

# Between Calls for Action and Narratives of Denial: Climate Change Attention Structures on Twitter

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## 1. Results: Event Types, Domains, Discourses, and User Types

**Table 1.1.** Distribution of event types within the attention peaks (multiple coding possible)

Year	Government Action/ Decision	Extreme Weather Event	Protests	Campaign /Election	Cultural Event	Climate Conference	Release of Scientific Report
<b>Total</b>	<b>15</b>	<b>10</b>	<b>9</b>	<b>9</b>	<b>5</b>	<b>3</b>	<b>2</b>
2017	5	2	0	0	0	0	0
2018	2	1	4	3	1	1	1
2019	2	2	3	2	1	1	0
2020	2	3	0	4	1	0	0
2021	4	2	2	0	2	1	1

**Table 1.2.** Distribution of tweets and generated retweets per user type

User Type	Tweet n	Retweet n	% T	% RT
Political actors	453	683865	18.12	23.08
Cultural actors	307	474699	12.28	16.02
Scientists	168	177706	6.72	6.00
Activists/Organisations	201	204919	8.04	6.91
Journalists	496	610394	19.84	20.6
Media outlets	303	229129	12.12	7.73
Citizens/ Individual users	283	244783	11.32	8.26
Deleted	216	143672	8.64	4.85
Other	73	194313	2.92	6.56

**Table 1.3.** Frequencies of domains and discourses across the sample and Retweet percentage

	<i>n</i>	%	% of Retweets
<b>Domains</b>			
Nature	771	30.84	29.03
Science	436	17.44	17.04
Trans-/International Politics	370	14.80	20.23
National Politics	1519	60.76	62.63
Civil Society and Activism	146	5.84	7.77
Media	596	23.84	15.92
Economy	375	15.00	11.40
Health	202	8.08	8.76
Culture	142	5.68	5.68
<b>Discourses</b>			
Climate change denial	1099	43.96	56.28
Climate change belief	472	18.88	14.00
Calls for action	948	37.92	38.32
Narratives of delay	301	12.04	8.38
Negative future scenarios	407	16.28	13.93
Optimistic future scenarios	144	5.76	6.29
Industry/capitalism as a cause of climate change	206	8.24	5.84
Corporate/industry/capitalism as an opportunity	143	5.72	4.83
Highlighting social injustice	286	11.44	8.78
Denying social injustice/preserving status quo	35	1.40	0.71
Anti-administration/government	994	39.76	45.44
Criticising media reporting	61	2.44	1.25

*Note.* Some (sub-)categories were not further presented because of low frequency or they were merged. For all the coded variables, see Coding Frame.

## 2. Results: Cluster Analysis

**Table 2.1.** Means across identified clusters. For more detail, see the following tables.

	<b>Cluster 1</b> <i>universal calls for change</i>	<b>Cluster 2</b> <i>scientific calls for change</i>	<b>Cluster 3</b> <i>narratives of denialism</i>	<b>Cluster 4</b> <i>believers criticising administration</i>	<b>Cluster 5</b> <i>contested weather debates</i>	<b>Cluster 6</b> <i>contested political and social debates</i>
<b>Domains</b>						
Nature	0.43	0.32	0.10	0.24	0.59	0.17
Science	0.07	0.54	0.08	0.20	0.10	0.13
Trans-/International Politics	0.26	0.16	0.16	0.09	0.04	0.17
National Politics	0.39	0.21	0.72	0.95	0.51	0.66
Civil Society and Activism	0.08	0.00	0.13	0.04	0.02	0.07
Media	0.20	0.30	0.17	0.21	0.12	0.43
Economy	0.23	0.18	0.09	0.10	0.10	0.20
Health	0.08	0.09	0.10	0.08	0.09	0.05
Culture	0.09	0.02	0.04	0.03	0.08	0.07
<b>Discourses</b>						
Climate change belief	0.34	0.41	0.00	0.86	0.48	0.32
Climate change denial	0.02	0.01	0.87	0.00	0.22	0.19
Calls for action	0.64	0.50	0.01	0.28	0.34	0.46
Narratives of delay	0.09	0.06	0.35	0.01	0.08	0.20
Negative future scenarios	0.14	0.40	0.04	0.10	0.22	0.15
Optimistic future scenarios	0.11	0.10	0.04	0.02	0.03	0.05
Industry/capitalism: cause of CC	0.12	0.13	0.01	0.06	0.06	0.11
Industry/capitalism: opportunity	0.10	0.04	0.04	0.03	0.07	0.07
Highlighting social injustice	0.15	0.05	0.11	0.11	0.05	0.17
Anti-administration/government	0.18	0.09	0.39	0.85	0.25	0.39
Criticising media reporting	0.03	0.07	0.06	0.04	0.05	0.06
<b>User Types</b>						
Deleted accounts	0.08	0.02	0.14	0.04	0.12	0.13
Citizens/Individual users	0.12	0.07	0.14	0.10	0.09	0.15
Scientists	0.08	0.12	0.03	0.06	0.07	0.04
Political actors	0.28	0.16	0.05	0.14	0.23	0.20
Activists/Organisations	0.08	0.11	0.04	0.10	0.08	0.08
Cultural actors	0.06	0.14	0.15	0.19	0.11	0.07
Media outlets	0.10	0.15	0.16	0.13	0.11	0.11
Journalists	0.15	0.18	0.29	0.22	0.18	0.19
<b>Event Types</b>						
Governmental Action	1.00	0.41	0.98	0.98	0.00	0.00
Scientific Reports	0.00	0.59	0.02	0.02	0.00	0.00
Campaign/Election	0.01	0.07	0.12	0.23	0.73	1.00
Protest	0.76	0.01	0.25	0.09	0.21	1.00
Cultural Events	0.45	0.00	0.21	0.03	0.74	0.53
Climate Conference	0.17	0.01	0.28	0.03	0.00	0.24
Extreme Weather	0.65	0.07	0.18	0.37	1.00	0.05

**Table 2.2.** More detailed cluster interpretation, containing n, mean per cluster, mean per overall sample, and t-value

	<b>Cluster 1 (n = 474; 19%) <i>universal calls for change</i></b>		
	M cluster	M total	t
<b>Domains</b>			
Nature	0.43	0.31	0.259205
Science	0.07	0.17	-0.27622
Trans-/International Politics	0.26	0.15	0.325575
National Politics	0.39	0.61	-0.43596
Civil Society and Activism	0.08	0.06	0.101689
Media	0.20	0.24	-0.08843
Economy	0.23	0.15	0.223677
Health	0.08	0.08	-0.01648
Culture	0.09	0.06	0.155493
<b>Discourses</b>			
Climate change belief	0.34	0.44	-0.19662
Climate change denial	0.02	0.19	-0.42789
Calls for action	0.64	0.38	0.544191
Narratives of delay	0.09	0.12	-0.09023
Negative future scenarios	0.14	0.16	-0.06968
Optimistic future scenarios	0.11	0.06	0.244071
Industry/capitalism: cause of CC	0.12	0.08	0.152828
Industry/capitalism: opportunity	0.10	0.06	0.173715
Highlighting social injustice	0.15	0.11	0.119061
Anti-administration/government	0.18	0.40	-0.44116
Criticising media reporting	0.03	0.05	-0.09926
<b>User Types</b>			
Deleted accounts	0.08	0.09	-0.02229
Citizens/Individual users	0.12	0.11	0.035422
Scientists	0.08	0.07	0.068518
Political actors	0.28	0.18	0.268705
Activists/Organisations	0.08	0.08	-0.01648
Cultural actors	0.06	0.12	-0.18043
Media outlets	0.10	0.12	-0.07413
Journalists	0.15	0.20	-0.13263
<b>Event Types</b>			
Governmental Action	1.00	0.60	0.815925
Scientific Reports	0.00	0.08	-0.29489
Campaign/Election	0.01	0.36	-0.73185
Protest	0.76	0.40	0.73423
Cultural Events	0.45	0.32	0.267927
Climate Conference	0.17	0.12	0.162875
Extreme Weather	0.65	0.40	0.500807

**Table 2.3.** More detailed cluster interpretation, containing n, mean per cluster, mean per overall sample, and t-value.

	<b>Cluster 2 (n = 310; 12%) <i>scientific calls for change</i></b>		
	M cluster	M total	t
<b>Domains</b>			
Nature	0.32	0.31	0.023446
Science	0.54	0.17	0.951066
Trans-/International Politics	0.16	0.15	0.028166
National Politics	0.21	0.61	-0.80779
Civil Society and Activism	0.00	0.06	-0.23529
Media	0.30	0.24	0.152888
Economy	0.18	0.15	0.076594
Health	0.09	0.08	0.03636
Culture	0.02	0.06	-0.17574
<b>Discourses</b>			
Climate change belief	0.41	0.44	-0.05333
Climate change denial	0.01	0.19	-0.44884
Calls for action	0.50	0.38	0.241947
Narratives of delay	0.06	0.12	-0.19067
Negative future scenarios	0.40	0.16	0.642091
Optimistic future scenarios	0.10	0.06	0.170249
Industry/capitalism: cause of CC	0.13	0.08	0.157677
Industry/capitalism: opportunity	0.04	0.06	-0.09216
Highlighting social injustice	0.05	0.11	-0.18623
Anti-administration/government	0.09	0.40	-0.6339
Criticising media reporting	0.07	0.05	0.117726
<b>User Types</b>			
Deleted accounts	0.02	0.09	-0.22719
Citizens/Individual users	0.07	0.11	-0.13339
Scientists	0.12	0.07	0.208125
Political actors	0.16	0.18	-0.04349
Activists/Organisations	0.11	0.08	0.107513
Cultural actors	0.14	0.12	0.039756
Media outlets	0.15	0.12	0.083125
Journalists	0.18	0.20	-0.05279
<b>Event Types</b>			
Governmental Action	0.41	0.60	-0.38895
Scientific Reports	0.59	0.08	1.880236
Campaign/Election	0.07	0.36	-0.60831
Protest	0.01	0.40	-0.80276
Cultural Events	0.00	0.32	-0.67915
Climate Conference	0.01	0.12	-0.33952
Extreme Weather	0.07	0.40	-0.67178

**Table 2.4.** More detailed cluster interpretation, containing n, mean per cluster, mean per overall sample, and t-value.

	<b>Cluster 3 (n = 341; 14%) narratives of denialism</b>		
	M cluster	M total	t
<b>Domains</b>			
Nature	0.10	0.31	-0.44566
Science	0.08	0.17	-0.25104
Trans-/International Politics	0.16	0.15	0.037247
National Politics	0.72	0.61	0.239339
Civil Society and Activism	0.13	0.06	0.325991
Media	0.17	0.24	-0.15276
Economy	0.09	0.15	-0.18201
Health	0.10	0.08	0.070858
Culture	0.04	0.06	-0.05543
<b>Discourses</b>			
Climate change belief	0.00	0.44	-0.88511
Climate change denial	0.87	0.19	1.737251
Calls for action	0.01	0.38	-0.76956
Narratives of delay	0.35	0.12	0.695186
Negative future scenarios	0.04	0.16	-0.3457
Optimistic future scenarios	0.04	0.06	-0.06959
Industry/capitalism: cause of CC	0.01	0.08	-0.25703
Industry/capitalism: opportunity	0.04	0.06	-0.05543
Highlighting social injustice	0.11	0.11	-0.00821
Anti-administration/government	0.39	0.40	-0.00898
Criticising media reporting	0.06	0.05	0.059221
<b>User Types</b>			
Deleted accounts	0.14	0.09	0.193296
Citizens/Individual users	0.14	0.11	0.077565
Scientists	0.03	0.07	-0.16303
Political actors	0.05	0.18	-0.34106
Activists/Organisations	0.04	0.08	-0.15554
Cultural actors	0.15	0.12	0.073745
Media outlets	0.16	0.12	0.113664
Journalists	0.29	0.20	0.237572
<b>Event Types</b>			
Governmental Action	0.98	0.60	0.774027
Scientific Reports	0.02	0.08	-0.21925
Campaign/Election	0.12	0.36	-0.49285
Protest	0.25	0.40	-0.31315
Cultural Events	0.21	0.32	-0.22728
Climate Conference	0.28	0.12	0.487705
Extreme Weather	0.18	0.40	-0.43959

**Table 2.5.** More detailed cluster interpretation, containing n, mean per cluster, mean per overall sample, and t-value.

<b>Cluster 4 (n = 576; 23%)</b> <i>believers criticizing administration</i>			
	M cluster	M total	t
<b>Domains</b>			
Nature	0.24	0.31	-0.14547
Science	0.20	0.17	0.070916
Trans-/International Politics	0.09	0.15	-0.16266
National Politics	0.95	0.61	0.70776
Civil Society and Activism	0.04	0.06	-0.09363
Media	0.21	0.24	-0.06579
Economy	0.10	0.15	-0.1382
Health	0.08	0.08	0.004283
Culture	0.03	0.06	-0.10294
<b>Discourses</b>			
Climate change belief	0.86	0.44	0.839078
Climate change denial	0.00	0.19	-0.48183
Calls for action	0.28	0.38	-0.20214
Narratives of delay	0.01	0.12	-0.33724
Negative future scenarios	0.10	0.16	-0.16364
Optimistic future scenarios	0.02	0.06	-0.16411
Industry/capitalism: cause of CC	0.06	0.08	-0.07877
Industry/capitalism: opportunity	0.03	0.06	-0.13293
Highlighting social injustice	0.11	0.11	-0.00377
Anti-administration/government	0.85	0.40	0.915574
Criticising media reporting	0.04	0.05	-0.03319
<b>User Types</b>			
Deleted accounts	0.04	0.09	-0.1531
Citizens/Individual users	0.10	0.11	-0.03412
Scientists	0.06	0.07	-0.01887
Political actors	0.14	0.18	-0.11
Activists/Organisations	0.10	0.08	0.055342
Cultural actors	0.19	0.12	0.219586
Media outlets	0.13	0.12	0.011491
Journalists	0.22	0.20	0.04646
<b>Event Types</b>			
Governmental Action	0.98	0.60	0.773403
Scientific Reports	0.02	0.08	-0.23092
Campaign/Election	0.23	0.36	-0.26479
Protest	0.09	0.40	-0.62458
Cultural Events	0.03	0.32	-0.63025
Climate Conference	0.03	0.12	-0.26247
Extreme Weather	0.37	0.40	-0.06906



**Table 2.6.** More detailed cluster interpretation, containing n, mean per cluster, mean per overall sample, and t-value.

<b>Cluster 5 (n = 375; 15%)</b> <i>contested weather debates</i>			
	M cluster	M total	t
<b>Domains</b>			
Nature	0.59	0.31	0.619389
Science	0.10	0.17	-0.19267
Trans-/International Politics	0.04	0.15	-0.29669
National Politics	0.51	0.61	-0.20087
Civil Society and Activism	0.02	0.06	-0.14674
Media	0.12	0.24	-0.27722
Economy	0.10	0.15	-0.12895
Health	0.09	0.08	0.047428
Culture	0.08	0.06	0.111613
<b>Discourses</b>			
Climate change belief	0.48	0.44	0.087208
Climate change denial	0.22	0.19	0.077182
Calls for action	0.34	0.38	-0.07284
Narratives of delay	0.08	0.12	-0.12319
Negative future scenarios	0.22	0.16	0.151094
Optimistic future scenarios	0.03	0.06	-0.10857
Industry/capitalism: cause of CC	0.06	0.08	-0.09609
Industry/capitalism: opportunity	0.07	0.06	0.065546
Highlighting social injustice	0.05	0.11	-0.19935
Anti-administration/government	0.25	0.40	-0.30516
Criticising media reporting	0.05	0.05	-0.01617
<b>User Types</b>			
Deleted accounts	0.12	0.09	0.119424
Citizens/Individual users	0.09	0.11	-0.08806
Scientists	0.07	0.07	0.019057
Political actors	0.23	0.18	0.124729
Activists/Organisations	0.08	0.08	0.008215
Cultural actors	0.11	0.12	-0.03187
Media outlets	0.11	0.12	-0.04466
Journalists	0.18	0.20	-0.04966
<b>Event Types</b>			
Governmental Action	0.00	0.60	-1.22511
Scientific Reports	0.00	0.08	-0.29489
Campaign/Election	0.73	0.36	0.778277
Protest	0.21	0.40	-0.39683
Cultural Events	0.74	0.32	0.89696
Climate Conference	0.00	0.12	-0.36928
Extreme Weather	1.00	0.40	1.224092

**Table 2.7.** More detailed cluster interpretation, containing n, mean per cluster, mean per overall sample, and t-value.

<b>Cluster 6 (n = 423; 17%)</b> <i>contested political and social debates</i>			
	M cluster	M total	t
<b>Domains</b>			
Nature	0.17	0.31	-0.29939
Science	0.13	0.17	-0.11086
Trans-/International Politics	0.17	0.15	0.069019
National Politics	0.66	0.61	0.101895
Civil Society and Activism	0.07	0.06	0.053279
Media	0.43	0.24	0.445539
Economy	0.20	0.15	0.142456
Health	0.05	0.08	-0.11318
Culture	0.07	0.06	0.040471
<b>Discourses</b>			
Climate change belief	0.32	0.44	-0.24695
Climate change denial	0.19	0.19	-0.00438
Calls for action	0.46	0.38	0.173091
Narratives of delay	0.20	0.12	0.248852
Negative future scenarios	0.15	0.16	-0.02491
Optimistic future scenarios	0.05	0.06	-0.02244
Industry/capitalism: cause of CC	0.11	0.08	0.112849
Industry/capitalism: opportunity	0.07	0.06	0.040471
Highlighting social injustice	0.17	0.11	0.191537
Anti-administration/government	0.39	0.40	-0.01006
Criticising media reporting	0.06	0.05	0.036737
<b>User Types</b>			
Deleted accounts	0.13	0.09	0.138265
Citizens/Individual users	0.15	0.11	0.120064
Scientists	0.04	0.07	-0.08907
Political actors	0.20	0.18	0.044921
Activists/Organisations	0.08	0.08	-0.01758
Cultural actors	0.07	0.12	-0.15716
Media outlets	0.11	0.12	-0.04553
Journalists	0.19	0.20	-0.02345
<b>Event Types</b>			
Governmental Action	0.00	0.60	-1.22029
Scientific Reports	0.00	0.08	-0.29489
Campaign/Election	1.00	0.36	1.333808
Protest	1.00	0.40	1.220287
Cultural Events	0.53	0.32	0.443743
Climate Conference	0.24	0.12	0.357935
Extreme Weather	0.05	0.40	-0.70565

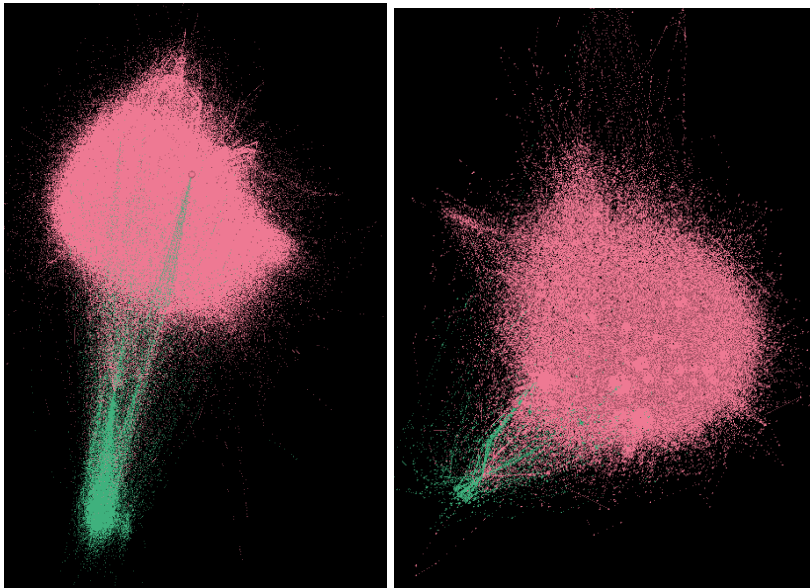
### 3. Results: Network Analysis

#### 3.1. Retweet Networks

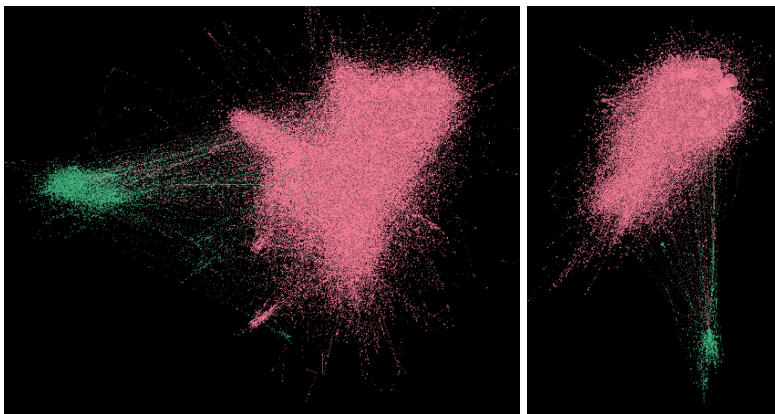
##### 3.1.1. Polarized Retweet Networks

Exemplary visualizations of two networks per Year, showing an overall pattern. Calculation of this dichotomous differentiation (mainstream vs. counterpublic) was forced via adjusting the parameters of the modularity class algorithm individually per day.

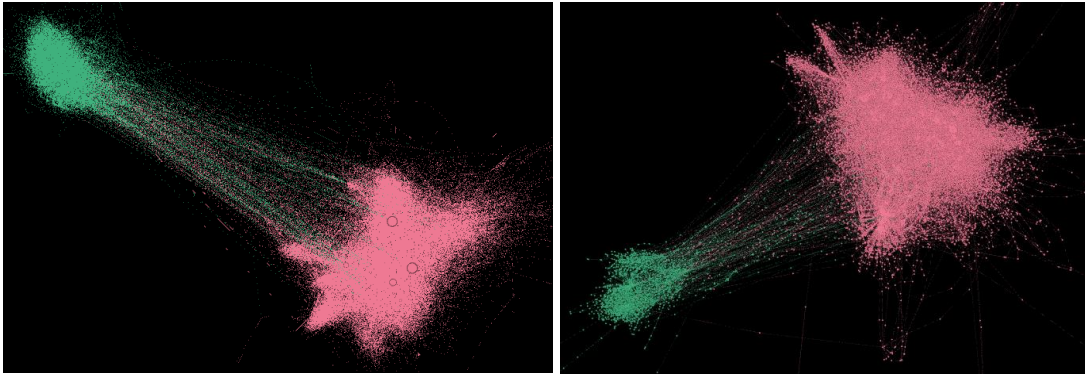
**2017** (2017-06-01-02 & 2017-09-09-10)



**2018** (2018-12-03-04 & 2018-11-18)



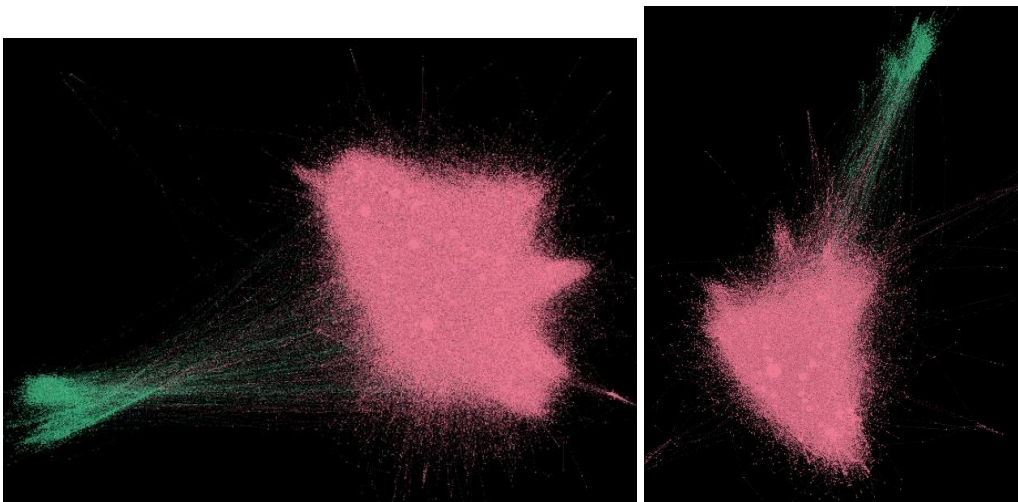
**2019** (2019-09-05 & 2019-07-31)



**2020** (2020-09-15 & 2020-10-08)



**2021** (2021-08-09 & 2021-09-02)



### 3.1.2. Distributions of Users and Content within the Networks

**Table 3.1.** Distribution of users (as nodes) that could be assigned to one of the two main communities per retweet network per attention peak. Calculation of this dichotomous differentiation (mainstream vs. counterpublic) was forced via adjusting the parameters of the modularity class algorithm individually per day.

		Mainstream Community		Counterpublic		Total Nodes
		n. Nodes	% Nodes	n. Nodes	% Nodes	
2017	20th Jan	85278	72%	16206	14%	118987
	25th Jan	12183	85%	971	7%	14277
	1st-2nd Jun	467647	92%	26891	5%	509308
	9th-10th Sep	148483	79%	20522	11%	187242
	29th Dec	104380	58%	58079	32%	179255
2018	8th Oct	68140	51%	52121	39%	134160
	20th Oct	45285	57%	23839	30%	79017
	18th Nov	63171	85%	5649	8%	74031
	24th Nov	100035	80%	12877	10%	125137
	3rd-4th Dec	92912	78%	15694	13%	119164
2019	25th Feb	146944	87%	13981	8%	168649
	31st July	153140	87%	11820	7%	175117
	22nd Aug	109167	55%	67876	34%	197946
	5th Sep	73448	67%	24857	23%	110232
	23rd-24th Sep	308916	68%	90666	20%	451301
2020	6th-7th Jan	187111	78%	34491	14%	241029
	10th Sep	104168	61%	51552	30%	171498
	15th Sep	129886	67%	38318	20%	195200
	30th Sep	156806	79%	27717	14%	197837
	8th Oct	120481	78%	20571	13%	154206
2021	17th-18th Feb	232059	84%	22637	8%	276063
	22nd April	99217	70%	26605	19%	141516
	9th Aug	187387	86%	16796	8%	217841
	2nd Sep	133475	85%	12285	8%	156697
	1st-2nd Nov	260111	74%	72502	21%	352980

**Table 3.2.** Distribution of automatically generated communities among users that retweeted “Narratives of Delay” discourse tweets during Peak Event 17, no interactional filter (e.g. K-Core) applied.

<b>Autom. Generated Community Class Name</b>	<b>Percentage</b>
Mainstream	22.22
Counterpublic	77.78

**Table 3.3.** Distribution of automatically generated communities among users that retweeted “Narratives of Denialism” cluster tweets during Peak Event 19, no interactional filter (e.g. K-Core) applied.

<b>Autom. Generated Community Class Name</b>	<b>Percentage</b>
Mainstream	29.79
Counterpublic	70.21

**Table 3.4.** Distribution of automatically generated communities among users that retweeted “Narratives of Denialism” cluster tweets during Peak Event 21, no interactional filter (e.g. K-Core) applied.

<b>Autom. Generated Community Class Name</b>	<b>Percentage</b>
Mainstream	17.06
Counterpublic	82.94

**Table 3.5.** Distribution of automatically generated communities among users that retweeted “Narratives of Denialism” cluster tweets during Peak Event 22, no interactional filter (e.g. K-Core) applied.

<b>Autom. Generated Community Class Name</b>	<b>Percentage</b>
Mainstream	26.15
Counterpublic	73.85

**Table 3.6.** Distribution of automatically generated communities among users that retweeted “Denial” discourse tweets during Peak Event 22, no interactional filter (e.g. K-Core) applied.

<b>Autom. Generated Community Class Name</b>	<b>Percentage</b>
Mainstream	99.47
Counterpublic	0.053

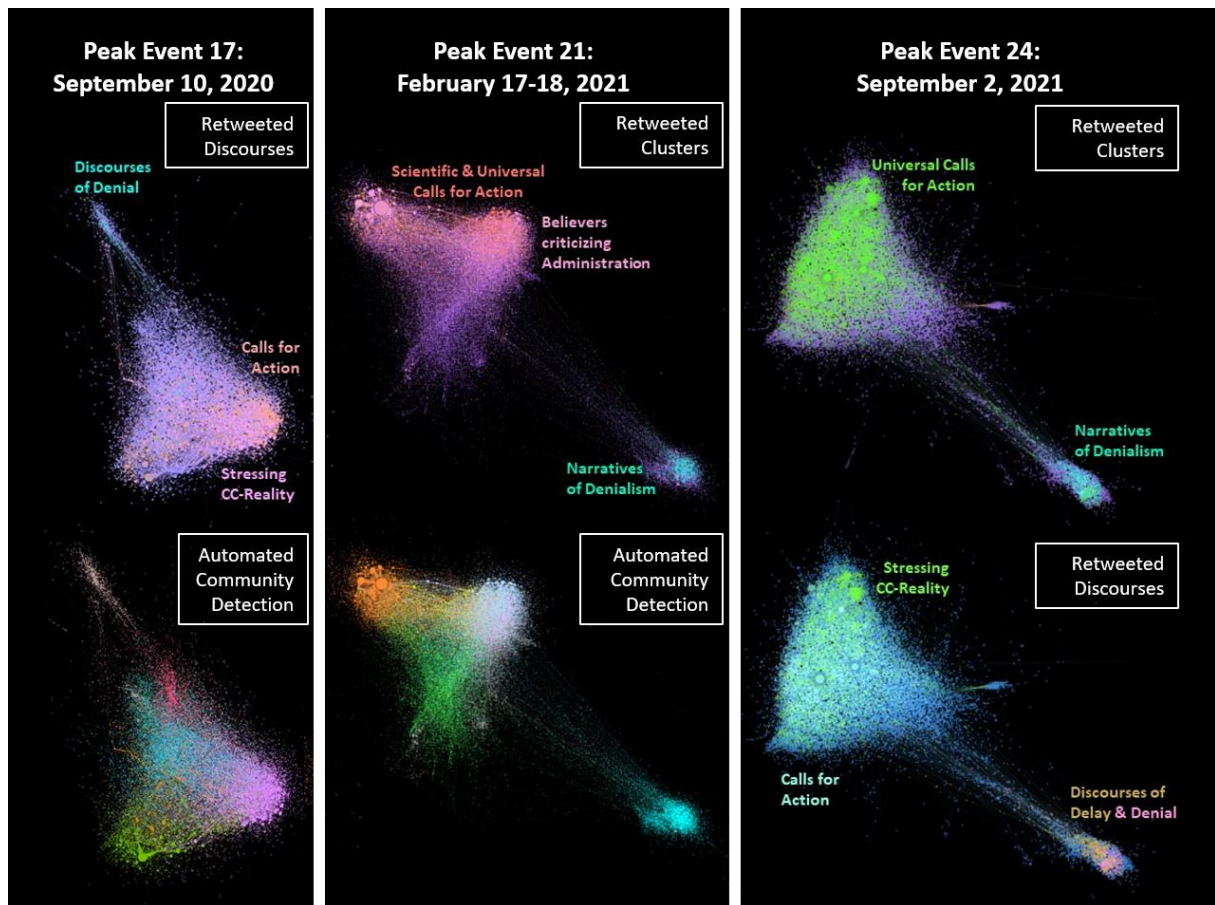
**Table 3.7.** Distribution of automatically generated communities among users that retweeted “Narratives of Delay” discourse tweets during Peak Event 22, no interactional filter (e.g. K-Core) applied.

<b>Autom. Generated Community Class Name</b>	<b>Percentage</b>
Mainstream	57.39
Counterpublic	42.61

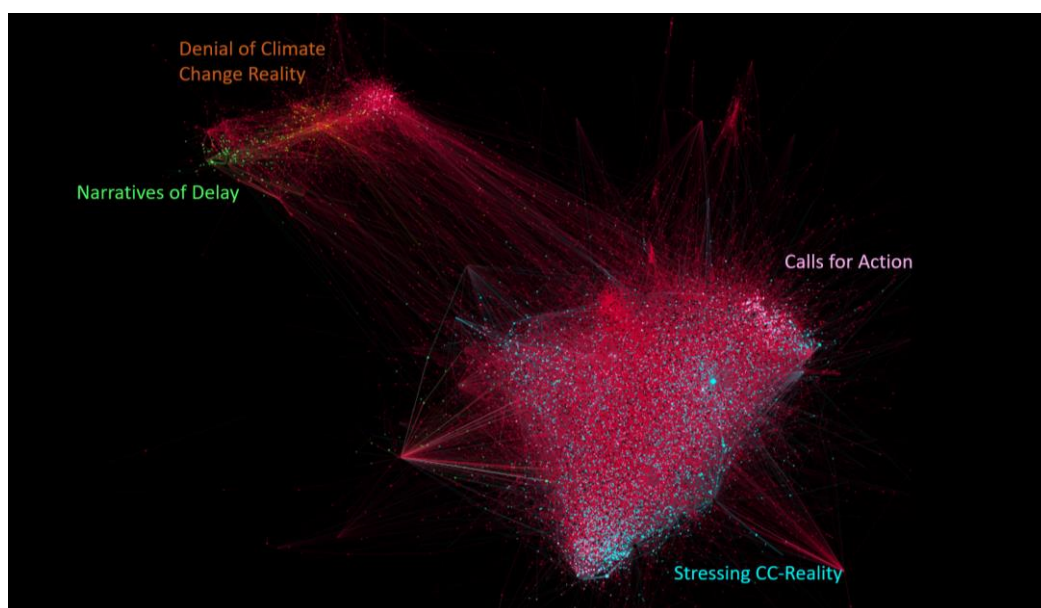
**Table 3.8.** Distribution of automatically generated communities among users that retweeted “Denial” discourse tweets during Peak Event 24, no interactional filter (e.g. K-Core) applied.

<b>Autom. Generated Community Class Name</b>	<b>Percentage</b>
Mainstream	11.25
Counterpublic	88.75

### 3.1.3. Additional Visualization of Content Amplification in Networks



**Figure 3a.** Automated community detection with most detailed resolution.



**Figure 3b.** Visualization of content amplification during the debate of April 22, 2021.



## 3.2. @Mention/Reply Analysis

### 3.2.1. General Overview

**Table 3.2.** Number of conversational interactions of the Mainstream communities and their respective counterpublics. Calculation of this dichotomous differentiation (mainstream vs. counterpublic) was forced via adjusting the parameters of the modularity class algorithm individually per day. Accordingly, our approach could only account for the users that retweeted and formulated a genuine tweet during the very same attention peak.

Sender Community	Recipient Community	Number of Mentions	% Frequency per Community	% Frequency of All Tweets
Mainstream	Mainstream	238534	92%	72%
	Outgroup	20702	8%	6%
Total		259236		78%
Outgroup	Mainstream	37385	52%	11%
	Outgroup	35007	48%	11%
Total		72392		22%

### 3.2.2. Related to Event Types



**Figure 3c.** Comparison of ingroup and outgroup mentions/replies by focusing event type.

## 4. General Information on Data and Coding

### 4.1. Data Retrieval and Search String

For retrieving data from Twitter's API, we used the R package *academictwitteR* by Barrie and Ho (2021). The search string was “#climatechange” OR “climate change” OR “#globalwarming” OR “global warming” OR “#climatecrisis” OR “climate crisis”. Data was collected between 9<sup>th</sup> and 10<sup>th</sup> of February, 2022.

The search string for data retrieval from the OMM was #climatechange OR “climate change” OR “global warming”, and since July 22, 2021 the search string was updated to include also “climate crisis”. OMM saves tweets of the previous day at 3:00 am (UTC) and provides all counted retweets up until this point. Therefore, data is collected on a daily basis. Due to formatting errors, a small fraction of the OMM's tweets may be truncated at 140 characters (if deleted before re-collection with modified package).

The search strings consider word boundaries, meaning that terms such as “climate” and “crisis” need to co-occur subsequently, next to each other, and as individual terms.

Sources:

*OMM*:

[https://icdc.cen.uni-hamburg.de/omm/omm\\_twitter365.html](https://icdc.cen.uni-hamburg.de/omm/omm_twitter365.html)

<https://www.cen.uni-hamburg.de/en/icdc/data/society/omm-twitter.html>

*academictwitteR*:

<https://github.com/cjbarrie/academictwitteR>

## 4.2. Coding of Domains, Discourses, and Days of Retrieval

### 4.2.1. Reliability Tests

**Table 4.1.** Inter-Coder Reliability Test: Random Sample (n=250) of 5.000 tweets from 25 peak events, 2 coders.

	n_Units	Agreement	Holstis_CR	Krippendorffs_ Alpha
<b>Domains</b>				
Nature	250	0.97	0.97	0.93
Science	250	0.97	0.97	0.9
Trans-/International Politics	250	0.95	0.96	0.83
National Politics	250	0.98	0.98	0.97
Civil Society/Activism	250	0.99	1.00	0.97
Media	250	0.96	0.96	0.82
Economy/Industry	250	0.96	0.97	0.87
Health	250	0.98	0.98	0.91
(Popular) Culture	250	0.99	0.99	0.92
<b>Discourses</b>				
Climate Change is real	250	1.00	1.00	1.00
Climate Change denial	250	0.92	0.92	0.84
Climate Change mixed	250	0.99	0.99	0.94
Calls for action	250	0.97	0.98	0.95
Narratives of delay	250	0.98	0.98	0.70
Action mixed/criticism	250	0.98	0.98	0.79
Negative future scenario	250	0.99	0.99	0.98
Positive future scenario	250	0.99	0.99	0.91
Future mixed/unclear	250	0.99	1.00	0.97
Anti industry/capitalism	250	0.99	0.99	0.93
Pro industry/capitalism	250	0.99	0.99	0.90
Industry/capitalism mixed/unclear	250	0.99	1.00	0.89
Social injustice: highlight	250	0.96	0.97	0.88
Social injustice: denial	250	1.00	1.00	1.00
Social injustice mixed/unclear	250	1.00	1.00	1.00
Anti government/authority	250	0.96	0.96	0.91
Pro government/authority	250	1.00	1.00	1.00
Government/authority mixed/unclear	250	0.99	0.99	0.88
Criticism of media	250	1.00	1.00	1.00
Support of media	250	0.98	0.98	0.59
Media mixed/unclear	250	1.00	1.00	1.00

**Note:** (sub-)categories “Religion” and the respective discourses “Negative/positive/unclear towards religion” as well as “mixed/unclear towards media reporting” were not further considered due to no/very low occurrence in the data.

**Table 4.2.** Intra-Coder Reliability Test: Sample of the first 131 coded users, repeated after coding the total sample of authors of top 2.500 tweets, 1 coder.

<b>User Type</b>	<b>n_Units</b>	<b>Agreement</b>	<b>Holstis_CR</b>
Citizen/Individual/Personal Accounts	131	1.00	1.00
Educators/scientists/researchers	131	0.99	0.99
International political organisations	131	1.00	1.00
Political actors	131	1.00	1.00
Activists or Activist Organisations	131	0.98	0.98
Media Outlets/Organisations	131	1.00	1.00
Media: individuals - Journalists	131	1.00	1.00
Economy: Corporations or Business People	131	1.00	1.00
Cultural Actors	131	1.00	1.00
Religious Actors	131	1.00	1.00
Deleted Accounts	131	0.98	0.98
Other	131	1.00	1.00

## 4.2.2. Peak Events: Coding and Description

Date	Main event(s)	Coding Category	No. of Peak Event
<b>2017</b>			
20/01	- White House removes climate / LGBT+/ human rights page [Trump inaugurated].	Governmental Decision	1
25/01	- White House orders EPA and NASA not to talk about CC - Badlans national park defies trump & tweets CC is real then forced to delete - Other national parks also rise up	Governmental Decision	2
1-2/06	- Trump's announcement of USA's withdrawal of the Paris Climate Accord	Governmental Decision	3
9-10/09	- Hurricane hits Florida (floods) - Scott Pruitt Says it's not time to talk about climate change & banned the words CC and global warming	Extreme Weather Event Governmental Decision	4
29/12	- Extreme cold weather - Trump tweets about needing some global warming (climate vs weather)	Extreme Weather Event Governmental Decision	5
<b>2018</b>			
08/10	- release of the IPCC special report "on the impacts of global warming of 1.5°C above pre-industrial levels" (07.10.18)	Scientific Report	6
20/10	- Upcoming US midterm election - Australia government suffers Wentworth by-election defeat - Norway bans deforestation - AOC says CC as bad as Hitler @ Climate Change	/Campaign/Election Protest	7

Town Hall

- Supreme Court halts youth climate change case
- Climate Crisis Rally in Preston (UK)

18/11	<ul style="list-style-type: none"> <li>- California wildfires</li> <li>- Trump says forests need “raking” &amp; fires don’t alter his opinion on CC</li> <li>- Michael Caputo says wildfires aren’t new on CNN</li> <li>- XR blocked bridges day before in London</li> </ul>	<p>Extreme Weather Event</p> <p>Governmental Decisions</p> <p>Protest</p>	8
24/11	<ul style="list-style-type: none"> <li>- White House releases report that hurricanes are worsening due to climate change day after thank giving to bury report (Black Friday)</li> <li>- Al Gore calls out trump for trying to bury the report</li> </ul>	Governmental Decisions	9
03-4/12	<ul style="list-style-type: none"> <li>- David Attenborough speech at UN conference in Katowice (Poland)</li> <li>- Greta Thunberg speech in Katowice</li> <li>- Arnold Schwarzenegger speech in Poland</li> <li>- France announces they will temporarily rescue the fuel tax- as Macron gives in to the yellow vest protests in Paris</li> <li>- CNN Climate Town Hall (Bernie sanders speech)</li> </ul>	<p>Climate Conference</p> <p>Protest</p> <p>Campaign/ Election</p>	10

**2019**

02/25	<ul style="list-style-type: none"> <li>- Oscars</li> <li>- Sunrise Movement Protests</li> <li>- Scott Morrison makes climate change pledge</li> <li>- AOC gives speech about reducing population growth</li> </ul>	<p>Cultural Event</p> <p>Protest</p> <p>Campaign/ Election</p>	11
31/07	<ul style="list-style-type: none"> <li>- Google Camp in Italy: controversial debate about celebrities traveling there</li> <li>- Ethiopia planting millions of trees in 24 hours</li> <li>- Greta Thunberg speaks to French Parliament</li> <li>- Extreme rain in UK (Yorkshire)</li> <li>- Siberian wildfires</li> <li>- EU Leaders meet in Spain to discuss CC</li> <li>- Extreme heat in Greenland - melting the ice sheet</li> </ul>	<p>Cultural Event</p> <p>Protest</p> <p>Governmental Action</p> <p>Extreme Weather Events</p>	12
22/08	<ul style="list-style-type: none"> <li>- Amazon fires</li> <li>- Jay Inslee (Green New Deal campaigner) exits the primary</li> <li>- Bernie Sanders release Green New Deal plan information</li> </ul>	<p>Extreme Weather Event</p> <p>Campaign/Election</p>	13

05/09	- CNN host democratic Climate Town Hall (debate) - Climate Activists gathered outside Climate Town Hall	Campaign/Election Protest	14
23-24/09	- The UN Climate Action Summit at the UN headquarters, New York City: at least 486 tweets in our sample included Thunberg's quote "how dare you", Trump left after 10 mins - Greta Thunberg & other activists filed a complaint with UN - reports on the global climate protests → a frequent tweet tagging US politicians: Stop denying climate change and declare a climate emergency #AnswerWithAction - Shut Down protests in Washington, DC	Climate Conference Protest Governmental Actions	15
<b>2020</b>			
06-7/01	- Golden Globes (Joaquin Phoenix/Russel Crowe speeches on CC) - Australian wildfires - Arsonists arrested	Cultural Event Extreme Weather Event	16
10/09	- Californian/Oregon wildfires (orange skies) - Deniers blaming fires on arsonists and poor forest managements - Barack Obama tweeted: "The fires across the West Coast are just the latest examples of the very real ways our changing climate is changing our communities. Protecting our planet is on the ballot. Vote like your life depends on it—because it does." & lots of subsequent tweets referring to his tweet in regard to upcoming elections (split agreement)	Extreme Weather Event Campaign/Election	17
15/09	- U.S. West Coast's fires - death toll rises to 35: - Arsonists arrests - Biden calls Trump a climate arsonist	Extreme Weather Event Campaign/Election	18
30/09	- Trump vs Biden debate - Chris Wallace re-focuses debate from Hunter Biden to CC (Trump supporters opposing)	Campaign/Election Governmental Decision	19
08/10	- VP Debate - Pence denies knowing cause of CC	Campaign/Election Governmental Decision	20



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2021

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17-18/02	<ul style="list-style-type: none"> <li>- Texas cold snap</li> <li>- Ted Cruz in Cancun</li> <li>- Tucker Carlson denies climate change on air</li> <li>- USA re-joins Paris Agreement &amp; makes strong emissions reduction pledge</li> </ul>	<p>Governmental Decision</p> <p>Extreme Weather Event</p>	21
22/04	<ul style="list-style-type: none"> <li>- Earth Day 2021</li> <li>- Greta Thunberg speech</li> <li>- Biden hosted the first 'Leaders Summit on Climate'</li> </ul>	<p>Cultural Event</p> <p>Protest</p> <p>Governmental Decision</p>	22
9-10/08	<ul style="list-style-type: none"> <li>- Parts of the IPCC 6th assessment report has been released, titled Climate Change 2021: The Physical Science Basis</li> </ul>	<p>Scientific Report</p>	23
02/09	<ul style="list-style-type: none"> <li>- Hurricane in New Orleans, major flooding in NYC – many died in basements</li> <li>- Joe Manchin calls to stop climate change spending</li> <li>- Lots of references to infrastructure not being ready for climate change</li> <li>- XR protests in UK</li> </ul>	<p>Extreme Weather Event</p> <p>Governmental Decision</p> <p>Protests</p>	24
1-2/11	<ul style="list-style-type: none"> <li>- COP26</li> <li>- Blackpink (Korean band) calls on fans to act on climate</li> <li>- Prince Charles speech</li> <li>- Biden unveils Build Back Better Framework</li> </ul>	<p>Climate Conference</p> <p>Cultural Event</p> <p>Governmental Decision</p>	25

### 4.2.3. Coding Frame

#### Content category I: Domains

<b>Code</b>	<b>Category</b>	<b>Definition</b>	<b>Examples</b>
1	<b>Nature</b>	The tweet included a reference to a report or first-hand experience of a natural phenomenon or event (scientifically/likely to be) affected by climate change	Extreme weather, storms, floods, bush fires, etc.
2	<b>Science</b>	The tweet included a reference to a release of a scientific report , a scientific conference, or event; or a scientific actor communicating data/findings via text or speech	Release of IPCC report, other scientific publications, (national) scientific conference, news about a scientist
3	<b>Transnational/International (political focus)</b>	The tweet included a reference to an international or transnational event or international-related policies	COP event, Paris Agreement and related development
4	<b>Politics (National)</b>	The tweet included a reference to (reports on) recent political decisions, policies, events, or political actors' conduct or statements	National elections, policy decisions, Trump, Joe Biden, Al Gore, etc.
5	<b>Civil Society/Activism</b>	The tweet included a reference to an activist or civil society action, event, or conduct or statement by civil society actors or organizations	FFF, XR, Greta Thunberg, activist legal actions
7	<b>Media</b>	The tweet included a reference to an event or conduct by a news media organization or actor, or reference to news media actors	specific outlets (e.g. The Guardian), "the media" in general
8	<b>Economy/Business</b>	The tweet included a reference to a company's or business actor's conduct or statement (being reported on), or an outcome of the economy at large	Conduct of a certain company (e.g. Sony), evaluations or reports on the effects of climate change on the economy

9	<b>Health</b>	The tweet included a reference to reports on health issues related to climate change, or evaluations of mental health issues (either scientifically proven or not), also includes mental health	pollution, contamination, OR “Eco anxiety” issues, COVID-19
12	<b>(Popular) Culture</b>	The tweet included a reference to cultural actors’ conduct or statement (e.g. celebrities), or recent cultural events, films, exhibitions, popular culture artifacts or events	Oscars, movie release, Hollywood stars, a cultural or art artefact (potentially related to climate change )
13	<b>Religion</b>	The tweet included a reference to religious actors or organizations’ conduct or statement	Mentioning a church, the Pope

## Content category II: Discourses

#	Category	Sub-category	Definitions & Examples
20	<b>Climate change reality</b>		
21		<b>CC = Denial</b> / Anti-“Believers” / “Pro-Deniers”	The user is denying the existence of climate change, or referencing to it as a hoax  Criticizing climate advocates, scientists (& activists)  Supporting climate antagonists (& hoaxers)  Denial of scientific facts
22		<b>CC = Real</b> / is happening / Anti-hoax / Pro-“Believer” / ‘settled science’ frame	The user is discussing or stressing that climate change should be/is prioritized in discussions, is real/important and human-caused

		The user refers to the denialists' discourse about climate change (being a hoax), adding critique, sarcasm or his/her opinion on it
		Supporting climate advocates (& activists)
		Criticizing climate action antagonists (& hoaxers)
23	<b>CC = Unclear/Ambivalent</b>	Unclear statements on human causation of climate change, or an unclear or ambivalent opinion, or sarcastic text regarding the reality of climate change
30	<b>Climate change solvability and actions</b>	
31	<b>Call for action</b> (& implicit solvability) & self- efficacy	Explicit, active invitation to act, or the need to act on CC, "we must act now", "let's do this", "we can't wait any longer" kind of texts, (implicitly) stressing the individual/human responsibility to solve/mitigate or to raise awareness and protest  also: passive action e.g. "keep it in the ground"  pledging for/mentioning far-reaching changes (As president, I will act/change)  self- efficacy: "it's real, it's bad, but, it's us & there's hope"
32	<b>Narrative of Delay</b> (& implicitly unsolvable OR solutions just as bad or even worse)	"WhatAboutism", or: Arguing that individuals/organizations/nations/humanity cannot do anything about climate change – or blaming others, or: Apathy/Nihilism
33	<b>Talking about actions = unclear/ ambivalent</b>	Mentioning possible actions of CC mitigation but taking no clear stance or criticizing and appreciating them simultaneously

<b>40</b>	<b>Future scenario / effects</b>		
<b>41</b>	<b>Negative Future Scenarios</b>		Imaginative or established general/global negative effects, specific negative effects, humans as destroyers, OR local negative effects of climate change in the future – nationally or smaller ALSO = “threat” and “unfolding climate crisis”
<b>42</b>	<b>Optimist Future Scenarios</b>		Sustainable futures, green energy solutions, positive human behaviour, “technology will save us”
<b>43</b>	<b>Mixed/unclear Future</b>		A combination of positive and negative future scenarios, or an unclear view of the future  general reference to following generations, e.g. “the kids”
<b>50</b>	<b>Religious</b>		
<b>51</b>	<b>Anti-Religious</b>		Religious actors or faiths are criticized or defamed
<b>52</b>	<b>Pro-Religious</b>		Religion is mentioned appreciatively and may even be presented as a potential solution to climate change problems (or used as a tool of denial).
<b>53</b>	<b>Mixed/unclear</b>		References to the debates presented above without taking a clear position or criticizing and supporting at the same time
<b>60</b>	<b>Capitalism / Industry / Economy</b>		
<b>61</b>	<b>Anti-capitalism / - industry (&amp; “degrowth”)</b>		Explicitly naming and blaming the (fossil fuel) industry or economic structures and corruption

62	<b>pro-capitalism / - industry (&amp; “growth”)</b>	Determining economic structures, industry & technology way to mitigate or even solve CC-related problems
63	<b>Mixed/unclear</b>	Mixed/unclear stances towards the debates described above
70	<b>Justice and (in-)equality</b>	
71	<b>Highlighting social inequality &amp; demanding equality</b>	Naming social inequality, discrimination, unfair distribution of the negative effects of CC on the global south, climate refugees, or other forms of discrimination against minorities.
72	<b>Denial of social Inequality / Anti-marginalized</b>	Negation of the above (& protection of “status-quo”)
73	<b>Mixed/Unclear</b>	References to the debates presented above without taking a clear position or with sarcastic/ironic comments
80	<b>(Anti-) Government</b>	
81	<b>Anti-Authorities/ Government</b>	Criticizing (decisions of) those in charge/elected officials/part of the government during time in office
82	<b>Pro-Authorities/ Government</b>	Supporting/advocating (decisions of) those in charge/elected officials/part of the government during time in office
83	<b>Mixed/unclear</b>	References to the debates presented above without taking a clear position or criticizing and supporting at the same time

**90**      **Media  
Reporting Style**

- |           |  |   |
|-----------|--|---|
| <b>91</b> | <b>Anti-Media/<br/>Reporting style</b> | Media is criticized, either because it reports too much, too little, or in an unbalanced way about climate change                 |
| <b>92</b> | <b>Pro-Media/<br/>Reporting style</b>  | Media coverage is explicitly praised, for example because it reported in a balanced manner or set important accents in the debate |
| <b>93</b> | <b>Mixed/unclear</b>                   | References to the debates presented above without taking a clear position or criticizing and supporting at the same time          |