

# Women's Driving in Saudi Arabia – Analyzing the Discussion of a Controversial Topic on Twitter

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**Abstract.** Twitter provides a window into peoples' opinions about issues of public interest. In this paper, we analyzed the stance, gender and location of tweets and tweeters related to the controversial issue of women driving in Saudi Arabia. We used a sample of tweets between 2012, when the first campaign for women driving began, until 2017, when the government issued a policy that allowed women to drive. We manually labeled 4089 tweets for stance (i.e., being in support, against, or neutral on this topic). Our data analysis showed that there was more support for than opposition to this issue, and that the ratio of opposing tweets was lowest after the change was officially announced. There were more male than female tweeters in our sample. Our analysis of the gender and location of tweeters showed that in our data, women were more opinionated (both, pro and against women driving) than the men, and most tweets on this topic originated from Saudi Arabia, Turkey and the USA, respectively.

**Keywords:** Stance Analysis, Twitter, Social Computing, Saudi Arabia

## 1 Introduction

Social media platforms such as Twitter are popular around the world. With 13.8 million active users out of 24 million internet users (91% of total population), Saudi Arabia is among the countries with the highest number of Twitter users among its online population [1, 2]. Moreover, Saudi Arabia is producing 40% of all tweets in the Arab world [3]. One of the issues discussed on Twitter is the permission for women to drive in Saudi Arabia. This longstanding issue has been more than a regulatory in Saudi Arabia; a country that has had undergone social and economic changes with their new governmental regime. The issue of women driving highlights the historical and ideological conflict in Saudi Arabia between conservative and more liberal voices. On October 26th, 2013, a social movement began when 60 women drove their cars in the streets of Riyadh, the capital of Saudi Arabia [4]. This movement sparked heated debates between

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people for and against women driving in Saudi Arabia. On 26 September 2017, the policy changed to grant women permission to get Saudi drivers' licenses was officially announced. Measuring public opinion is challenging in Saudi Arabia, e.g., due to a lack of polling data. In addition, previous studies based on other societies and languages might not generalize to the culture of Saudi Arabia due to differences in traditions and norms. In this study, we capture a piece of this culture by collecting and analyzing data from a public channel, namely Twitter, which can offer a window into public opinion and the role of social media in Saudi Arabia. More specifically, we aim to explore peoples' attitudes towards the topic of allowing women to drive in Saudi Arabia, and if these attitudes shifted when relevant events happened. We also examine the gender and location of tweet authors and if these features correlate with peoples' stances towards the given topic. This work can help explore the relationship between a change in policy and the expression of peoples' opinions on social media. This study might also inform the development of models of social behavior that fit the Saudi Arabic culture.

## 2 Related work

Social media can have an impact on people, e.g., by challenging existing norms and integrating different opinions. Borge-Holthoefer and colleagues [5] explained how Twitter can provide a platform for modern protests such as the 2013 Egyptian coup. They used content analysis and network analysis to trace opinion changes in Egypt's population during the protests. Their results show little evidence of users changing sides between pro-military/anti-military and Secularist/Islamist camps. Another study by Magdy and colleagues [6] argued that social media can be used to predict future attitudes and stances. This study investigated the attitudes of U.S. Twitter users towards Muslims reactions to the 2015 terrorist attacks in Paris. The authors used tweet content and network interactions to make a distinction between online speech that attacks/blames, defends, and is neutral towards Muslims after a terrorist attack. Their results showed that it is possible to predict users' stances toward a social issue on Twitter since people tend to agree with like-minded others (homophily). Abokhodair and colleagues [7] attempted to understand the opinion of online users regarding online privacy and its value in Arab golf countries, mainly Qatar. They analyzed tweets that mentioned "privacy", focusing on how digital contexts can lead to different opinions about privacy. Their results showed that users from Arab golf countries value their privacy widely because of religious reasons. Moreover, when men are discussing women's' privacy, they tend to use authoritarian language because they link their privacy to their honor. Another study by Abokhodair and Vieweg [8] also discussed the concept of privacy and social media use in two of the Arab Gulf country, Qatar and Saudi Arabia. Their results confirmed that privacy is not a choice but can be imposed by cultural norm, specifically for women. A related study by Al-Dawood and colleagues [9] indicated that Saudis are restricted by their cultural boundaries when it comes to online dating and matchmaking. They found that it is very hard for males and females to meet or find potential partners face-to-face because gender segregation is culturally enforced. Moreover, they showed how social media, and technology in general, can help with

such cultural restrictions. Despite multiple papers that address the engagement of individuals with societal issues on social media, our body of knowledge about the discourse of controversial social and cultural issues in Saudi Arabia is still limited.

### 3 Data

For this research, we collected publicly available social media data from Twitter by using Crimson Hexagon [10]. First, we sampled public posts from March 1, 2012 (before the first campaign on women driving) through September 30, 2017 (governmental announcement of allowing women to drive). The sample only included tweets from accounts that set Arabic as their language. The following query was used (translated from Arabic to English below):

(“سواقه” OR “قيادة” OR “قياده” OR “سواقه”) AND (“المرأة” OR “المراه” OR “النساء” OR “حريم”) OR (“الغاء” OR “لن تقودي” OR “رفض” OR “ضد” OR “مع”) OR (“سيارة” OR “سياره”)  
 (“Driving” OR “Drive”) AND (“Women” OR “Females”) AND (“Car”) OR  
 (“With” OR “Against” OR “Ban” OR “Refusal” OR “Cancellation”)

Using this query, we collected 106k tweets, which we then divided into four time periods as follows: Time period 1: March 1st, 2012 - September 30th, 2013; represents the time before the first driving campaign movement (9,628 tweets). Time period 2: 1st – 31th, October 2013; the month during which the driving campaign began (10,826 tweets). Time period 3: 1st, November 2013- 31th, August 2017; before the governmental announcement of allowing women to drive in Saudi Arabia (65,437 tweets). Time period 4: 1st - 30th, September 2017; the month during which the government announced the permission for women to drive (10,247 tweets). During annotation, we noticed a considerable number of repeated tweets written by different users (10% of the total dataset), which were removed to avoid bias. This left us with 96,138 tweets.

## 4 Method

### 4.1 Stance Identification

Stance identification typically seeks to identify whether a person is for or against some given issue [11]. To have an equal distribution of data per time period we randomly selected 10% of the tweets from each time period. That resulted in 4,089 tweets to be our sample for manual tagging of the stance per tweet. We annotated each tweet as either being “positive” (i.e., in favor of women driving), “negative” (i.e., against women driving), or “other” (i.e., tweets with no clear or strong stance for or against women driving, and tweets with contradicting or unclear stances). The first two authors, whose native language is Arabic, annotated the tweets. The third author, who is also familiar with the Arabic language and Saudi culture, intervened when there were any disagreements. By the end of the annotation process, approximately 5% of the total annotated tweets were labeled by both coders. We used Cohen’s Kappa [12] to measure inter-annotator agreement. which was  $\kappa = 0.756$  (95% CI, 0.6742 to 0.8382),  $p < .0005$ .

## 4.2 Identification of Author Gender

For Arabic names, automatic annotation of gender might not give accurate results. Thus, we decided to perform another type of manual labeling for the same 4,089 tweets used for stance identification. Annotators looked at each user’s name, screen name, and link to their Twitter profile. Annotators relied on their cultural knowledge to infer the correct gender as either being “female”, “male”, or “not sure”.

## 4.3 Identification of Author Location

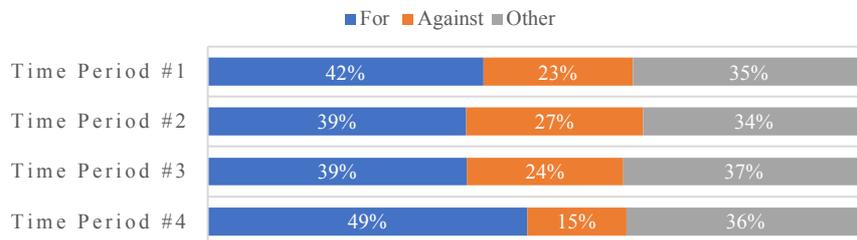
Although allowing women to drive is a Saudi Arabic concern, this topic received international attention. To find out if Twitter users from other countries are also involved in this discussion, we retrieved locations as provided by Crimson Hexagon [10]. To infer locations, Crimson Hexagon uses two types of information: 1) geotagged locations, which are only available for about 1% of Twitter data [13, 14]; and 2) for tweets that are not geotagged, an estimation of the users’ countries, regions, and cities based on “various pieces of contextual information, for example, their profile information”, as well as users’ time zones and languages<sup>1</sup>.

# 5 Results

## 5.1 Stance Analysis

**Overall Stance Distribution.** Out of 4,089 tweets, 1,689 (41.3%) had a positive stance on the issue, while only 931 tweets (22.7%) had a negative stance, and the rest of the tweets were classified as “others”. In other words, about 2/3 of the tweets had a clear stance, and out of those tweets, the majority was in support of women driving.

**Stance Distribution over Time.** Figure 1 shows the distribution of stances across the four time periods. There are only minor differences in stance between the time periods. Our results show that before the social movement and after the announcement of the new regulations (time periods 1 and 4), there was a higher agreement for women to drive. Most importantly, when the new regulation was announced, the percentage of agreeing to the new law was the highest.



**Fig. 1.** Stance distribution over the four time periods.

<sup>1</sup><https://crimsonhexagon.com/>



Fig. 2. Gender distribution across the four time periods.

## 5.2 Gender Analysis

**Overall Gender Distribution.** Since Saudi culture is a gender-unequal society [15], we were interested in measuring if author gender correlates with stance. In our annotated sample, 2,443 (59.7%) of 4,089 tweets were posted by male authors, and 1,428 tweets (34.9%) by female authors. This matches previous studies that report low percentages of Saudi women participating in social media [3], which might be due to ongoing societal and cultural constraints imposed on some females when it comes to using social media [16].

**Gender Distribution over Time Periods.** Figure 2 shows the gender distribution across over time. The participation of women slightly decreases as the events unfold.

**Relationship between Gender and Stance.** To gain a better understanding of the relationship between author gender and stance, we analyzed the gender distribution across stances. A previous study has shown that some Saudi males report traditional attitudes towards working females [15]. Our results, shown in figure 3, show that in our sample, women are more opinionated (as opposed to neutral, i.e., the “other” category) on this topic: more women (47%) than men (40%) were in support of women driving in Saudi Arabia, and women (26%) than men (22%) were against women driving in Saudi Arabia. One explanation for this observation might be that the Saudi people are primed by the long tradition of driving being only permitted for men or stereotypes about male leadership roles [17]. Moreover, this effect might be also attributed to the language used to describe driving in Arabic, as the word “قيادة” means “driving” as well as “leading” in English. Overall, males (38%) had more “other” opinions than females (27%). A recently conducted study in a start-up company in the United States had shown that

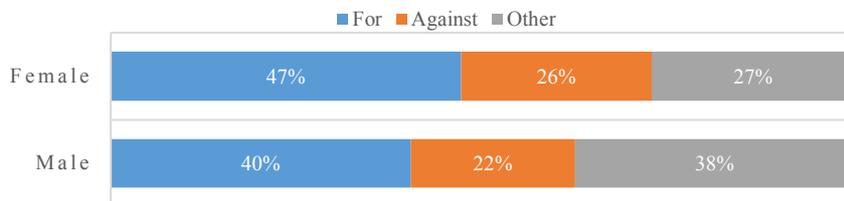
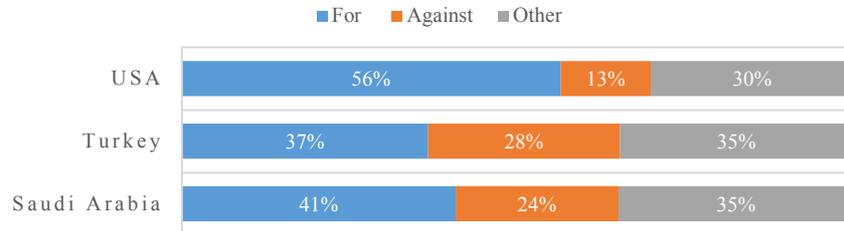


Fig. 3. Gender distribution across stance.



**Fig. 4.** Location distribution across stance.

men tend to refrain from participating in gender-parity initiatives because they feel that it is not their place or psychological standing to be involved in such discussion [18].

### 5.3 Country Analysis

**Overall Country Distribution.** We first analyzed the distribution of the tweet authors' country to see where most posts originated from. Out of the original dataset that contained 96,138 non-repeated tweets, 42.25% had a location. Of these tweets, 29,006 (30.17%) originated from Saudi Arabia. The second highest number (4,097 tweets, 4.26%) came from Turkey. We were curious about this relatively high number of tweets from Turkey (the third highest contribution came from the U.S, with 1,818 tweets/ 1.89%). Moreover, we noticed that several tweets with similar, spam-like content originated from Turkey. To investigate this effect in more detail, we attempted to identify whether these accounts were bots or not. We used Botometer<sup>2</sup> to evaluate 3,618 tweets (out of the 4,097 from Turkey) and found that approximately 25% of the accounts were no longer accessible for analysis. Among the accessible accounts, Botometer identified 3% of the accounts as being bots, indicating that the majority of the tweets from Turkey were not from bots.

**Relationship between Location and Stance.** To gain a better understanding of the relationship between author location and attitude towards women driving, we analyzed the location distribution across stances. We selected the three top countries with the highest ratio of tweets in our labeled corpus of 4,089 tweets. These were Saudi Arabia (51%), Turkey (8%), and the USA (3.6%). Figure 4 shows the distribution of stance for the tweets originating from these countries. The highest ratio of tweets in favor of women driving in Saudi Arabia came from the USA, and the highest number of tweets voicing opposition to this concept came from Turkey. One limitation to these findings is that location might not equate nationality.

## 6 Discussion and Conclusion

In this study, we explored the stance towards a controversial topic of public interest (allowing Saudi Arabic women to drive) based on a sample of tweets. To achieve that,

<sup>2</sup><https://botometer.iuni.iu.edu/>

we partitioned a set of tweets into four time periods that represents major events that relate to that topic. Our results show that there was less opposition than support for this topic, and that the ratio of opposing tweets was lowest after the change was officially and publicly announced. More men than women are represented in our sample. The women in our sample were more opinionated (both, pro and against women driving) than the men.

This study has several limitations. First, the manual mark-up required annotators to understand Arab and Saudi culture. Therefore, our dataset is comparatively small. Second, using Twitter and Crimson Hexagon as a data source and collection tool involves multiple types of potential sampling biases [19-21]. For future work, we are expanding the dataset by collecting current and upcoming tweets, with the new policy taking effect in June 2018. Our work will focus on building a classifier and a model to help predict the public's acceptance of this policy change.

## Acknowledgment

We thank Daniel Kerchner from George Washington University for his help in reviewing the paper and providing his valuable feedback.

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