Gender dynamics of German journalists on Twitter

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***Abstract*—Women are underrepresented in many areas of journalistic newsrooms. In this paper, we examine if this established effect is continued in the new forms of journalistic communication, Social Media Networks. We used mentions and retweets as measures of journalistic amplification and legitimation. Furthermore, we compared two groups of journalists in different stages of development: political and data journalists in Germany in 2021. Our results show that journalists regarded as women tend to favor their peers in mentions and retweets on Twitter: while both professions are dominated by a massive number of men and a high share of men-authored tweets, females mentioned and retweeted other women to a more extensive degree than their male colleagues. In addition, we have found data journalists to be more inclusive towards non-members in their network compared to political journalists.**

***Index Terms*—Journalism, Social networking (online), Gender issues, information retrieval**

I. Introduction

Twitter and other Social Media Networks (SMN) have changed journalism in many ways. Most research focuses on how Twitter has challenged journalist values like objectivity, gatekeeping, and transparency [15], [17]. In addition, it has altered the news cycle by creating a hybrid system of new actors and news-sourcing habits [6], with Twitter being a common source for journalists [29]. Others found changes in the dissolution of private and professional personae on Twitter, which might collide with corporate brands [13].

Female journalists are underrepresented in many newsrooms and are less visible in media [25], [32]. Other channels of public appearance could provide new platforms for female journalists to promote their work or build a reputation. Twitter, as a platform with few barriers to entry, naturally would be expected to serve as an enhancement to building a platform. However, previous work has shown that this is not necessarily the case [17], [34]; political journalists especially have been shown to form male-dominated, elitist networks [18].

We build on an emerging body of literature that uses Twitter data to analyze networks of journalists to find out if there are gender-related differences between journalists on Twitter in general and groups of journalists in particular.

We analyzed 478,263 tweets from political and data journalists in Germany in the year 2021 to compare communication styles within these communities and between sexes. We find males to be dominating the number of tweets, whereas women tend to favor other women in mentions. We also found this effect for retweets of political journalists. We will start by laying out related literature on gender issues in journalism, then give an overview of political and data journalists in Germany, followed by a methods, and a result section.

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II. Related Work

Twitter for Journalists. Since its start in 2006, Twitter has been shown to be a central source of news in Washington D.C. [12], [16], in several Westminster democracies [13] and Germany [9], [26], [27]. Several authors have investigated the effects and foundations of journalistic networks on Twitter on the journalists themselves [14], [35]. Showing that political journalists prefer to engage with other political journalists, whether in opinion-building on political debates or joking about the debates. Several scholars have shown that journalists discuss issues mostly with other journalists or politicians [21], [22], [26]

Twitter and Gender dynamics. Female journalists on Twitter reveal more about their personal lives and link more to external websites, indicating more transparency than their male peers [17]. An analysis of political reporters in Washington, D.C. showed that male journalists amplify and engage their male peers nearly exclusively. Females also engage with each other but also retweet males more in absolute terms than they retweet women [34]. On the other hand, female journalists frequently encounter sexual harassment in online environments [33], especially when they are covering topics that are somewhat regarded as being male territory [31]. This has been shown to limit their ability to communicate with their audience [7] and leads to avoidance [33].

Twitter use of political journalists in Germany. For reporters on the German parliament, Twitter is the most used social media network for journalists covering federal politics in Berlin [27]. Research from 2014 has shown that the correspondents include politicians in their communicative circles, but otherwise stick together when debating, not reacting to other users who try to contribute to the discussion [26]. This is consistent with other authors, as previously mentioned.

Data journalism is a newer playfield of journalism and in comparison to other areas, data journalism is regarded as a new field that is not being guarded by "old boys" networks, thus being more open to all genders [36]. While its roots are mostly dated back to the 1970s idea of "precision

journalism" [8], [20]. Its main focus is the combination of data analytical approaches to find and extract information in data and tools to visualize the results and tell stories with it, which enhances traditional reporting [1], [8]. It is well established in Germany's media landscape [3], [11].

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III. Hypotheses

A. The "boys on the bus" are now on Twitter

The first hypothesis is centered around the idea of an elitist community of political journalists that has been found multiple times in the past [19] — Twitter could by default have an opening effect on those groups. Political journalists have been shown to form elitist circles on Social Media. We want to compare them to data journalism as a newer form of journalism. Because the latter is derived from a more technical, computer science-driven background — so-called "programmer-journalists" [28] — they may have different approaches to communication. Data journalism is often regarded as more transparent in its underlying data and methods [10], which might convey differently in Social Media discourses, our first research question and related hypothesis are as follow:

RQ1: Are data journalists engaging more with others on Twitter than political journalists?

H1: Data journalists have fewer internal discourses than political journalists.

B. Journalistic gender dynamics on Twitter

Another set of hypotheses is aligned with the question of gender dynamics in the Twitter behavior of journalists.

Twitter plays a vital role in publicly providing journalistic legitimation [5] or dominance in a specific field [2]. This has also been argued above when excluding outsiders from discourses but is also true within the field when establishing a hierarchy [23].

As Usher et al [34] have shown, there have been male dominance in Washington D.C.'s political journalism's use of Twitter. Not only do male journalists amplify their gender, but also females tend to mention and retweet male correspondents more than their peers, in absolute terms. While selective behavior in SMNs has been described earlier, by showing that men retweet primarily men and women retweet mostly women [37], the quantity of this gender gap in journalists is striking, being described as a "gendered echo chamber" [34, p. 338].

RQ2: Are there differences in gender bias in mentions and retweets of German politics and data journalists on Twitter?

We create two hypotheses for our Tweet analysis:

H2: Women journalists are mentioned less than men.

H3: Women journalists are retweeted less than men.

IV. Data

To provide an accurate and detailed snapshot of **German political journalists** on Twitter, we based the selection on the circulation and size of German newspapers. We tried to identify journalists who are clearly deployed to political sections or mainly working on political topics. This approach limits the proportion of regional newspapers, which use news agencies to a more extensive degree in their political reporting than larger newspapers and have no apparent politics reporters. Many larger newspapers offer an imprint with an overview of their authors and their vitae, which often contains Twitter accounts. Smaller newspapers sometimes lack that information, which then has to be retrieved from the articles. From these 730 accounts, all Tweets between January 1 and December 31, 2021, were retrieved on January 7, 2022, using Twitter API v2 [30]—in total 430,451 tweets.

To identify **data journalists**, we, used an advocacy group as a starting point. A majority of German data journalists have decided to congregate as a so-called "Fachgruppe" (*professional group*) of the non-governmental reporters' representation "Netzwerk Recherche" in the fall of 2020, "Netzwerk Recherche" sees itself "as general representatives of the interests of the entire field of data journalism and all its manifestations" [24]. We identified 167 members at the time of our data collection, which is similar to what has been collected in previous studies [3], [11]. Twitter usernames were added manually as well as affiliations whenever they were mentioned in the profile's description text. 148 data journalists could be connected with a Twitter account and 47,812 tweets have been downloaded on March 11, 2022, for the year 2021.

Adding a gender attribution. We assigned a binary gender category to all users in our lists by manually coding the author's first name into traditional male or female first names. This approach may result in miss-specifications if someone identifies as another gender as would be expected by the name. However, as this work tries to identify a potential divergence between users that appear as women and men for outsiders, we consider this issue approach to be sufficient. In unclear cases, we tried to deduce the gender using profile pictures. No names have been found which were not explicit enough to be assigned to a gender. In our data, 28.6 percent of political and 32.2 percent of data journalist users were regarded as women, while 71.4 percent of political and 67.8 percent of data journalists were identified as men. Both groups have fewer shares of women than the "World Journalism Study" found in Germany in 2016 with 40.1%.

V. Results

Men are not just over-represented in our sample, they also tweet significantly more (724.47 Tweets per man / 289.23 Tweets per woman on average). Consequently, men created a large majority of tweets. Less than 19 percent of data journalist tweets were written by women and only 13 percent of political journalists' tweets (Table I). This is also consistent for data journalists, although not in similar dimension. Men political journalists also use more mentions on average, which is measured by extracting all strings prefixed by an at-sign, which is Twitter's specification for tagging usernames. Women political journalists receive slightly more retweets on average.

Data journalists have a more open discourse. Part of our research focused on a general question about the arena of debate that takes part on Twitter. By extracting all mentions

TABLE I
SUMMARY STATISTICS OF GENDER, RETWEETS, AND MENTIONS OF POLITICAL (P) AND DATA (D) JOURNALISTS' TWEETS

		n	$Share$	$\overline{Tweets}$	$\overline{Retweets}$	$\overline{Mentions}$
P	m	375,582	0.87	4,803.0	248.6	1.14
	f	55,211	0.13	1,415.5	293.6	1.25
D	m	38,815	0.81	1,425.2	484.1	1.34
	f	8,997	0.19	1,358.0	506.0	1.41

and comparing these users to our pre-compiled lists by cross-tabulation, we can show the share of references that stay within the political and data journalistic network.

Of all mentions by the political journalists, 10.7 percent are referenced within our sample, and 89.3 are outside of our sample. This number is even lower for data journalists. Only 8.2 percent of mentions are within the data journalistic community and nearly 92 percent elsewhere. We find a statistically significant difference (χ^2 = 429.06, p <0.001, df = 1) between the two groups, with data journalists including more outsiders in their discourses, therefore being a less closed network compared to political journalists, which confirms H1.

Apart from that, this indicates that these journalists tend to include a vast amount of others in their debates, which is not in line with other findings [22], [23], [26].

Females favor their peers in mentions. We have already shown in Table I that there is a gap between the gender share of tweets and the gender share of users. This divergence can also be observed in the cross-tabulated share of mentions. This analysis only applies to tweets among our observed group of journalist users because we cannot derive gender for others.

Women users tend to favor their peers in terms of mentions when tweeting in the journalistic bubble. Political journalists mention their peers in 27.4 percent of mentions, which is close to their share in the user list, but more than their share on all tweets in the sample. This effect is even more extensive for women data journalists: they mentioned other female data journalists in 35.9 percent of intra-data journalistic discourses, which is even higher than the share of women in the primary user list. Men in comparison only mentioned women in 17.0 percent for political journalists and 20.7 percent for data journalists; see Table II. A Chi-Squared analysis showed a statistically significant result for both groups (p <0.001). The effect size ϕ is 0.10 for political (χ^2 = 549.78, df = 1) and 0.13 for data journalists (χ^2 = 112.03, df = 1), which points to a small effect. A contribution analysis shows that the mention of women by women composes 66.48 percent of the measured effect for political journalists, 63.76 percent for data journalists. We are therefore able to confirm H2.

Retweets are more evenly distributed for data journalists. While mentions are unevenly shared between genders in both groups, this is not entirely identical concerning retweets. Female political journalists are only retweeted by males in 13.3 percent of intra-journalistic retweets; male data journalists only share tweets of females in 18.4 percent of cases, as shown in Table III. Again, the share of females retweeting

TABLE II
GENDER OF MENTIONED USERS BY AUTHOR'S GENDER

		Mentioned		
		m	f	
Political	m	83.0%	17.0%	χ^2 = 549.78, p <0.01
	f	72.6%	27.4%	
Data	m	79.3%	20.7%	χ^2 = 112.03, p <0.01
	f	64.1 %	35.9%	

TABLE III
GENDER OF RETWEETED USER BY AUTHOR'S GENDER

		Retweeted		
		m	f	
Political	m	86.7%	13.3%	χ^2 = 326.42, p <0.01
	f	76.5%	23.5%	
Data	m	81.7 %	18.3%	χ^2 = 1.56, p >0.05
	f	78.5%	21.5%	

their female peers is higher in both groups, but in both cases lower than their share of users. A Pearson's Chi-squared test shows a statistically significant result for political journalists, for data journalists the results are not significant. The effect size of 0.10 is small for political journalists and even smaller for data journalists. While residues and contributions favor an effect between females for political journalists, this is not the case for data journalists. The effect on them seems to be much smaller. H3 can be confirmed very certainly for political journalists, but not in regard to data journalists.

Networks. To further understand the dynamics of retweets we created a retweet network. Purple nodes represent females and green nodes represent males. Gray edges represent at least two retweets between males in both directions, purple edges at least two retweets between females, and green edges a retweet connection between a male and a female user. For data journalists, we show edges for at least one retweet in both directions, as the network is a lot smaller.

While female networks are hard to spot in the network of political journalists (see Fig. 1), we find clusters of affiliations between different publishers. While reporters and editors for the media company *Axel Springer* and its outlets are closely connected on the left, journalists for *Der Spiegel* or *Süeddeutsche Zeitung* are found on the lower right.

The data journalists' network does not show similar patterns, which could be influenced by the smaller team size in the field (see Fig. 2).

We found the values of in-degree ($t(642) = 2.0341, p < 0.05$), out-degree ($t(440.09) = 2.9155, p < 0.01$), and Kleinberg's authority centrality score ($t(642) = 2.0108, p < 0.05$) to be statistically significant for political journalists, while they are not for data journalists. See Tables IV and V for network property metrics.

We further analyzed community structures by running community detection algorithms. Louvain clustering [4] reached

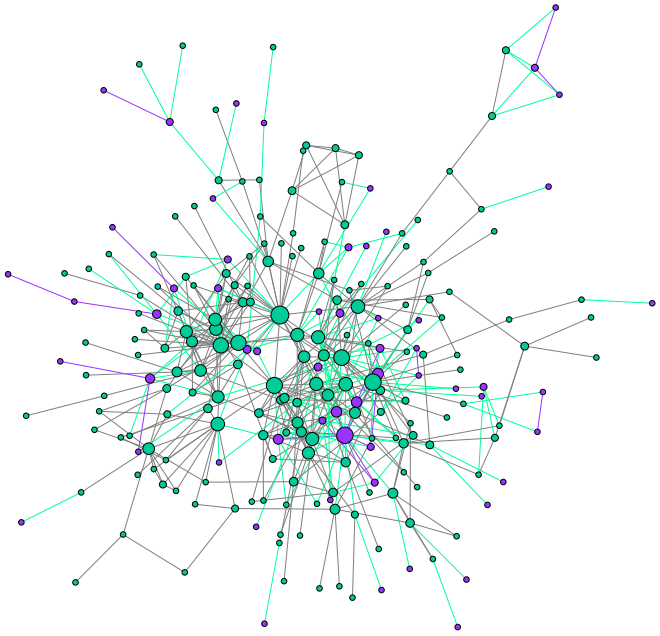

Fig. 1. Retweet-network of political journalists by gender: Graph network of retweets by German political journalists, showing edges when at least 2 mutual retweets were sent by both nodes. Purple: women, green: men

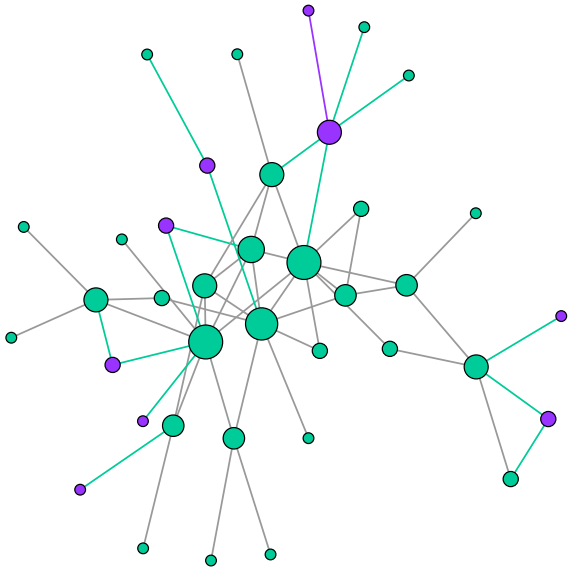

Fig. 2. Retweet-network of data journalists by gender: Graph network of retweets by German data journalists, showing edges when at least one mutual retweet was sent by both nodes. Purple: women, green: men

the highest modularity of 0.53. The algorithms seek to optimize by increasing the relative density of edges inside communities in contrast to edges outside communities. While we find more communities for political journalists — plausible, due to the higher number of tweets and users, we find that the median share and counts of women in the communities are higher for data journalists in mention networks (see Table VI).

TABLE IV
PROPERTIES FOR NETWORKS OF MENTIONS BETWEEN POLITICAL (P) AND DATA JOURNALISTS (D)

Property	P	D
Diameter	8.00	6.00
Mean Dist.	2.81	2.34
Edge Density	0.03	0.088
Reciprocity	0.48	0.53
Transitivity	0.28	0.41
Components	1.00	6.00

TABLE V
PROPERTIES FOR NETWORKS OF RETWEETS BETWEEN POLITICAL (P) AND DATA JOURNALISTS (D)

Property	P	D
Diameter	8.00	7.00
Mean Dist.	3.05	2.76
Edge Density	0.02	0.05
Reciprocity	0.33	0.28
Transitivity	0.26	0.33
Components	1.00	1.00

TABLE VI
SUMMARY STATISTICS FOR LOUVAIN COMMUNITY DETECTION

Graph	Count	$\overline{Users}$	$\overline{Share_W}$	med	$\overline{Women}$
Mentions D	37	3.62	0.43	0.25	1.11
Mentions P	135	4.77	0.36	0.00	1.33
RTs D	69	1.68	0.30	0.00	0.49
RTs P	202	2.82	0.28	0.00	0.75

VI. DISCUSSION

We have shown differences in mention and retweeting behavior between genders of political and data journalists in Germany, confirming H2 and H3 for political journalists. Women tend to mention their peers more often in tweets than men. Since the latter make up the larger share of the Twitter network, they tend to be more visible. The differences could lead to women and their work being less apparent on Twitter, therefore receiving less amplification and legitimization.

This effect can also be found in retweets of political journalists, although it is not similarly strong for data journalists. This might indicate that data journalists tend to share the work of others with less regard to gender, compared to their colleagues in political reporting. However, women journalists show higher rates of retweet behavior for their peers. Since the effect appears in both groups, this indicates that women pay greater attention to tweets by other women; however, this effect is much more solid for political journalists. These results confirm earlier work by [34].

While analyzing retweet networks, we found visual evidence of clusters of affiliations that might impact tweet behavior, which might be a vantage point for further research. Community detection found that data journalists' mention networks tend to have a higher median share and count for females than other studied networks.

This work could not reproduce earlier findings on the high level of intra-journalistic discourses on Twitter. Nuernbergk has shown a journalistic-political Twittersphere, which mainly references each other [26], similar findings by [23] and [22]. We did not find such an effect, with relatively high percentages for external mentions and retweets. However, we need to point out that as this work did not include politicians in the sample, or control for different groups of non-journalistic actors, and focused more on gender differences, the results are not fully comparable with those earlier results. We also did not include

media companies' Twitter accounts in our analysis, which might make up a large share of mentioned or retweeted users.

We could, however, find a significant difference in shares of those internal discourses between the two groups of journalists, with data journalists being less locked than political journalists, which confirms H1. That might indicate a greater openness to the influence of others in the data journalistic community, which is a finding that could need closer examination.

VII. Conclusion

We presented a comparison of Twitter networks of German political and data journalists to analyze differences in communication between women and men. We did find a difference in the proportions of internal discourses within the two groups of journalists. Data journalists tended to have fewer internal discussions on Twitter than political journalists. However, we could not reproduce earlier findings, which showed an elitist network of political journalists on Twitter.

This study showed that men dominated the number and share of tweets in networks of political and data journalists in Germany. While women were much less mentioned and retweeted by men, other women tended to favor their peers. This effect was visible in both groups for mentions and was also observable for retweets by political journalists, and, to a lesser degree, for data journalists. This indicates a different perception of the work and arguments made by colleagues on Twitter between genders, which might lead to less amplification and legitimization of women's voices on Twitter. Further research is required to extract the reasons behind this effect and the prospects of countering this behavior.

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