

Perceptions on the Future of Automation in r/Truckers

Lisa Orii*
Wellesley College
Wellesley, MA, USA

Andrew L. Kun
University of New Hampshire
Durham, NH, USA

Diana Tosca*
Wellesley College
Wellesley, MA, USA

Orit Shaer
Wellesley College
Wellesley, MA, USA

ABSTRACT

New developments in automation have led to discussions about the impact that autonomous trucks will have on the trucking industry. However, there is a lack of literature on truck drivers' perceptions of automation. To gain an understanding of the trucking community's sentiments towards automation, we analyzed member discussions related to automation in the r/Truckers subreddit. Among the comments we analyzed, concerns about the feasibility of automation were popular and, in general, community members expressed negative perspectives on automation in trucking. This was corroborated by our findings that only 0.98% (9/915) comments had positive views on automation. Speculations on when automation of any degree will take place in the trucking industry varied, but the view that automation would eventually happen but not for a long time was the most common. To conclude, we highlight a need to support and empower truck drivers through the significant changes facing this industry.

CCS CONCEPTS

• Human-centered computing → Empirical studies in HCI.

KEYWORDS

automation, trucking, online communities

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1 INTRODUCTION

In recent years, there has been much discussion about the potential impact of AI, automation, and robotics on the labor market. The rise of autonomous-driving technology is predicted to eliminate 2-3 million trucking jobs in the near future [1]. Research indicates that

these projections are overstated [10], and that although automated driving is likely to replace manual driving in some situations, drivers will still be required to drive in other situations, and to perform non-driving tasks [9]. However, there is an agreement that the trucking industry is undergoing a dramatic shift [2, 9]. Considering the forthcoming change in the trucking industry, it is important to understand how truck drivers perceive automation and its impact on the industry and their lives. This understanding will contribute to many, if not all, of the themes of future research in human-automation interaction, articulated by Janssen et al. [11]. Two of these themes are trust in automation and technology acceptance - understanding truck driver perceptions is necessary to support both. Furthermore, understanding perceptions will support any effort to create explainable automation - note that explainability is a legal requirement by European laws. And finally, truck drivers' perceptions will help us explore the ethical and social dilemmas of automation, such as which parts of the truck driving job should be automated, and what are the resulting impacts on the drivers and on society.

Thus far, research regarding truck drivers has focused on their well-being, including safety, fatigue, and the lack of physical activity or social contact [15, 18]. There are few studies that investigated the requirements for future workplaces in highly automated trucks and the degree to which truck drivers accepted such workplaces [8, 20]. We seek to further illuminate truck drivers' perspectives and attitude towards automation. In this study, we contribute towards this goal by analyzing social media posts from the subreddit r/Truckers, highlighting drivers' perspectives related to trust, impact on jobs and responsibilities, and feasibility of automation. We begin by surveying related work.

2 RELATED WORK

2.1 Truck Drivers and Automation

Studies have explored how automation (of any level) in trucks can positively impact driving safety and the physical, social, and emotional experiences of truck drivers. Truck driving induces a high level of mental stress and can directly contribute to physical fatigue and higher levels of inattentiveness, which are major causes of traffic accidents [13]. Research has found that autonomous trucks can allow the driver to perform exercises while driving [18], increase driving safety, decrease stress and increase the time for relaxation, raise attentiveness, and improve the drivers' commitment to the transport company [20]. However, there is a general mistrust toward semi-autonomous trucks from both truck companies and truck drivers [20]. Few studies focus on the attitudes of drivers toward

*Both authors contributed equally to this research.

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autonomous driving [5, 8]. A study with 23 German and Polish speaking truck drivers by Fröhlich et al. [8] found that many of the participants were not in favor of using future highly automated trucks. While trust in road safety, reliability of self-driving trucks, and the likelihood of workflow improvement were found to be less important to truck drivers' intentions to work in automated trucks, the ease of use of automated trucks, that is, the quality of the design of the driver's cabin, was highly important [8]. While these studies attend to the benefits and concerns related to autonomous trucks on truck drivers' jobs, these works are limited in their considerations of the factors that truck drivers consider in their evaluations of automation.

2.2 Developments and Limitations of Automation in the Industry

In the last few years, we have seen a number of companies make meaningful developments in automated trucking technology. In 2019, Walmart reported on its work with Gatik (a Silicon Valley startup) to automate the "middle-miles" of shipping by creating fixed routes for driverless vehicles to travel from warehouse to warehouse [16]. The autonomous trucking startup TuSimple successfully piloted autonomous trucks to deliver mail between Phoenix and Dallas, in collaboration with the U.S. Postal Service, where the driverless trucks were arriving at their destinations earlier than expected [3]. In 2019, the Swedish company Einride was the first company to use their completely driverless trucks, called Pods, to complete deliveries on public roads; Einride reports that the Pods will be able to complete fenced-area and local deliveries in 2021 [6, 7]. Locomotion and NVIDIA DRIVE are planning a rollout of a platooning system for autonomous trucks in public roads in 2022 [4]. Despite the new developments, there are still limitations in the field of trucking that may reduce the impact autonomous vehicles have on jobs in the trucking industry. A 2019 study argues that projections for potential job losses in the trucking industry due to automation are inflated, estimating that closer to 456,000 trucking jobs are at the highest risk for automation, mostly long-haul trucking jobs [10]. The report cites the many non-driving tasks truck drivers engage in that cannot be easily automated, including loading and unloading cargo, maintaining logbooks, customer service, and inspecting vehicles for safety concerns [10].

3 METHODS

We follow a method frequently used in HCI research [17] - analysis of social media community posts to gain insight into the experiences and thoughts of the community members. Our method is analogous to that of Otiono and Olaosebikan et al. [17]. We focused on analyzing forum posts in the r/Truckers community on Reddit. Reddit's r/Truckers community has 61.9k members (as of December 2020) and is defined as "The best trucker subreddit out there." We chose to study this community because of the active discussions, publicly available content, and its members who are composed of people in the truck driving community (both drivers and people with an interest in trucking).

3.1 Population of r/Truckers

We do not have information about the demographics of the community members, as Reddit users are mostly anonymous, although the anonymity of members are neither required nor guaranteed. The community used for this study do not necessarily reflect the sentiments of the general population of truck drivers. Members of r/Truckers are likely fluent English speakers and computer literate individuals.

3.2 Data Analysis

We obtained 39 posts and 915 comments from r/Truckers dated between March 2017 and November 2020. We used PRAW, the Python Reddit API Wrapper, to extract the data from Reddit's database. We specifically queried posts in r/Truckers that were related to the keyword "automation." After obtaining the post titles and comments for each post, we filtered out the posts and comments that fit at least one of the following criteria: 1) comments that were irrelevant (e.g. discussion of automatic transmission or electric cars), 2) comments created by bots, 3) comments that were relevant but just expressed agreement or disagreement (e.g. "No, not really."), 4) hostile or sarcastic comments that reflected the infeasibility of automation but did not provide concrete explanations (e.g. "Bwahahahahahahaha!!"). However, if the larger post was not directly related to automation, but included comments that contributed to gaining insight into truck drivers' sentiments toward automation, the comments were included in our analysis.

First-level codes were developed upon review and discussion of data by two taggers. We clustered the codes to develop seven themes: feasibility of automation, jobs, timeline for automation, general questions and answers, expectations for automation, personal experiences, and positive views toward automation. Among the comments analyzed, some were tagged as "miscellaneous." Posts that include relevant comments were considered in our data. Irrelevant comments that did not discuss automation in relevant posts were considered to be miscellaneous comments. Because these comments did not discuss automation (and were, in general, hostile or sarcastic) we did not include them in our analysis.

Each comment was tagged using one or more themes. Inter-coder reliability based on 100% of the data was calculated for each code, and yielded a 88.21% agreement. The number of comments tagged by a theme, ordered from most to least, were 28.5% (261/915) miscellaneous, 20.1% (184/915) feasibility of automation, 17% (156/915) timeline for automation, 13.4% (123/915) jobs, 4.2% (38/915) expectations for automation, 2.2% (21/915) general questions and answers, 1.1% (10/915) personal experience, and 0.98% (9/915) positive views toward automation. If a comment was tagged with multiple themes, we considered there to be an agreement if both taggers tagged the comment with at least one of the same themes. If none of the same themes were tagged by the taggers, then there was no agreement.

4 RESULTS

4.1 Feasibility of Automation

The "Feasibility of Automation" theme refers to speculations about the feasibility of implementing automation considering various aspects including infrastructure, policy, and reliability related to

automation. Overall, 17% (156/915) of the comments were related to this theme.

4.1.1 Cost, Work, Infrastructure Required for Automation. One community member implied that high costs would be required to replace non-automated trucks: *"You gotta think the cost of one of those trucks will be astronomical you think a company is going to swap out their fleets overnight?"* Members also indicated the necessity for changes in infrastructure to accommodate automated trucks, but raised concerns about the practicality of making these changes: *"...they would have to repave every road in America and have the correct line markings on ever single road ... how many companies are in the middle of nowhere on county roads with no markings ... that's only one issue and a big one"*.

4.1.2 Concerns Related to the Reliability of Automation. Concerns related to the reliability of automation were largely present. Community members expressed doubts about automation's capabilities to recover from failures: *"I just don't see a robot being able to recover a crashed or rolled over tractor trailer. There are so many variables in every wreck."* 0.98% (9/915) of comments questioned the ability for driverless trucks to function in difficult conditions: *"Honestly I don't know if they'll ever figure out how to get an autonomous truck to run over Donners pass in the winter, i70 west bound out of Denver in the winter, all of Wyoming, or any northern state for that matter in the winter."* We found 1.5% (14/915) of comments were concerned about security vulnerabilities or trustworthiness of technology, as exemplified in the following comment: *"The 1 thing about technology that's a guarantee is that for every 10 brainstorming computer whizzes out there theres 50 computer hackers looking to break it...The wrong person gets into a trucks system for the purpose of causing harm and it will be a bad day.... plus be able to do it remotely without the fear of being caught? That's just more incentive"*. We saw 0.54% (5/915) of comments expressed concerns about accidents caused by automated trucks and who would be liable for such accidents: *"Who is going to be liable when one [driverless truck] fucks up? Legit question that remains murky..."* and *"...The first time someone gets hit by one, theres gonna be nasty lawsuits. Who's gonna pay for that cost when a person is cheaper?"*

4.2 Jobs

The theme "Jobs" encompasses speculations on how jobs will be impacted in trucking and explanations of jobs that were already impacted by automation.

4.2.1 Speculation on How Jobs Will Be Impacted. We found that 1.2% (11/915) of the Reddit comments expressed fear of job loss due to automation. For example, *"Sadly this is a possibility and will mark the end of my career. No way I am letting a machine drive me around the roadway and then they will make drivers responsible for accidents caused by the truck."* One member asked the trucking community whether they should become a truck driver, given the possibility that automation could end their careers, *"I'm 22. Plan on doing this for a career. Think it's a good idea for the future as well?"*

We also found 0.66% (6/915) comments which expressed that they did not fear job loss, and referenced the questionable performance of current computerized truck parts: *"Not at all. Trucks these days already have tons of computerised parts on them that fail*

and malfunction." Two members considered adapting to changes in technology to be critical to avoiding job replacement and accommodating new working conditions when automation is incorporated into their jobs: *"should be fine, just keep up with any tech as it comes out for general use."* and *"A huge reason why I've been learning how to code. Why lose my job to an autonomous truck when I could just learn how to write code for the truck."*

4.2.2 Non-driving Tasks and Automation. We saw that 4.3% (39/915) of comments wrote about how human drivers will be required in automated trucks. Community members explained that certain non-driving tasks performed by truck drivers cannot be easily automated, as demonstrated in the following comment: *"There's more to trucking than just following road rules, in my humble opinion. Google (and even Rand McNally) sometimes can't gps their way to a lot of drops. And when the trucks get there, who will unload if the receiver can't? AI? I think we've got a long way to go before a fully automated trucking industry."* One community member described tasks that would require human intervention: *"...Various changing weather conditions, road terrain, chaining, load management, safety measures, and sectors that are not financially capable of upgrading to support automation requirements (road sensors, road repairs, etc) may all require human intervention."*

4.3 Timeline for Automation

The "Timeline for Automation" theme is the speculation on when automation will take place (to any degree). 4.0% (37/915) of comments specified the number of years they suspect automated trucks to proliferate.

4.3.1 Automation Will Eventually Happen but Not for a Long Time. We found that 9.3% (85/915) of comments indicated that automation will not happen for a long time. These comments included those that explicitly said that automation will take at least 30 years to enter the trucking industry. Several community members described technology-supported reasons for believing that automation is far in the future: *"...I am a computer and tech nerd, but have no belief that tech and robotics will advance to the point in our lifetimes that AI will safely, reliably and efficiently be able to take a human out from behind the wheel. Anyone who does is living in fantasyland."* One community member commented on how different locations might have different timelines for the usage of automated trucks: *"It'll hit local guys first in big areas like San Fran and New York It'll take 5-10 more years to move to other cities. 15-20 to move to the rural areas. 30-50 before the government stops making them have a driver on board. So it'll be 50 years in the very least before it takes anyone's job. It'll make your job easier most likely."*

4.3.2 Automation will Happen Soon. We found that 2.8% (26/915) of comments wrote about how automation will happen soon, including those that specified that automation will enter the trucking industry in less than 20 years: *"Still I think [widespread automation is] coming sooner than people think. On a lot of [subreddits] I see people thinking it'll happen in a couple of years which is dumb as shit but a common sentiment here is 20+ which feels equally outrageous... My bet is 8 to 12 years"* or *"They will star [sic] to come onto the market with partial autonomy within 5 years. They're already testing them. The self driving trucks - meaning class 4 autonomy - will be 10 years or*

so...” We also found that 0.77% (7/915) of comments implied that some tasks related to truck driving would be automated earlier than other tasks. For example, “*Well, I agree [truck driving will] be “automated” of sorts real soon. Those long drives down the highway, I feel are just a few years away. What won’t be automated, city driving...*”

4.3.3 Automation is Already Happening. We saw that 1.7% (16/915) of comments gave examples of automated trucks that are already being used. One member wrote about three different companies that have made efforts toward automated trucks and predicted that future improvement in technology will actualize automated trucks soon: “[Automation is] already happening. So far we’ve got Tesla starting production of their Semi. Thor might not be far behind. Nikola seems to be very bullish about their production issues. Not looking at electric, Shell has announced their Starship diesel concept and not doubt others will step forward...”

4.3.4 Comparisons with Automation in Other Industries. We found that 2.7% (25/915) of comments compared the timeline for automation in the trucking industry with automation in other sectors, such as automation in cars, trains, and planes, and claimed that automated trucks would be popularized after trains and planes are automated: “...They still don’t have trains or planes 100% autonomous, and those are orders of magnitude easier to implement the technology in between key infrastructure differences and just general controlled access to the equipment.”

4.4 General Questions and Answers (Q & A)

The theme “General Questions and Answers” was assigned to comments that discussed general questions and explanations about automation and trucking. For example, one member asked, “*Why do you think [automation] will hit big cities first?*” In response, another member commented, “*Everything always does. Fiber, Amazon same day, delivery of any kind really. The [infrastructure] is usually “better” by which I mean more abundant...*”

4.5 Expectations for Automation

Comments categorized as “Expectations for Automation” were neutral or matter-of-fact explanations on how automation will impact the trucking industry. Community members speculated how truck drivers and automated trucks would split tasks such as driving. For example, “*I think what you’re going to see is it hitting all of them at roughly the same time, with drivers only responsible for the start and end. Down the highways of rural and suburban America, hauling one trailer is just like any other. Pay will drop and drivers will only be driving at the start and end and doing the grunt work of hooking/dropping/tarping/etc.*”

4.6 Personal Experiences with Automation

Comments under “Personal Experiences with Automation” were personal anecdotes related to automation. 0.66% (6/915) of comments discussed situations in which truck drivers experienced automatic brakes, and most expressed annoyance at the automated features, as seen in the following comment: “*Sometimes when I go under bridges and overpasses it will lock the brakes up real hard. I’ve complained to my company but they don’t care and won’t turn it off*

because it’s a “safety feature.” How safe will that be if it locks my brakes on icy/wet roads?”

4.7 Positive Views toward Automation

The fewest number of comments implied anything hopeful about automation. 0.3% (3/915) of comments expressed general excitement about innovation and change. For example, “*...a ton of stuff can happen in five years! It’s exciting none-the-less!*” One member generalized automation as an economic benefit and supported the usage of automated trucks: “*...All in all, automation is a good thing. Always has been a driver of economic growth, and is one of the few countering forces to government destruction of capital.*”

We saw that 0.77% (7/915) of comments discussed the potential benefits that may come with automation, such as the following: “*...personally, I can’t wait! It’ll be the end of log books first of all. Way more home time because I can just leave at night and go to sleep in the truck and wake up close to where I’m delivering instead of having to leave the day before so I can sleep there. I’ll be more than happy to sit in the back and watch TV for the same money.*”

One person commented about the safety benefits of automated trucks, contrary to the popular view among other community members that automation is unreliable: “*Well this is why we need automated trucks. The automated system would have saved that persons life by magically stopping faster.*”

5 DISCUSSION

In this paper, we present findings from a social media content analysis of the r/Truckers subreddit. Our findings highlight the perspectives and attitudes of truck drivers towards automation in the trucking industry. While these findings are qualitative and do not represent all, or even a representative sample, of truck drivers, we provide important insights into the views of drivers who are critical and potentially vulnerable stakeholders in an industry facing significant changes.

The theme “Feasibility of Automation,” where community members expressed concerns about putting automation into practice, encompassed the most comments. This suggests that many members in the subreddit r/Truckers community express negative sentiments toward automated trucks. Community members expressed little enthusiasm for working with automated trucks given the perceived failings of technology. These negative feelings towards automation could potentially make adoption of emerging technologies more difficult, as drivers are not inclined to find the technology reliable.

One important result of our exploration is that community members do not share the same conceptual notion of automated trucks - some thought of automation as fully autonomous vehicles, while others expected to see partially-automated vehicles, such as today’s vehicles with assistive lane-keeping functions. Not surprisingly, the timeline for automation, as well as the speculation on how jobs will be impacted, differed depending on the person’s understanding of automated trucks. The comments that suggested eventual job replacement implied that full automation was possible or assumed that automated trucks equated to full automation with no human interaction or attention needed. In response to such comments, some community members reminded others about the possibility of lower levels of automation, where human tasks are supported

(rather than replaced) by automation. On the other hand, we also found comments that were critical of partial automation functions, specifically automated braking. These negative sentiments are an indication that truck drivers might not trust automation technologies in trucks and might resist accepting them, thereby reducing the value of these technologies. The specifics of the sentiments also provide us with potential avenues for addressing the lack of trust and acceptance. Let us first address partial automation, which provides assistive functions such as automated braking. Here, researchers should work to reassure truck drivers that the assistive functions are safe, and can help them in their jobs. Of course, the safety of these functions depends in part on how they are used. For example, assistive functions require drivers to constantly pay attention to the road, as these functions do not work perfectly under all circumstances. Truck drivers would benefit from training with the assistive functions. And while the general public might not be willing to be trained on how to use partial automation functions, truck drivers are professionals who drive for a living, and this might make them more interested in receiving training (cf. [12]).

Our findings also make it clear that explainable automation could help truck drivers trust automation. If the driver is surprised by an action (e.g. automated braking), and does not get a timely and adequate explanation for it, they might very well turn off the function to avoid a future surprise. Here, we need further exploration into what constitutes timely and adequate explanation of automated functions.

Addressing lack of trust in, and acceptance of, more advanced automation will have to go beyond training to use the automation. More advanced automation will bring up issues of job social dilemmas, including security and equity. Here we expect that truck drivers will remain an integral part of the trucking business for many years to come, since many tasks will not be fully automated, or will still need supervision, at least for legal purposes. Yet, research is needed to understand how we can support truck drivers reskill and/or upskill to operate effectively in such a new work environment. We believe that the data we explore here provides one pointer: peer-to-peer interactions might be a fruitful avenue to provide relevant information to truck drivers. Many posts began with questions about what community members thought about the future of trucking, including discussion starters that expressed community member's honest concerns about the persistence of truck drivers' jobs in the trucking industry. An open forum for discussion allowed members to consult with fellow truck drivers and share their concerns and questions regarding their jobs and future developments. However, most comments were subjective responses and lacked technical or scientific reasoning that supported their comments.

Also, as truck drivers look to acquire new skills, we expect that they might face similar barriers as the vocational workers interviewed by Thakkar et al. [19]. Thus, we must also work to empower truck drivers to attain knowledge online - this means providing content that will be relevant to them (e.g. how their existing skills map into new trucking job requirements), helping them effectively discover this content online, and also providing access to this content to truck drivers who do not speak English.

5.1 Limitations and Future Work

The posts and comments we analyzed are not representative of the entire truck driving community, as we are limited to Reddit users who speak English. We are working to extend our study to other platforms to study a more diverse group. The comments we analyzed were from 2017 to 2020- we intend to continue and consider more recent developments through a survey and in-depth follow-up interviews with truck drivers. With interviews, we hope to validate our findings from our analysis of social media posts as well as gain more nuanced insights. More broadly, we plan to relate our work to findings in other domains where people and automation interact, such as human-robot interaction, aircraft control, and smart devices [14]; and we will do this by highlighting the specific context of truck driving, where professional users (truck drivers) interact with an embodied, situated system (the truck with driving assistance and/or automated driving features), which (sometimes) requires time-sensitive and safety critical actions (driving) [11].

6 CONCLUSION

There is a gap between the reality of automation in industry, as conveyed in media, and what its development is pushing for, and truck driver's perceptions of automation in the trucking industry. Especially with recent advances in automation and changes in the workplace, it is essential to understand the impacts of automation on truck drivers. In this study, we analyzed social media comments to understand how truck drivers perceive automation in the trucking industry. We identified seven topics that were discussed by community members: jobs, timeline for automation, feasibility of automation, positive views toward automation, personal experiences, general questions and answers, and expectations for automation. We discuss sense making of the data and propose approaches to establish truck drivers' trust in automation features, which in turn will increase the acceptance and safety of automation. We also highlight a need to support and empower truck drivers through the significant changes facing this industry.

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