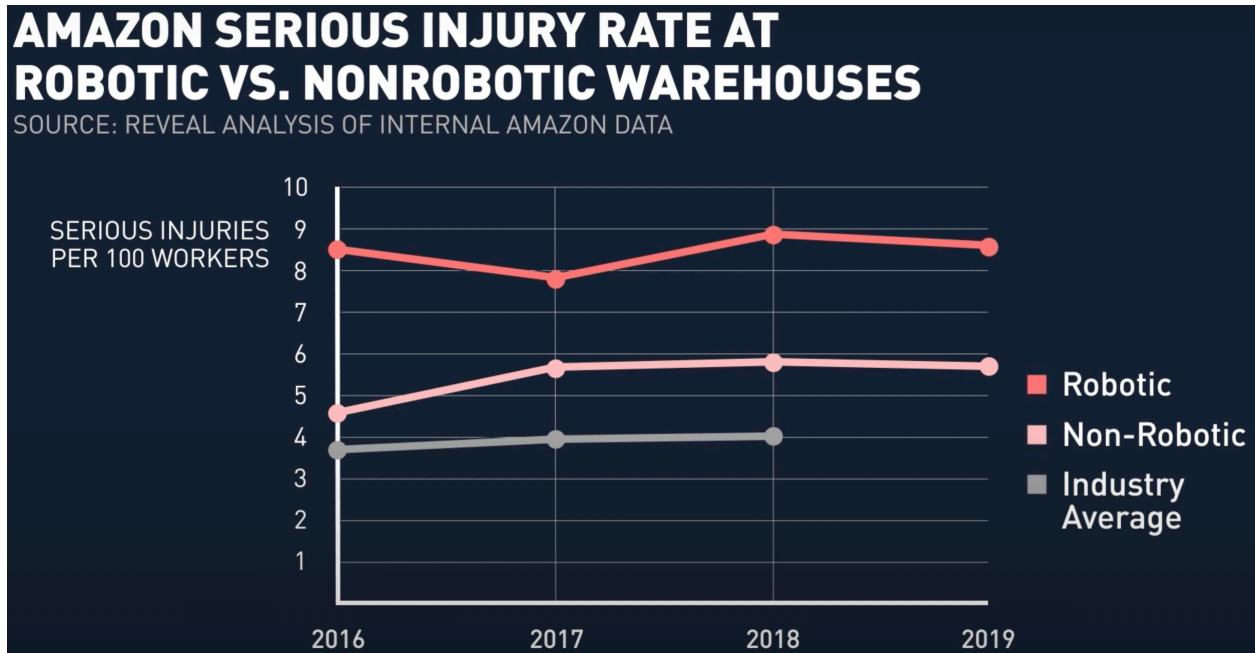


Figure 1: Injuries per 100 Workers in Amazon Warehouses: Amazon warehouses with more automation experience around twice the injury rate of those without (Evans & Leon, 2020).

Frey & Delfanti’s (2021) research of Amazon patents implies a continuation of the trend and refer to the technologies as “digital Taylorism” (para. 5). Ramirez prefers the term “automated Taylorism”, citing “Amazon has updated Taylorism ... the work of management itself—the task of studying, reconstituting, and controlling the work process—has been partially automated” (p. 59). It appears that predictions of AI and automation were not entirely incorrect, but they predicted the wrong group would experience labor replacement.

On a macro scale, the logistics industry has experienced many hardships in the past year on account of labor shortages. The Port of Los Angeles and the Port of Long Beach both

negotiated with unions to increase maximum work hours and began operating at all hours to account for backed up cargo (Swanson et al. 2021). As for commercial trucking, estimated shortages of 68,000 drivers have prompted creation of new high school training programs (Franklin, 2021). A McKinsey report (Bhattacharjee et al., 2021) on labor shortages in logistics and transportation notes that logistics has been hit particularly hard in comparison to other sectors, and the trucking industry has been losing workers over time pre pandemic.

Techno-determinist narratives of AI and associated imaginaries provide a compelling explanation for both the harm of workers at Amazon and supply chain shortages. Both consequences stem from the idea that certain jobs have a looming existential threat of AI and automation. Consider the perspective of a young adult weighing the value of different careers. Jobs that are widely predicted to experience automation appear much less attractive. Frey & Osborne's (2017) predictions of automation within different work sectors, shown in Figure 2 on page 8, placed management positions at low probabilities of automation while transportation and material moving jobs were assigned very high probabilities. Such predictions lead logistics workers to fear for their jobs, and white-collar workers to feel secure.

Additionally, techno-determinist narratives suppress workers at Amazon from taking measures to prevent harm. An article published by the University of Miami's Law Review (Monero, 2020) argued that California's new classification of employees and contractors will expedite automation at Uber and other companies. Additionally, a Bloomberg opinion piece (Sutherland, 2020) contextualizes newfound labor negotiating power with increasing automation and draws a causal link. Amidst such narratives surrounding automation, one can imagine the effects upon unionization efforts of employees at Amazon and similar companies.



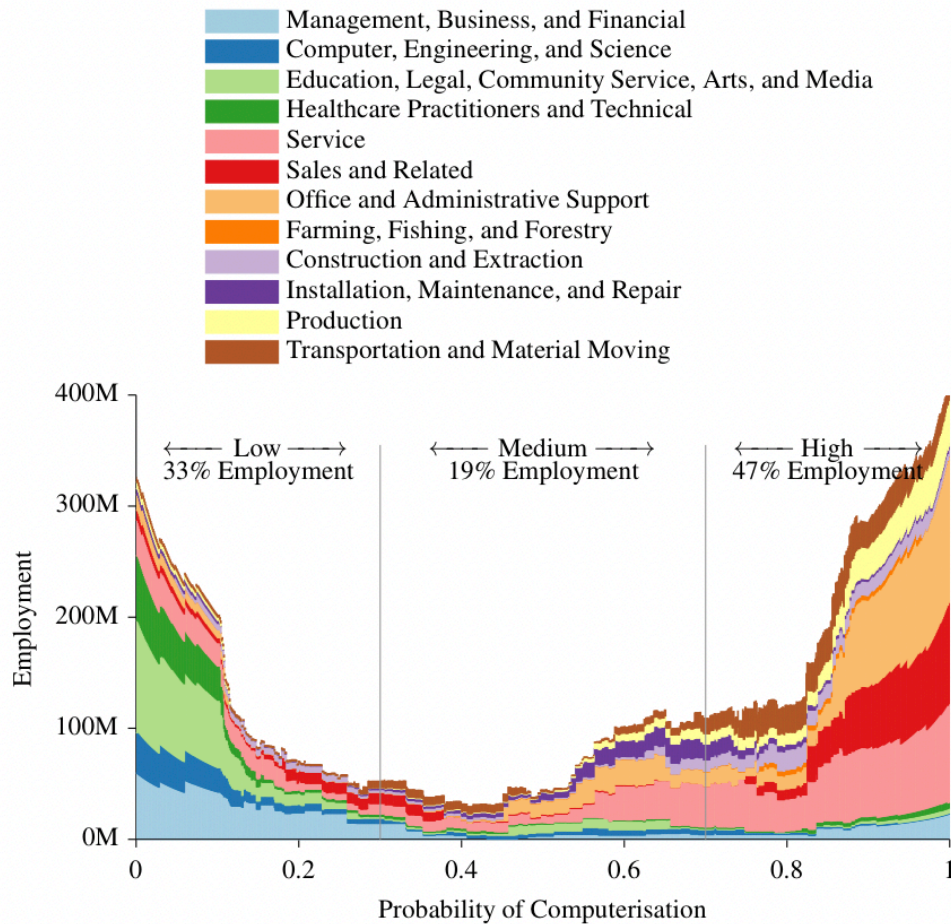


Figure 2: Employment vs. Probability of Automation by Sector: Despite Amazon’s algorithmic management methods, management and administration jobs are assigned low probabilities of computerization, and transportation jobs are assigned high probabilities (Frey & Osborne, 2017).

## ACTOR NETWORK RECONTEXTUALIZATION

The issues within the logistics industry require a reimagined conceptual mapping to pinpoint where the issues lie. The explanations offered by this paper explore the socio-technical relationships that have driven the implementation and responses to AI. Therefore, this problem cannot be traditionally engineered. Actor-Network Theory (ANT), as described by Cressman (2009), effectively models the problem. Cressman describes ANT as an adequate method for

analyzing systems involving semiotics and power relationships, both of which pertain to AI narratives.

The most concerning aspect of the problems related to AI and narratives in logistics is the lack of proper discourse surrounding them. Without even knowing the problems, solutions cannot be made. Thus, this paper first considers, why aren't the right things being talked about? Academics in STS and related fields have created literature that precisely asks this question and offers answers. Kerr et al.'s (2020) examination of expectations of AI sampled 41 documents from actors deemed performative in setting expectations and broke them into categories of the European Commission, consulting companies, expert consultations, public surveys, whistle blowers, and workers (para. 11). Roberge et al. (2020) use Callon's framework of translation to examine three instances of translation and the surrounding discourses in an AI summit, Zuckerberg's congressional hearing, and "killer robots" in military engagements. Finally, Hansen's (2020) analysis of 253 Danish Newspapers used Jasanoff's concept of imaginaries to uncover how discourse in news media has contributed to the construction of AI imaginaries.

All three sources provided conclusions that support Ramirez's (2020) critique of AI discourse. Hansen (2020) concludes that regardless of opinion, news media has portrayed AI as human and holding agency, "the common thread is not only ascribing human attributes, but also describing the machine, computer, or robot as an autonomous entity, able to perform tasks" (Constructions of AI Imaginaries section). Kerr et al. (2020) consider bold claims from AI supporters, "Accenture Labs model how AI will double the growth of economies by 2035" (para. 15), and AI critics "These commentaries largely focus on the potential that AI might become super-intelligent" (para. 17). Roberge et al. (2020) find similarities in all three translation cases

in demonstrating how, “the myth of AI acts as a means of social engineering” (Conclusion, para. 2).

Modeling the development of AI using ANT requires examining the power of different actors and relationships between them. Perhaps the most powerful actor in America, the government, has produced policy across administrations that suggest AI is inevitable and massively disrupting (Bareis & Katzenbach, 2021). However, the United States government is so large and connected that its own outputted opinions on AI are probably just the inputs of other actors. As noted by Ramirez (2020) and Kerr et al. (2020), US AI policy draws input from tech entrepreneurs and management school figureheads, and governments vest interests by financially supporting research. Roberge (2020) corroborates, “only a handful of translators have any practical influence: renowned scientists but also larger corporations such as Google or Facebook, often with the support of state institutions investing financial and/or symbolic resources” (Theoretical Architecture section, para. 3).

The academic consensus within STS suggests that a few very rich and powerful individuals hold most of the power in shaping the discourse surrounding AI. It is impossible to know the intentions of such individuals, but the benefits of current discourse and implementations are discernable. The optimist-determinist narrative lubricates the pipeline of capital to tech companies and allows companies who purchase AI services to make radical estimates in shareholder reports. The pessimist-determinist narrative takes a more subtle approach by pirating the discourse. Individuals such as Elon Musk, the wealthiest person in the world, sponsor organizations such as Open AI that focus on the ethical dilemmas of creating artificial general intelligence and warn of hostile super-intelligence AI (Roberge, 2020). The two narratives in conjunction result in very few regulations being made for AI.

All the examined human and institutional actors explain the formation of semiotic actors such as imaginaries within the actor-network. The imaginaries in turn empower their constructors by providing a mask. On this subject Bareis & Katzenbach (2021) wrote, “myths massively reduce complexity and decouple developments from their social contexts and power structures” (Conceptual Frame section, para. 4). Similarly, Ramirez (2020) wrote, “Myths depoliticize; they remove things from the contested domains of power and relocate them among life’s naked truths” (p. 1). Thus, techno-determinist narratives of AI withhold decisions for powerful actors by masking their power.

## **RESHAPING THE DISCOURSE**

To achieve the development and implementation of AI technologies in a way that is productive and beneficial to the greater American society, changes must be made regarding the discourses surrounding AI. First, there must be a deconstruction of the current semiotics that surround the technologies. By doing so, the average individual can become aware of their own agency in the formation and implementation of AI. Finally, a greater actor-network encompassing all the stakeholders must make actionable decisions regarding the technologies.

Currently, AI exists in a state of unfettered development and use. The most impactful decision stakeholders can make is which actors to introduce to the actor-network. Professional codes of ethics, including the ACM and IEEE, only make vague references to social awareness and ethical values in afterthought (Kerr et al., 2020). Additionally, Kerr et al. (2020) criticize the performativity of all present ethics guidelines, “At best, ethics guidelines are generically performative, operating at a linguistic level to assuage and deflect critique and regulation” (Conclusion, para. 2). In addition to stronger professional ethics guidelines, regulation should be

considered. The status quo of AI regulation involves private companies meeting amongst themselves and setting their own terms (Roberge, 2020).

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