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Fanbois and Fanbots: Tesla's Entrepreneurial Narratives and Corporate Computational Propaganda on Social Media

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Abstract: This paper reports the discovery of a series of computational social media accounts (Fanbots) on Twitter that may have played a critical role in sustaining the entrepreneurial narratives of Tesla, the electric-vehicle maker. From 2010 to 2020—a period of trial, error, and eventual success for Tesla—these computational agents generated pro-firm tweets (Corporate Computational Propaganda, CCP), accounting for more than 10% of the total Twitter activity that included the cashtag, $TSLA, and 23% of activity that included the hashtag, #TSLA. Though similar to programmed social media content in the political sphere, the activities of these accounts predate the existence of political computational propaganda associated with foreign support for, for instance, Brexit in the United Kingdom (2016) and Donald Trump in the United States (2016). The paper (a) characterizes the extent of Fanbot content in two large Tesla tweet corpora, (b) identifies possible motivations for the creation of these accounts in relation to the firm's entrepreneurial narratives, and (c) explores possible mechanisms by which the Fanbots might have acted. Although we are unable to directly observe the source or stated purpose of these accounts, based upon the timing of Fanbot creation and other indirect indicators, we infer that these accounts and the social media activity they generated were intended to influence social perception of Tesla. The conclusion assesses the generalizability of a Fanbot-based strategy, highlighting contextual limitations, while also pointing to ways that firms may already be using CCP to manage social approval in emerging-industry contexts.

Keywords: case study; entrepreneurial narratives; impression management; computational propaganda; industry emergence

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1. Introduction

For decades, the electric vehicle has been the "car of tomorrow" but never quite the car of today [1,2]. Notwithstanding annual predictions about any given year finally being the year of the electric car, recent developments suggest that the automobile industry may truly be on the cusp of electrification. Nearly every automaker from General Motors to Rolls-Royce has announced plans to build and market one or more electric automobiles, and numerous startups have entered the electric-vehicle market. In this sense, electric-vehicle manufacturer Tesla may have accomplished its initial mission statement, "to accelerate the world's transition to sustainable transport," and in the process, making CEO Elon Musk one of the wealthiest people alive.

Among the many possible reasons advanced to explain Tesla's success, this paper identifies a potentially novel contributing factor: the creation of algorithmic Twitter accounts that generated pro-Tesla content, totaling more than one tenth of the volume of (cashtag) tweets about the firm. By supporting the entrepreneurial narratives advanced by the firm and its CEO, this computational content may have influenced public perception of Tesla from the time of the firm's IPO in June 2010 to the end of 2020. To the best of our knowledge, the existence of this type of computational content has not been previously identified or reported upon.

The paper first introduces the concept of entrepreneurial narratives and their centrality to stakeholders in new ventures. Tesla's many, expansive entrepreneurial narratives are then introduced. Support for these narratives is found in both traditional media and on Twitter, the CEO's preferred social media platform. The crux of the paper arises from our discovery of a set of algorithmic Twitter accounts (Fanbots) created in apparent support of Tesla. The existence of these accounts challenged us to (a) characterize the extent of Fanbot content in two large Tesla tweet corpora, (b) identify possible motivations for the creation of these accounts as they affect the firm's entrepreneurial narratives, and (c), if we stipulate that the Fanbots were created to advance the firm's preferred entrepreneurial narratives and suppress nascent counternarratives, explore possible mechanisms by which the Fanbots might have acted.

To characterize the pro-Tesla conversation on Twitter and the role of Fanbots therein, we first collected the corpora of tweets containing the cashtag $TSLA or hashtag #TSLA using Twitter's Academic API. Next, we used an off-the-shelf tool for the detection of bots (Botometer) to identify likely Fanbots among the most active accounts in these two datasets. We find that a substantial share of active users, who are in turn responsible for a significant fraction of the tweets, are likely Fanbots. We suggest the Fanbots may operate by shaping the engagement between and among Fanbois, a term used to describe the enthusiastic followers of the firm and its CEO.

The conclusion discusses the consequences of our findings for Tesla and proposes additional research that might be undertaken to deepen and generalize an understanding of the relationship between corporate computational propaganda and the social perception of entrepreneurial narratives in emerging-industry contexts such as the global electric vehicle industry.

2. Theoretical Background

Entrepreneurial narratives matter for early-stage ventures [3]. Narratives are especially important when there is a large gap between the present state of the world and the future the firm promises to create [4]. Consequently, protecting firm-generated narratives from criticism and potentially damaging counternarratives emerges as an important function of the firm and its managers. Proceeding from the concept of entrepreneurial narrative and its importance to the way stakeholders—including investors, customers, suppliers, employees, and policymakers—interact with an entrepreneurial firm, we highlight one case where narratives were numerous, expansive, and central to the company's strategic objectives. We also recognize the importance of emergent critiques and counternarratives that may undermine a firm's preferred entrepreneurial narratives [5].

Impression management—via strategic public communication resulting in traditional media mentions—has long been recognized as an important managerial responsibility [6]. Increasingly, firms and their leaders use social media to convey information and influence and align stakeholders with the corporate mission through online "evangelization" [7]. Social media users can bring attention to certain topics through a process described as "visibilization" [8]. While traditional media were long thought to be the preferred means of influencing stakeholder perceptions and sentiments in bulk [9], social media allows a firm or its CEO to directly engage with stakeholders, including supporters of the firm.

Devoted supporters of a firm—who may be a subset of social media users—are particularly important targets for impression management. These "fanbois"—a term originally coined to describe enthusiastic followers of the Apple founder and technology evangelist Steve Jobs—are defined by the website Techopedia as people "who (are) unusually attracted or devoted to a particular technology or tech company" [10]. Social media platforms allow fanbois to be more than "followers" by demonstrating their support for a firm in a shared virtual space, while affiliating with other like-minded users.

Algorithms have long been known to influence users of social media platforms. Existing research has focused on the ways that platform algorithms—like those that select which posts are visible to certain audiences—distort discourse through information overload

and opacity [11]. By curating the data available to users, these algorithms can alter public perception, while concealing the source and agency of the content [12]. Algorithms may operate independently of the platform, and such independent computational agents acting in support of the firm are identified as "fanbots." The firm-specific content they generate represents a new type of communication labeled "corporate computational propaganda" (CCP). This content may align collective beliefs among like-minded users about a firm's entrepreneurial narratives.

Taken together, these theoretical domains—entrepreneurial narrative, impression management, and relationships between firm supporters and social media algorithms—frame the context for our research: the creation and use of fanbot-generated content on Twitter to manage and support Tesla's expansive entrepreneurial narratives.

3. Entrepreneurial Narratives and Counternarratives

Observers who have followed the trajectory of electric vehicle maker, Tesla, have documented multiple, overlapping entrepreneurial narratives that supporters of the firm, including CEO Elon Musk, have deployed to strengthen conviction in the firm's ultimate success [13]. Without evaluating the specific claims underlying each, we view these narratives as appealing to the preferences and beliefs of different subsets of stakeholders. Given that Tesla was a modest-sized startup (in 2010) that promised to disrupt and transform the auto sector, the firm needed to deploy an expansive set of entrepreneurial narratives that were capable of connecting the present and the future. Challenging each of these narratives was a nascent counternarrative. Though thought to be less visible and salient, counternarratives pose a unique risk to the entrepreneurial firm, potentially jeopardizing its ability to secure the resources required to fulfill its mission. Therefore, protecting entrepreneurial narratives from displacement by emerging counternarratives was an important function of entrepreneurs and management teams. We explored a subset of Tesla's entrepreneurial narratives and nascent counternarratives (see Figure 1).

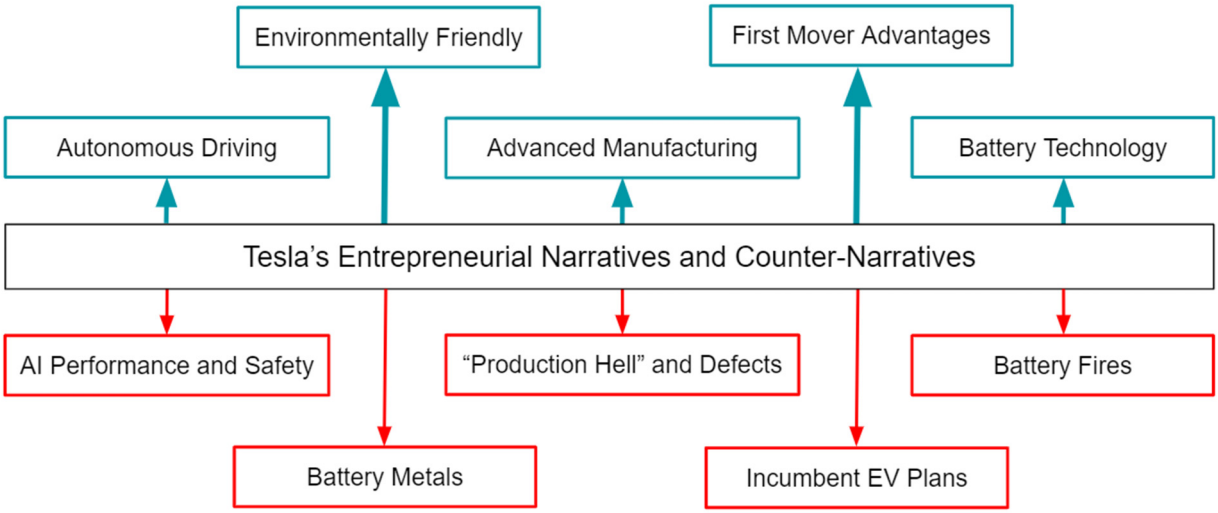

Figure 1. Tesla's entrepreneurial narratives and associated counternarratives.

3.1. Tesla Produces Environmentally Friendly Automobiles

Tesla's stated purpose and initial entrepreneurial narrative positioned the firm as an electric-vehicle company whose products would help to save the world from accelerating climate change by reducing global emissions of greenhouse gasses associated with the use of traditional, internal combustion engine-powered vehicles [14]. The firm also had a goal of making the energy supply chain more sustainable, as exemplified by its acquisition of SolarCity and deployment of residential solar kits and commercial megapacks [15]. This narrative can be found early in the firm's existence and is more or less constant throughout the 2010s.

Several counternarratives challenged Tesla's positioning as a sustainable transport and energy company. First, the company's vehicles and battery pack-based products are powered by the electricity stored in battery assemblies that require metals such as lithium, nickel, and cobalt to build. The extraction and processing of these metals are known to be socially and environmentally problematic [16]. Second, though Tesla's products are "electric," the sources of that electricity vary by region and generally include fossil fuels [17]. Beyond the environmental issues related to material and energy sourcing, critics of electrification have argued that the adoption of EVs is insufficient to mitigate the effects of climate change, and that the growth of Tesla does not represent a major turning point in the environmental footprint of our transportation systems [18,19].

3.2. Tesla Is a Tech Company with a Leading Position in Autonomous-Driving Technology

A second narrative positioned Tesla as a software company whose software happened to be embedded in electric vehicles. This view was reaffirmed by CEO Musk on Twitter as recently as February of 2022 [20]. Many supporters of the firm described a Tesla as "a computer on wheels" [21]. Specific elements of this narrative focused on novel aspects of Tesla's operations, including, for instance, its introduction of "over the air" software updates [22] and the idea that a Tesla vehicle was a technology platform that could support other value-generating activities [23]. Broad reliance upon this narrative allowed the firm to position itself as a "tech company" that should be evaluated and assessed in comparison with technology companies like Apple and Amazon, rather than car companies like Ford and General Motors [24–26].

A popular variant of this entrepreneurial narrative showcased Tesla's identity as a software company with a leading position in autonomous-driving technology. This narrative was underpinned by accounts of the vast quantities of data Tesla had accumulated from its vehicles, data that were being analyzed by the firm's proprietary supercomputers to power the artificial intelligence engine behind its autonomous-driving technology [27]. This narrative projected a future with "Full Self Drive," whereby millions of "robotaxis" would provide driverless transport services as a revenue source for owners of Tesla cars [23,28]. Tesla was so confident in this narrative that it charged customers up to $15 K for a "Full Self Drive" package that was known to be in various stages of beta testing [29].

The counternarrative to the view that "Tesla is a software company" focused upon its principal identity as an automobile manufacturer. For instance, even after acquiring SolarCity and introducing Powerwall battery technology, Tesla generated approximately 85% of its revenue from the sale of automobiles as late as the fourth quarter of 2020 [30]. Moreover, specific claims about Tesla's autonomous-driving technology were subject to repeated criticism, at times from authorities [31]. By mid-2022, with no revenue-generating robotaxis in operation, many of CEO Elon Musk's other forward-looking statements were greeted by online comments reminding observers how Musk's prediction of one million robotaxis by the end of 2019 had failed to come to fruition [32].

3.3. Tesla Will Use Its First-Mover Advantage to Dominate the EV Industry

A third entrepreneurial narrative built upon Tesla's position as the first successful, large-scale entrant in the electric-vehicle market. In this view, the company was able to take maximum advantage of (i) federal loan guarantees intended to stimulate the growth of alternatives to internal combustion [33–36], (ii) subsidies for would-be purchasers of Tesla's products [37], and (iii) investors seeking a stake in the predicted electrification of the global automobile market [38]. In addition to building electric vehicles, Tesla would also build charging stations, benefiting from network effects [39] and possibly from a closed ecosystem, or "walled garden", whereby the only way customers and suppliers enter is through Tesla, affording it immense market power. Since subsequent entrants may not be able to realize these advantages [40] and will face competition from the ever-dominant Tesla, competitors' growth opportunities are more limited.

The counternarrative to Tesla's claim to the first-mover advantage took two forms. First, commentators pointed out that Tesla was not, in fact, the first company to bring a battery electric vehicle to market. Observers frequently point to GM's EV1 or Toyota's RAV4-EV, both of which were introduced in the late 1990s, as vehicles that preceded Tesla entry in the EV market [41]. The consumer adoption of these vehicles was obviously quite limited, with no evident competitive advantage attaching to the firms that preceded Tesla into the modern EV market. Second, many industry watchers cautioned that the incumbent automobile makers were simply waiting out the startup-led EV rush until such time as they could profitably enter the market space [42]. Companies like Ford, General Motors, and Toyota would take up the EV banner if and only if they could make money doing so, and the fact that Tesla was alone atop the EV market table for so many years reflected the incumbents' calculation that Tesla could not make money selling EVs [43].

3.4. Tesla's Leadership in Manufacturing Technology Will Result in Competitive Advantages

A fourth entrepreneurial narrative sought to foreground Tesla's development of new, best-in-class manufacturing technology. From its first car, a Lotus chassis fitted with a battery-electric drivetrain, Tesla claimed to be gaining manufacturing advantages over the auto industry through vertical integration and automation. Emphasizing the machine that builds the machine, CEO Elon Musk was quoted as having said, "Tesla's long-term competitive advantage will be manufacturing" [44]. At various times, the advanced manufacturing narrative was supported by the public release of the video footage of the line of robots (so called "army of droids") that assembled the Model S, the IDRA Giga Press that "printed" single-piece frames, and the construction of "Giga" factories in Nevada, China, Texas, and Germany. Taken together, this narrative sought to demonstrate how manufacturing advantages would generate cost efficiencies that would enable Tesla to make affordable, mass-market electric vehicles [45].

The counternarrative to Tesla's leadership in advanced manufacturing emerged during the ramp-up of the production of the Model 3, the first time the company confronted the specific challenges faced by mass-market car makers such as industrial-level inventory management and high-volume assembly-line operations. As Tesla attempted to build the Model 3 at scale, the firm struggled to manage these and other constraints due to over-automation of the assembly line and other factors that the company did not anticipate [46]. This struggle was described by CEO Musk as "production hell", and the scaling process was closely watched by both supporters and critics. At one point, the weekly Model 3 count was one of the most closely followed metrics in the business world [47].

Even as the company resolved production issues, and as the Model 3 and later, the Model Y, became available to customers, reports of manufacturing flaws began to appear in traditional [48,49] and social media [50]. In response to product defects, Tesla issued several recalls [51]. Regardless of the firm's remedies, these product flaws and defects hurt public perception of the quality of Tesla vehicles [52]. Moreover, accidents related to autonomous driving such as unintended acceleration extended the negative perception further to Tesla's software products. Taken together, these issues generated a counternarrative that Tesla vehicles were poorly manufactured and programmed.

3.5. Tesla Is Developing Advanced Battery Technology

As a derivative of the "Tesla produces an environmentally friendly vehicle" narrative, Tesla also positioned itself as a battery company whose world-leading battery technology would allow the firm to (i) rapidly achieve scale production [53,54], (ii) dominate the emerging stationary battery market [55,56], and (iii) outcompete manufacturers who procured batteries in the open market [57]. The company completed several acquisitions to bolster its battery-technology portfolio [58,59]. As battery production was a critical-path resource enabling the transition from internal-combustion engine to electric vehicle, Tesla's early advances in battery technology, manufacturing, and supply were reported as sources of enduring competitive advantage [60,61].

The counternarrative to Tesla's leadership in battery technology was catalyzed by several incidents of Tesla Model S vehicles bursting into flames following crashes [62]. These "thermal incidents" posed a high-visibility challenge to the battery-technology narrative [63] and are discussed in further detail below.

3.6. Balancing Entrepreneurial Narratives and Counternarratives

The preceding set of entrepreneurial narratives and counternarratives is intended to be suggestive, not exhaustive. Additional narratives stressed synergies arising from the combination of some of the base narratives identified above, as well as Tesla's promised expansion into related product markets such as light-duty trucks (Cybertruck) [64], long-haul trucking (Semi) [65], energy generation (Solar Roof) [66], local energy storage (Powerwall) [67], and insurance to cover them all [68].

In each of these cases, narratives were followed by counternarratives. Given Tesla's reliance upon continued access to public capital markets to secure funds for operations and to fund operating losses during its first decade as a public company, counternarratives that threatened the firm's preferred entrepreneurial narratives posed a meaningful threat to the firm's long-run prospects. Based upon our analysis and upon our observation of persistent differences between the market-valuation metrics of Tesla and that of its automotive rivals, none of these counternarratives were broadly embraced by Tesla stakeholders [69,70].

4. Surprise Finding

In the course of investigating the relationship between Tesla's entrepreneurial narratives and Tesla-related social media on Twitter, we observed a period in late 2013 when one of the counternarratives threatened to displace the associated, firm-preferred narrative. The narrative in question was Tesla's expertise in advanced battery technology. At the time, Model S was receiving highly favorable reviews, with automotive [71,72] and non-automotive sources [73] hailing the car as a singular breakthrough in the race to introduce a commercially successful electric vehicle. Starting in early Fall, however, social and traditional media reported several Model S battery fires, instances where the battery ignited following crashes or impact with roadside debris, destroying the vehicle [74,75]. Subsequent reports of Model S fires suggested spontaneous combustion, with parked vehicles catching fire and, in some cases, destroying buildings along with the car [76,77]. Stories about the dangers of the Model S, specifically its battery technology, surfaced following these incidents and provided traction for counternarratives that questioned the safety of EVs, especially those made by Tesla [78–81].

On 7 November 2013, following a third reported Model S battery fire, several weeks of bad publicity, and consecutive days of poor stock performance, we observed the creation of a set of eight unusual Twitter accounts that had the following features: the eighth account was created within 70 min of the first; all eight accounts posted positive messages about Tesla (using the $TSLA cashtag); and their Twitter activity started on the night of November 7 (see list of the eight accounts in Table 1). Over the following seven years, these accounts would post nearly 25,000 $TSLA and over 5000 #TSLA tweets. The content of these tweets did not appear to have been written by a human user (as shown for one account in Table 2), and their timing did not resemble that of a human user as the tweets occurred at three-hour intervals throughout the day (see histogram in Figure 2). Such content and tweet patterns led us to suspect that the accounts in question were independent computational agents acting in support of the firm, or Fanbots.

Table 1. Eight $/#TSLA accounts created within 75 min on 7 November 2013 (with Botometer scores).

TweetCount	UserName	UserCreationDateTime	UserBotometerScore
3386	danrocks4	2013-11-07 22:41	4.6
3258	lookn4wins	2013-11-07 21:59	4.6
3194	leahanneta	2013-11-07 22:29	4.8
3036	Jake132013	2013-11-07 21:42	4.8
2956	clayton_dd	2013-11-07 21:53	4.6
2852	Jim5011	2013-11-07 22:07	4.6
2850	Stock_Tracker1	2013-11-07 22:17	4.4
2807	Emylers	2013-11-07 22:50	4.9

Table 2. Sample of early $TSLA tweets from one 7 November 2013 account.

UserName	TweetCreationDateTime	TweetText
danrocks4	2013-11-13 15:45	Danrocks: $TSLA keeping this on watch . . .
danrocks4	2013-11-13 19:07	Danrocks: $TSLA Starting to get interesting . . .
danrocks4	2013-11-18 19:16	Danrocks: $TSLA Hit my list a few days ago . . .
danrocks4	2013-11-30 09:41	$TSLA Hitting Buzz . . .
danrocks4	2013-12-10 12:44	$TSLA alot of talk going around about this one . . .

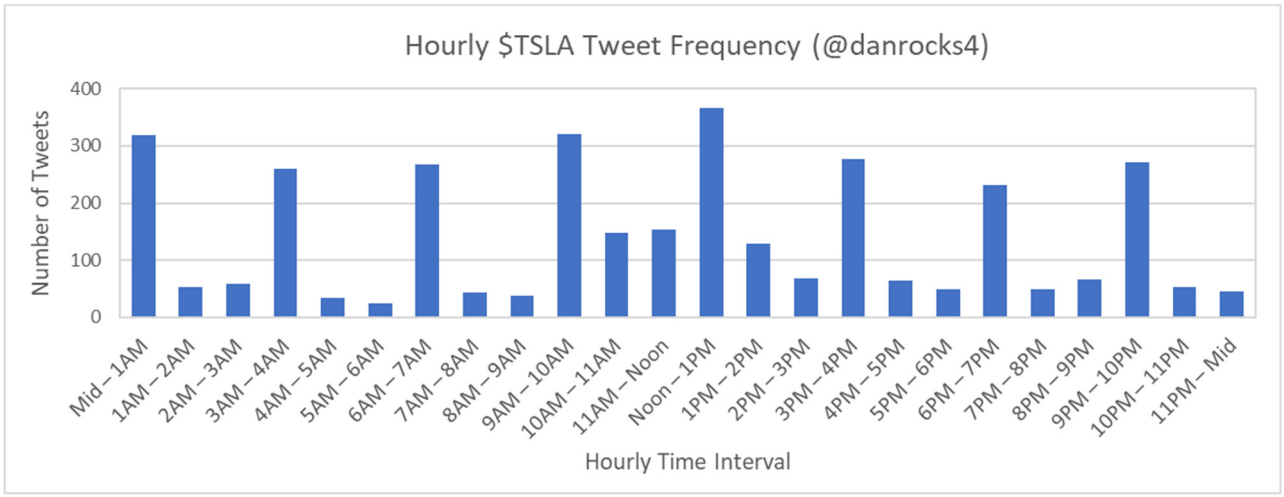

Figure 2. Hourly $TSLA tweet frequency of one 7 November 2013 account over the study period.

The creation of the 7 November 2013 Fanbots in such close proximity to the emergence of a counternarrative cued us to the possibility that computational agents may have been deployed to shape the conversation about Tesla on Twitter. In the end, the counternarrative that Model S batteries were dangerous and prone to combustion did not displace Tesla's preferred entrepreneurial narrative about the merits of the firm's battery technology. Over the ensuing years, pro-Tesla entrepreneurial narratives extended the appeal of the firm to broader sets of stakeholders, even as various counternarratives continued to simmer. However, the discovery of these Fanbots raised new questions about the use of corporate computational propaganda in shaping a firm's entrepreneurial narratives.

5. Data and Methodology

To explore the extent of CCP in this context, we sought to characterize the extent of fanbot activity within the corpus of tweets containing either the cashtag $TSLA or hastag

#TSLA from the time of Tesla's IPO in June of 2010 to the end of 2020, our study period. Using the Twitter Academic API, we queried the historical Twitter archive for tweets containing "$TSLA" or "#TSLA." Data and associated metadata were collected, including Tweet Date/Time, Tweet ID, and User ID. Subsequently, the two corpora were consolidated and sorted by total activity (number of tweets within the study period) of user accounts. The User Names of the 400 most active accounts in each corpus were then retrieved.

To identify potential fanbots within these corpora, these User Names were evaluated using an off-the-shelf IS platform known as Botometer (previously BotOrNot) [82–84]. This tool analyzes the language, timing, frequency, and other aspects of a given user's tweets to generate a score between zero (likely human user) and five (likely programmed bot user). Following previous research on Twitter bots, we treated a user with a Botometer score greater than or equal to 4.0 as a fanbot account [82,85] and found two visibly distinct groups of users (see histogram of Botometer scores in Figure 3). Within the 400 most active $TSLA and #TSLA Twitter accounts, we found 95 and 143 Fanbots, respectively, with an overlap of 24 accounts. Of these, 81 $TSLA and 126 #TSLA Fanbots were created within our sampling window, with an overlap of 21 accounts. In total, we identified 186 unique, post-IPO Fanbots operating within the two corpora.

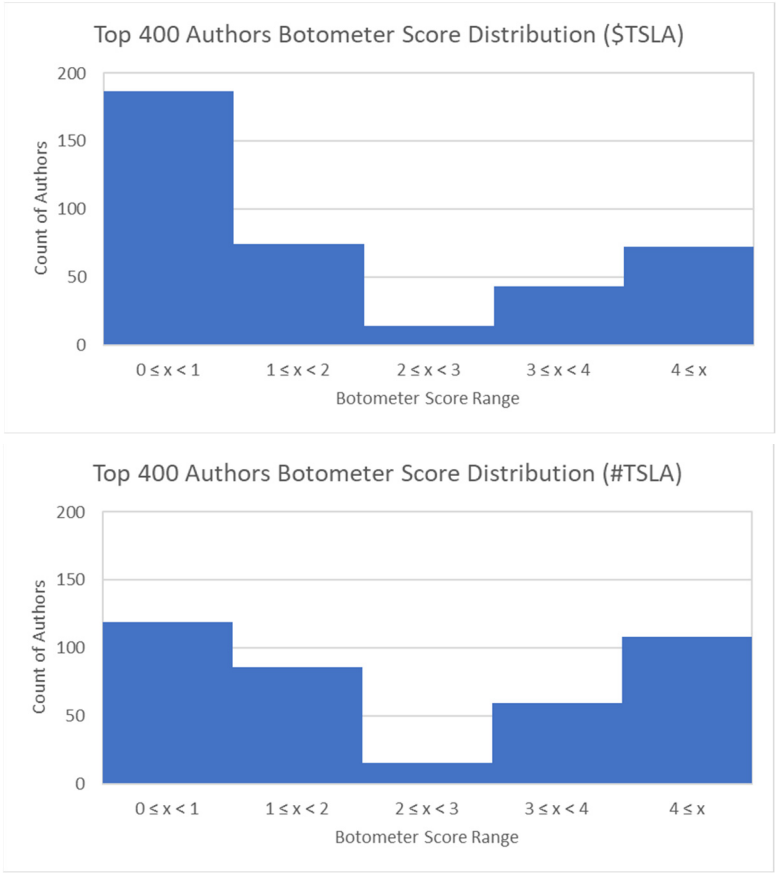

Figure 3. Histogram of the 400 most active $TSLA and #TSLA users by Botometer score.

Over the study period, there were a total of nearly 4.3 million tweets containing $TSLA. Of these tweets, approximately 1.4 million (or 33%) were posted by the 400 most active $TSLA accounts and more than 400,000 (or 10%) by accounts identified by Botometer as Fanbots. Over the same period, there were approximately 157,000 tweets containing #TSLA. Of these tweets, nearly 66,000 (or 42%) were posted by the 400 most active #TSLA accounts and 36,000 (or 23%) by accounts identified by Botometer as Fanbots. We interpreted the magnitude and share of CCP in the $TSLA and #TSLA Twitter corpora to be significant (see Figure 4).

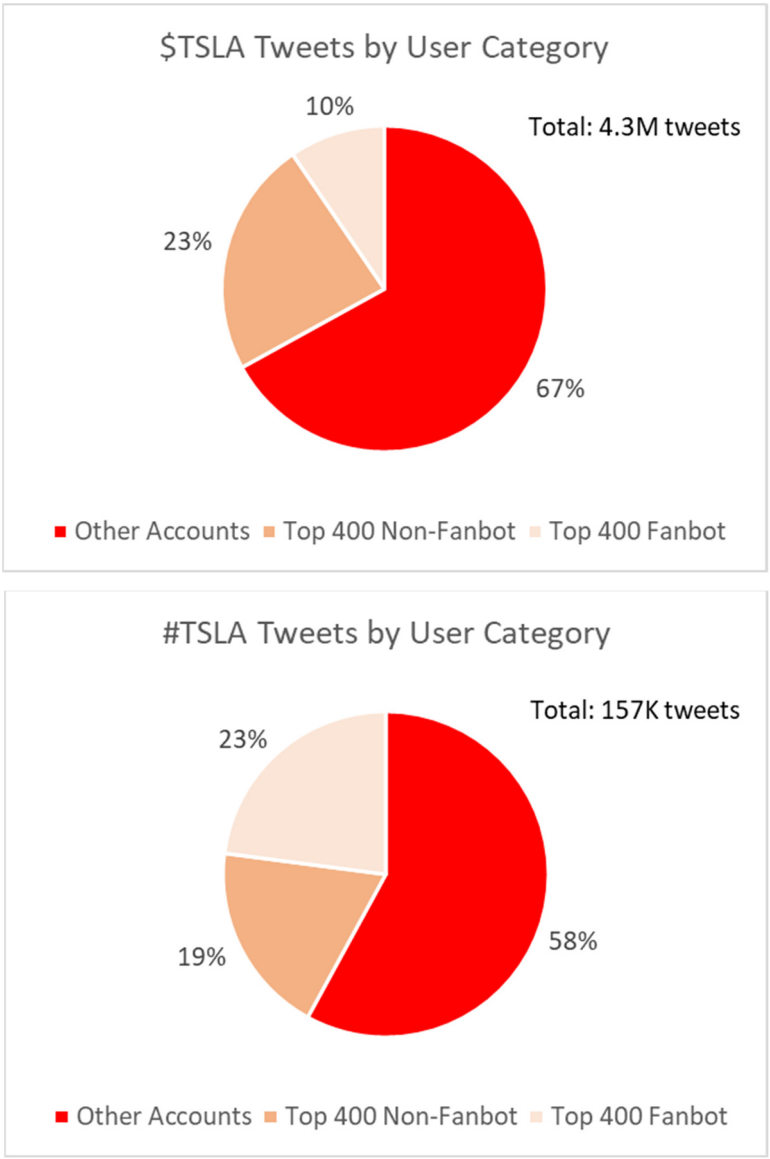

Figure 4. Distribution of $TSLA and #TSLA tweets by category of users.

6. Interpretation of Fanbots, CCP and Entrepreneurial Narratives

Having identified algorithmic Twitter accounts as a source of Corporate Computational Propaganda (CCP), we propose two possible motivations for the use of CCP to support Tesla's entrepreneurial narratives. Since creating fanbots and having them generate CCP is not costless, the fact that fanbots exist and make a considerable contribution to the overall corpus of tweets about Tesla suggests that whoever was responsible for the Fanbots believed that deploying these resources—to shape engagement and influence the conversation about Tesla on Twitter—would help bolster Tesla's preferred entrepreneurial narratives and, thereby, support the company's mission and operations. Even if the actors responsible for the Fanbots did not believe that they would be value-creating for Tesla (or in the immediate interests of the actors), they may have believed that CCP would insulate the firm's preferred entrepreneurial narratives from the threat of nascent counternarratives. In the latter case, investment in fanbots may be thought of as a counter-weight, or an insurance policy, against information that undermines the firm's preferred entrepreneurial narratives. Whether Tesla's entrepreneurial narratives would have thrived, or even survived, in the absence of the Fanbots and the CCP they generated is a question for future research. For now, the existence of fanbots suggests that some actor (an individual or group) believed

that they would serve the interests of the firm, though the mechanisms of such service warrant further study.

Below we present several possible mechanisms by which CCP may have increased social acceptance of Tesla's entrepreneurial narratives. We gathered these mechanisms under the umbrella of visibilization, the process by which fanbot-generated CCP increased the visibility of certain entrepreneurial narratives and, thereby, altered Twitter users' impressions of Tesla.

Visibilization describes the process by which certain tweets—Fanbot tweets containing content that supports Tesla's various entrepreneurial narratives—would attract attention and, thereby, be more visible to human users on the platform [8]. Social psychology suggests three possible mechanisms by which visibilization may operate in the context of CCP: repetition, recency, and availability.

Repetition. Unlike human users who need periodic breaks, fanbots are able to tweet almost continuously. As Tesla Fanbots generate CCP throughout the day, human Twitter users may be influenced by observing the tweets over and over again. Adding to this influence is the fact that CCP is generated by numerous Fanbot accounts, potentially exposing the observer to multiple sources of pro-Tesla content. As a result, human users may be subject to repetition bias, by which they believe the positive content to which they are exposed. We surmise that the beliefs of Fanbois, who were pro-Tesla prior to repeated CCP exposure, may be strengthened by repeated exposure to positive messages about the firm [86].

Recency. When tweets about a firm appear frequently, they may also be the most recent tweets observed, activating a recency bias among human users [87,88]. Such bias may leave the user with a pro-Tesla orientation and, after doing so repeatedly over time, may orient a wider group of active users such as Fanbois to more strongly believe in Tesla's entrepreneurial narratives and, as a result, support the firm through offline actions (e.g., purchasing vehicles or other products, purchasing shares, or generally holding and spreading positive beliefs about the firm and its entrepreneurial narratives).

Availability. When a social media user observes the repetition and recency of certain content, they may be further subject to an availability bias, whereby examples that readily come to mind are overweighted [89]. By exploiting the design architecture of the Twitter "feed," in which tweets scroll past and users see only the latest content, fanbots increase the likelihood that Twitter users, especially those actively engaging in the pro-Tesla conversation such as Fanbois, will view CCP and will overweigh the pro-Tesla information provided. As a result, Fanbois may become more committed to one or more pro-Tesla entrepreneurial narratives.

7. Discussion and Conclusions

We have provided evidence of the existence of Fanbot-generated corporate computational propaganda on Twitter that supported Telsa's entrepreneurial narratives. We proposed that this content bolstered positive accounts of these narratives—while also insulating against damaging counternarratives—through a process of visibilization. Fanbois, a large group of pro-Tesla human Twitter users, may have reacted to this visibilization through social psychological mechanisms of recency, repetition, and availability. Further research will be needed to fully identify the mechanisms linking fanbot activity to observable social phenomena like online polarization and mobilization. Nevertheless, this article has proposed one set of relationships between Fanbot-generated CCP and Fanboi-led social approval of the firm.

We readily admit that we have not ruled out all alternative explanations for the presence of Fanbots in the $TSLA and #TSLA tweet corpora. For instance, researchers have previously documented the prevalence of generic pro-market content on "financial" Twitter (tweets containing any cashtag) [90]. In unreported analyses, we did find evidence of "bot" content relating to other securities. However, the $TSLA corpus contains much more bot content than we found in the cashtag corpora of other companies in a random sample

of S&P500 firms. During the ~ten-year period we studied, Tesla's cashtag tweet corpus differed significantly from that of any other publicly traded firm, by both the total volume and total amount of CCP. Second, we cannot rule out reverse causality, whereby Tesla's ability to crack the long-standing challenge of successfully commercializing electric vehicles attracted both a growing community of admirers (Fanbois) and unrelated spammers seeking to redirect or capture attention in a large, online community of active, human users. This "collective attention spam" has been observed in Twitter [91]. However, even if we accept that some of the Fanbot tweet activity that we observed was created to access the emergent Tesla community on Twitter, we would still not be able to explain the events of 7 November 2013, when a set of Fanbot accounts were created in apparent response to specific challenges to a cornerstone entrepreneurial narrative of Tesla. Given the provisional and descriptive nature of our analysis, we expect and encourage further research to test these and possibly other alternative explanations. We have proposed our best explanation of the observed fact patterns.

At a more general level, does the discovery of Twitter Fanbots generating pro-Tesla computational propaganda foretell the rise of a new form of impression management for CEOs seeking to generate support for their firms' respective entrepreneurial narratives? This single-firm study cannot answer this question. On the one hand, our analysis thus far has assumed that any firm could, in principle, take advantage of CCP. However, we must stipulate that Tesla's CEO Elon Musk (even before announcing efforts to acquire Twitter in mid-2022) was a singular business figure on the Twitter platform. His Twitter popularity allowed him to use the platform as a powerful engagement tool, possibly enhancing the effects of Fanbot-generated CCP. Therefore, future research will need to examine the boundary conditions for these findings.

Given what we know at present, it is not clear if this strategy could be replicated by other firms seeking to use fanbot-generated CCP to support their own entrepreneurial narratives in the absence of a central actor with Elon Musk's ex ante celebrity. Put another way, we do not yet know the conditions under which CCP is likely to be effective in managing and supporting entrepreneurial narratives. Nevertheless, many less-celebrated CEOs, observing Musk's success using Twitter to advance Tesla's entrepreneurial narratives, are likely already trying to emulate this strategy, on Twitter or on other social media platforms.

Based upon Tesla's success, we can expect these strategies to be deployed by companies in similar situations, namely, startup ventures relying upon entrepreneurial narratives to sustain access to resources. Since 2016, policymakers have been focused upon identifying and regulating political computational propaganda [92], but as we have shown, the use of computational propaganda on Twitter by pro-corporate actors preceded its use in politics by several years. Our observation of Fanbots supporting entrepreneurial narratives leaves open the possibility that corporate computational propaganda may already be influencing social approval in other nascent market settings.

These initial findings provide a foundation for future research in this area. These findings also provide a foundation for future research on the role and function of CCP, particularly in the emergence of the contemporary electric-vehicle industry. Have other EV startups sought to use CCP to legitimize their respective entrepreneurial narratives? Does CCP have spillover effects between firms? Conversely, can CCP have competitive implications, such as enabling firms to engage in online, negative peer disclosure? Relatedly, does the existence of CCP alter the sentiment of online conversations about specific firms? If so, would such CCP-driven distortion have any impact on market movements of certain firms?

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