

# Shaping the Reaction: Community Characteristics and Emotional Tone of Citizen Responses to Robotics Videos at TED versus YouTube

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## ABSTRACT

When modelling for the social we need to consider more than one medium. Little is known as to how platform community characteristics shape the discussion and how communicators could best engage each community, taking into consideration these characteristics. We consider comments on TED videos featuring roboticists, shared at TED.com and YouTube. We find evidence of different social norms and importantly, approaches to comment writing. The emotional tone is more positive at TED; however, there is little emotional escalation in either platform. The study highlights the importance of considering the community characteristics of a medium, when communicating with the public in a case study of emerging technologies.

## CCS CONCEPTS

• Human-centered computing → Collaborative and social computing → Collaborative and social computing theory, concepts and paradigms → Social media

## KEYWORDS

Community Characteristics; Emotional Tone; Online Community Norms; Emerging technologies; Online community

## ACM Reference format:

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## 1 Introduction & Background

Personalization and adaptation for the ‘social’ can be challenging. We need to not only understand the different characteristics of the individual participant in a platform, but at

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the same time to take into consideration the characteristics of the community as a whole. More specifically, platforms like YouTube allow individual users as well as organizations to create their own channel within the platform, where followers can engage with multimedia content e.g. videos, and discuss, comment and rate, the content provided by the initiator. During this interaction and discussion, the users are forming a sense of community driven by their common interest (agreement or disagreement) on a specific topic. However, little is known of how the characteristics of these communities that are formed in different platforms differ especially when the topic of interest is controversial. Recently, social media discussions emerged as a rich source of information to engage people and learn about their feelings towards new, “hot” topics, such as emerging technologies (e.g., robotics, self-driving cars) and to understand their potential behaviors towards these technologies. In this work, we will investigate the public’s reactions to the same stimuli – six TED videos featuring roboticists – at two social platforms, the TED.com commenting forum as well as the commenting forums at the official TED YouTube channel. We aim to study the community characteristics at each platform, as well as the emotional tone expressed in public reactions to the videos. We do this following a linguistic analysis approach.

To this end, some research to date has analyzed discussion related to controversial science and technology issues in popular social media, such as blogs, YouTube and Twitter, highlighting several key challenges for understanding public reactions, as expressed in these media. For instance, Veltri in [19] aimed to shed light on how science issues are framed on Twitter, focusing on nanotechnology. Contrary to expectation, he found little evidence of conversation (i.e., interactive dialog) about this controversial topic. Through semantic latent analysis applied to a large corpus of tweets, he noted similarities between the content shared on Twitter and that in other media. In Veltri et al. [20] again studied Twitter, but in the context of communication concerning climate change, and with a much larger corpus as compared to Veltri’s previous study[19].

Addressing science-related communication in another social medium Walther et al. in [21] studied sources of influence on YouTube. They noted that the platform juxtaposes multiple

sources of information – typically, a video produced by an authoritative source such as a news organization with non-authoritative, public comments. They found that even anonymous “peers” can influence viewers’ perceptions of the video featured, as well as of the issue being presented.

What can be immediately noticed is that researchers often try to understand the characteristics (e.g., specific points covered, sentiments expressed) of the discourse surrounding a particular technology, focusing on one individual social platform. A notable exception is that described in [9], where the authors considered how Chinese scientists engage in and choose a social media for science communication. This research showed that scientists use different types of media for different purposes, but their choice is driven by technological development, social norms, as well as the sociopolitical environment. Their study employed qualitative methods for data collection and analysis focusing only on Chinese science communicators.

We argue that most previous research does not address the fact that professional communicators [5] and even individual researchers [4] typically use a whole set of social platforms to engage the public. For instance, a video could be posted at YouTube, and then shared via one’s Twitter and Facebook accounts. Therefore, a pertinent question is how the same content might be received across different social platforms and how this reception is affected by the characteristics of the community formed in this social platform. Different social platforms have their own communication norms, which are shaped in part by the technical and communication affordances of the medium (e.g., Twitter’s limit of 280 characters) as well as the audience drawn to it (e.g., Twitter’s more “newsy” tone versus Facebook’s more social atmosphere). In other words, given the lack of previous research comparing public reaction to emerging technology across multiple social media, it is difficult to understand the extent to which reactions may be strictly context-dependent or whether they may be more general (i.e., likely to be found across media). Hence, our two research questions:

RQ1: How do the audiences drawn to the videos via the two platforms differ?

RQ2: What social norms can we observe surrounding comment writing in each community, and what are the salient differences between them?

The work most related to ours is that described in [16], where the authors also compared comments shared at TED.com to those posted at the TED YouTube channel. However, they focused on comment content rather than tone; for instance, they were interested in whether the public engaged with the content of the video, or if they made observations about the speaker featured in the video. Their work was motivated by a popular criticism of TED, as providing more entertainment value rather than fostering genuine science communication. Indeed, the researchers found that commenters were more likely to discuss the characteristics of a presenter on YouTube, whereas they tended to engage with the talk content on the TED website [16].

It should be noted that their study differs from ours in terms of methodology as well; in particular, they took a sample of TED videos, featuring a broad range of topics. In contrast, as will be explained, we focus on a small set of hand-chosen videos with very similar characteristics, not only in terms of the speaker characteristics, but also in terms of popularity. To our knowledge, we provide the first cross-platform analysis of communication in social media related to emerging technologies, through a case study of robotics, which gives particular attention to the role of the online community characteristics in shaping the reaction of the public.

In contrast to previous work on science- and technology-related communication in social media, we approach the platforms we study – TED.com and YouTube – as fostering virtual communities. These communities can be described as “common interest” communities [15]; members share an interest in the emerging technology of robotics, and exchange views and information within the respective commenting forums. Our first research question (RQ1) relates to the composition of the audience that is drawn to discuss the same content – a given TED talk related to robotics – across the two platforms.

Modern social platforms (e.g. YouTube, Facebook, Twitter), take advantage of various communication affordances and creative media (e.g. annotated videos) that allow community members to engage in discussions based on each other’s comments and/or to express their opinion on the material presented [18]. Subsequently, these endeavors lead to the creation of collective knowledge sharing. Due to the various communication affordances offered by the medium, and social norms that exist in a given community, influential participants can/might affect the emotional response of the other members, resulting in an increase of activity at specific timepoints [10][9]. Having seen the dynamic nature of online communities and the importance of social norms in shaping interactions, we propose the second research question (RQ2).

## 2 Research Methodology

Given the tendency for people to become excited but in parallel fear robots, we decided to study public reactions to videos surrounding one specific emerging technology, intelligent robotics, rather than taking a broader approach such as that used in [17]. We present a case study of reactions to TED videos in which the featured speakers (i.e., science communicators) are well-known roboticists, speaking about technologies that they and their teams have created. As can be seen by the video titles in Table 1, all six videos in our corpus discuss emerging robotic technologies that are “humanlike” in some of their abilities. Given the general public’s sensitivity to this particular topic, it is expected that emotions, both positive and negative, will be frequently expressed in the comments shared.

### 2.1 Observational Approach

We conducted an observational study of the commenting forums for the six videos of interest, at both TED.com and YouTube.

These forums have very similar communication affordances; participants can post unstructured textual comments in response to a given video, as well as in response to another participant’s comment (i.e., reply), and can express their approval of a comment via a binary voting mechanism (e.g., “thumbs up/down” at YouTube, “UpVote” at TED.com). Comment metadata at both forums includes the participant’s screen name (or nickname), the date/time of the comment, as well as feedback metrics. In the current study, we focus on analyzing the top-level comments in each forum.

As detailed in Table 1, we identified a set of videos that met the following criteria: (1) the science communicator is a well-known figure from academia or industry, who is specifically identified as a roboticist in the video description, (2) the video appears at both TED.com and the TED YouTube channel, (3) the video has attracted at least 100 comments at its TED.com and YouTube forums. Our methodology can be characterized as Computer-Mediated Discourse Analysis (CMDA) [8], as our study of the social interactions that take place in the forums takes a language-focused approach.

**Table 1 Corpus of TED videos with statistics (TED – top cell; YouTube – bottom cell).**

Speaker	Title / Date	Views	Comment	%Ag ree.
<b>V1: Cynthia Breazeal,</b> MIT	The rise of personal robots TEDWomen 2010	1,045,765	190	0.86
		106,428	295	0.88
<b>V2: Rodney Brooks,</b> Rethink Robotics	Why we will rely on robots TED2013	1,328,622	222	0.94
		146,234	440	0.93
<b>V3: David Hanson,</b> Hanson Robotics	Robots that “show emotion” TED 2009	884,201	178	0.93
		170,630	319	0.89
<b>V4: Guy Hoffman,</b> IDC Media Invention Lab	<i>Robots with “soul”</i> TEDxJaffa 2013	2,886,361	134	0.92
		1,490,225	900	0.88
<b>V5: Vijay Kumar,</b> University of Penn	Robots that fly and cooperate TED2012	4,132,007	371	0.92
		1,812,116	1,382	0.90
<b>V6: Hod Lipson,</b> Cornell Uni.	Robots that are “self-aware” TED2007	1,194,274	123	0.88
		111,301	274	0.88

## 2.2 Data Collection and Processing

For the six YouTube videos, we used the YouTube API v3<sup>1</sup> to collect all video metadata, textual comments and comment metadata. For the six TED.com videos, we collected the same

data manually (i.e., copying and pasting from the browser), as TED.com provides no API. The textual comments were then subjected to analysis via the Linguistic Inquiry and Wordcount tool (LIWC) [14]. LIWC offers an efficient means to study people’s language patterns, which can provide insights into the way they think and feel, as well as their social relationships in digitally mediated environments [16]. In recent years, LIWC has gained traction with social media researchers, who have used it to understand, for example, how people express their emotions in textual-based blogs [7] or for developing theories in which linguistic behaviors are correlated to demographic characteristics of participants [12].

To explore the tone of the expressions in the two platforms, as well as the social norms surrounding the expression of one’s views via textual comments, we examined each of the four LIWC summary variables. These measures are based on years of psychological research surrounding the correlations between linguistic patterns and psychological and emotional processes. For each comment, we computed the scores on each of the four LIWC summary measures:

- Analytical thinking [14] aims to reveal the manner in which one thinks about and approaches a topic, by comparing the extent to which one uses “categorical language (i.e., references of complexly organized objects and concepts)” versus dynamic language, which typically indicates texts describing personal narratives. In other words, textual comments scoring relatively high on analytical thinking, are likely to contain more analytical thoughts toward robotic technology, as compared to those scoring low on this measure.

- Clout [11] provides a measure of the likelihood that the author enjoys high social status within the group setting (i.e., the audience of the comments). This measure is based on pronoun use, taking into consideration the extent to which one uses first-person singular versus plural pronouns, as well as second-person pronouns (as the latter two are characteristic of other-focused discourse).

- Authenticity [13] attempts to measure the likelihood of a text being truthful. The measure is based on previous research in which it was found that when lying, people tend to use fewer references to self or to others, more negatively charged words, and lower cognitive complexity, in comparison to those writing truthful texts. In the case of our comments, a lower authenticity score could indicate facetious comments.

- Emotional Tone [6] is based on a previous study of a corpus of public blog posts, written before and after the attacks of September 11th. In particular, four types of linguistic patterns were studied: emotional positivity (i.e., use of positive emotional words including “happy,” “good,” “nice”), cognitive processing (i.e., use of words such as “think,” “because”), the use of socially-oriented words (e.g., “talk,” “share,” “friends”) as well as personal pronouns beyond “I”, and an index measuring psychological-distancing of the writer (suggested by use of long words as well as words suggesting a discrepancy from reality such as “would”, “should”, “could”). Overall, Emotional Tone quantifies the overall positivity of a text.

<sup>1</sup> <https://developers.google.com/youtube/v3/>

### 2.3 Analysis of participant screen names

In order to better understand the audiences of the videos in our corpus, as well as conventions surrounding the expression of identity, we employed crowdsourcing [5]. Crowdsourcing has become very popular in social science and information systems research as well as user modeling and personalization work [3] particularly for exploiting knowledge and expertise, which are dispersed among the public, and takes on different forms. In addition, using the opinion of the crowd, in many cases (and in our case in particular) can help in omitting the researchers' own biases and helps in neutralizing the results. We used the Figure Eight platform<sup>2</sup> to enrich our dataset as to the perceived gender of the forum participants. Specifically, the following instructions were provided to our participants:

*"In this job, you will be presented with comments that people have made in response to a TED video concerning robotics. Review the author name as well as the comment, as you would if you were at the TED website. We are interested in knowing if you can infer the gender of the person who made the comment."*

Three choices were provided as radio buttons: "Man," "Woman" and "Can't tell." To keep the quality of responses high, workers needed to pass a quiz consisting of sample questions<sup>3</sup>. Workers were compensated \$0.05 (USD) for each five names analyzed. Our "contributor satisfaction survey," through which Figure Eight monitors workers' ratings on the job, in terms of the clarity of instructions, the fairness of the test questions, the ease of the job, as well as the pay, indicated that workers were very satisfied (overall score of 4.2 / 5). Each comment was analyzed by at least three workers. The percent agreement between them on judging the gender of participants commenting on each video is shown in the right-hand column of Table 1.

## 3 Statistical Analysis and Results

### 3.1 Audience characteristics

Our first question asks whether, despite the fact that the TED.com and YouTube commenting forums have nearly identical communication affordances, there are differences in their audiences and general posting behaviors. We first considered the gender distribution of participants, as well as their overall posting behaviors. Table 2 details the gender distribution within each video-commenting community. As expected, a Chi-square Test of Independence revealed that the six videos do not have the same participant gender distributions (i.e., there is a relationship between the video featured and the gender distribution in its comments); this is true both of YouTube and TED.com commenting forums.

However, when comparing the audiences of a given video between TED and YouTube, the patterns are strikingly similar across videos. The first obvious difference between the TED.com

and YouTube forums is that it is rather common to use a screen name resembling a "real name" at TED. In other words, in most cases, the crowdworkers were able to assign a perceived gender based on the screen name. However, at YouTube this is not the case; in all six forums, the proportion of participants for which a gender cannot be inferred is at least 0.50, reaching as high as 0.80. A second observation is that in all video commenting forums, across both social platforms, men dominate the participation. This is especially clear in the TED forums, as most screen names reveal gender; here, up to 80% of participants are likely to be men.

**Table 2 Participant gender distributions<sup>4</sup>. M=Man, W=Woman, U=Undefined**

	TED			You Tube			TED vs. YT $\chi^2$
	M	W	U	M	W	U	
V1	0.776	0.118	0.106	0.267	0.026	0.707	751* **
V2	0.817	0.129	0.054	0.298	0.020	0.682	857* **
V3	0.750	0.195	0.055	0.327	0.049	0.625	731* **
V4	0.686	0.272	0.041	0.426	0.064	0.509	588* **
V5	0.781	0.117	0.101	0.430	0.024	0.545	468* **
V6	0.789	0.016	0.187	0.168	0.027	0.805	791* **
	$\chi^2 = 438^{***}$			$\chi^2 = 292^{***}$			

Table 3 analyzes the length of textual comments posted in each forum, in terms of the number of words. First, a Mann-Whitney-Wilcoxon test (i.e., a non-parametric alternative to the two-sample t-test), shows that participants write longer comments at TED versus YouTube; this finding is consistent across all six videos we studied. Because of the often-small number of women participants, we could not conduct reliable statistical tests to compare the length of comments that men and women contributed.

However, we were able to use the Mann-Whitney-Wilcoxon test to compare the length of comments written by individuals with a "genuine, gendered" name (i.e., a name which suggested a gender) versus those using a name of unknown gender. In three of the TED.com forums, individuals using a gendered screen name wrote significantly longer comments, as compared to participants choosing a name that did not reveal their gender. Interestingly, among the YouTube commenting forums, it appears that participants using a gender-free screen name wrote comments that were just as long as participants with gendered names. In fact, on the video featuring Vijay Kumar, comments by participants with a gender-free name actually wrote longer comments.

<sup>2</sup> <https://www.figure-eight.com/>

<sup>3</sup> We note that they were compensated for their responses to these items as well.

<sup>4</sup> We use the following conventions to report levels of statistical significance: \*\*\*p<.001; \*\*p<.01; \*p<.05

**Table 3 Length of comments (mean / median).**

	All			M&W vs. Unknown	
	TED	YT	W	TED	YT
V1	98.54 81.50	28.27 17.00	37893 ***	1710 *	6618
V2	136.0 90.5	45.04 40.00	61207 ***	1641 **	17680
V3	89.5 64.0	20.00 13.00	41360 ***	809	12300
V4	66.42 34.00	19.77 9.00	82138 ***	423	96752
V5	61.45 34.00	19.15 10.50	351580 ***	8024 **	177630 ***
V6	109.70 58.00	29.99 22.50	23039 ***	n.a.	5288

### 3.2 Social norms surrounding expression / tone

Table 4 analyzes the extent to which contributors' writing patterns express analytical thought and indicate that they likely hold clout with others in the forum. As the distributions on the four summary measures are often non-normal, we again use the Mann-Whitney-Wilcoxon test to compare them across the two platforms. For two videos (featuring Hanson and Kumar), the comments posted at YouTube tend to be more analytical; for the remaining four videos no statistically significant differences are detected. With respect to clout, there is only one difference detected, on comments to the video of Guy Hoffman.

**Table 4 Comparison of comments – Analytical thinking and Clout (mean / median).**

	Analytic			Clout		
	TED	YT	W	TED	YT	W
V1	63.62 68.66	56.34 58.35	25608	67.75 70.00	61.57 55.29	25558
V2	59.29 63.06	58.36 61.80	25608	65.55 70.32	63.23 67.52	42416
V3	55.24 60.33	59.29 67.14	22361*	58.61 61.60	60.96 55.93	23906
V4	60.44 65.29	56.15 63.11	54178	63.21 69.89	55.63 50.00	60362**
V5	57.24 63.37	59.30 69.57	217110*	54.08 50.00	53.51 50.00	236340
V6	51.87 55.09	51.30 51.43	16101	55.47 50.00	55.31 50.00	15724

Table 5 compares the differences in comments posted at the two platforms with respect to authenticity (i.e., truthfulness) and emotional tone (i.e., expressing positive affect). Here, can we observe more consistency in our results. In particular, TED comments tend to have textual characteristics that are correlated with authenticity; in other words, the LIWC analysis suggests that more TED participants express truthful comments (in contrast to facetious or false comments). Likewise, there is evidence of a more positive emotional tone in comments made at TED, as compared to YouTube.

## 4 Discussion and Conclusion

The TED organization, a nonprofit devoted to sharing “ideas worth spreading,” uses multiple social media channels, from its own website, to Facebook, Twitter and YouTube to name but a few, to engage the public with videos featuring short, powerful talks. Two of these platforms – the TED.com website and YouTube – engage users via commenting forums with nearly identical communication affordances.

**Table 5 Comparison of comments - Authenticity and Emotional Tone (mean / median).**

	Authentic			Emotional Tone		
	TED	YT	W	TED	YT	W
V1	38.66 34.61	24.65 7.84	31372**	58.95 66.34	51.75 25.77	25106
V2	28.09 18.65	30.28 15.12	42635	54.60 54.86	48.27 25.77	45500*
V3	36.01 27.86	22.02 4.97	34096**	67.81 81.81	43.82 25.77	32867**
V4	30.56 20.24	27.63 5.07	62037**	72.77 93.61	52.11 25.77	66098**
V5	32.66 20.24	31.70 11.00	255300**	56.68 54.07	47.03 25.77	262040**
V6	32.85 25.89	36.26 23.51	16026	58.22 60.56	45.53 25.77	18952**

This presented us with an opportunity to study the two communities and identify differences and similarities regarding their participants' characteristics using an observational methodology: 1) how the audience demographics differ between the two platforms, and 2) the variance in social norms surrounding the use of screen names, as well as approaches to writing comments. These characteristics are important to ascertain, for personalization researchers and practitioners on the characteristics of the audiences of each platform and allow them to use suitable methodologies to engage these audiences. User modeling as a field needs to be sensitive toward affective factors, in influencing a citizen's impression of an emerging technology or technique, if they wish to have their personalization well received. Likewise, those wishing to learn about public opinion in social media need to keep in mind that platforms vary with respect to their community characteristics and social norms, which influence the manner in which participants present their thoughts as well as their own identities.

Our results revealed some salient differences in the audiences of the two platforms – TED.com and YouTube. With respect to our first research question, the makeup of the audiences, we observed evidence of gender imbalance both at YouTube and TED.com, with men dominating discussions of all six videos, both in terms of the number of comments contributed, as well as comment length. Of course, gender imbalance in social networks and virtual communities is a subject of ongoing discussion, and previous studies found that especially in YouTube, commenting forums are generally male dominated [21]. Our own observations relate to the well-known gender gap that exists in technology-related communities. Since the six videos studied

discuss robotics, it is possible that women participants might have not been as attracted to these videos. Even in the video featuring a woman speaker, Cynthia Breazeal, men dominate the respective commenting forums.

One of the most important findings of this work addressed our second research question, concerning the differences in social norms that exist between the audiences in the two platforms. In [1] they stress the affordances that made YouTube one of the most popular social communities for video sharing: over 100 million of users are using the platform leading to high reachability of videos among users; access to the platform is free and one is not obligated to create an account; one has the ability to upload a video after creating an account; and most importantly, anonymity is the prevalent social norm. The culture of anonymity in YouTube is easily observed in our results as well, allowing users to function behind a screen name or nickname of their choice, which likely makes them feel more comfortable expressing themselves. In fact, we observed that participants with screen names that were anonymous (i.e., in that a gender could not be inferred) wrote comments that were just as long if not longer, in response to the six videos, as compared to those participants who used more “realistic” names for which gender could be inferred.

On the contrary, the social norms at TED.com, which is self-promoted as a platform for discussing important and emerging topics, including matters of a technological and scientific nature, are quite different. At TED, the majority of screen names revealed (or suggested) the gender of the user and TED users with “revealing” screen names appear to write lengthier comments – possibly sharing their knowledge more openly and promoting the knowledge they possess – compared to the anonymous TED users who wrote brief comments. The above results might be a consequence of the nature of the TED platform that attracts more academic or intellectual audience [2] than YouTube. Academics or expert users of TED community might have a self-promoting culture that involves the use of discussion forums as a medium to become “known” in the online community of TED through their comments. Consistent with previous work [16], TED participants appeared more positive and authentic in the language they used for commenting, as compared to YouTube participants, which again reveals the differences in the audience attending the two platforms even if the material they were commenting on is the very same.

In conclusion, our results provide food for thought for those wishing to benefit from social media, either as a platform to model users and communities as a whole, or as a source of information on modelling citizens’ views toward particular topics or technologies. Future work can probe deeper into the complex correlations between community characteristics, video attributes as well as the characteristics of the particular technology being discussed. Such knowledge will help ensure that social media are a beneficial tool for those wishing to learn and share about technologies that are often difficult to

understand, but that are positioned to have a significant impact on the quality of our lives in the near future.

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