

Emotions under Discussion: Gender, Status and Communication in Wikipedia



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- 1 Introduction
- 2 Framework of analysis
 - Data acquisition and pre-processing
 - User gender labelling
 - Sentiment analysis
- 3 Results
 - Emotions and status
 - Emotions and gender
 - Networked emotions
- 4 Conclusions



1 Introduction

2 Framework of analysis

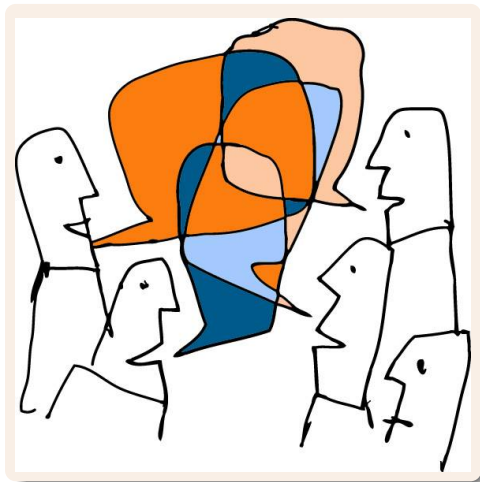
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- Wikipedia, largest collaborative project
- Discussion spaces are fundamental to the collaborative process
- Discussion triggers emotions and breeds particular emotional environments



- Studying the emotional dimension can help to face issues such as the gender gap and editors' decline
- Interactions in Wikipedia
 - *Implicit* → editing
 - *Explicit* → communication in article talk pages and personal talk pages

Approach

- extensive analysis of emotions in explicit communication
- through sentiment analysis of comments in article talk and personal talk pages



Research questions

- 1 How are the emotional and communication styles of editors affected by their **status**?
- 2 How are the emotional and communication styles of editors affected by their **gender**?
- 3 How are the emotional expressions affected by interacting with others in comment threads (**emotional congruence**)?
- 4 How are the emotional styles of editors related to those of the editors they interact more frequently with (**emotional homophily**)?



Results published in:



Laniado, D., Castillo, C., Kaltenbrunner, A., and Fuster Morell, M. F. (2012)
Emotions and dialogue in a peer-production community: the case of Wikipedia.
8th International Symposium on Wikis and Open Collaboration, WikiSym'12



Iosub, D., Laniado, D., Castillo, C., Fuster Morell, M. F., and Kaltenbrunner, A. (2014)
Emotions under Discussion: Gender, Status and Communication in Online Collaboration.
Plos One, 9(8)



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Dataset: conversations

Extracting conversations among editors from the English Wikipedia

Articles	3 210 039	
Articles with talk page (ATP)	871 485	(27.1%)
<i>Editors</i> who comment articles	350 958	
<i>Editors</i> with ≥ 100 comments on ATP	12 231	(3.5%)
Total comments in ATP	11 041 246	
<i>Comments containing ANEW words</i>	7 414 411	(67.2%)
Comments by <i>editors</i> with ≥ 100 comments on ATP	5 480 544	(49.6%)
<i>Comments by these editors and with ANEW words</i>	3 649 297	(33.3%)

Table: Data extracted from a complete dump of the English Wikipedia, dated March 12th, 2010



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User gender labelling

- $\approx 12\,000$ users wrote ≥ 100 comments in articles talk pages
- Gender identified through Wikipedia API for $\approx 2\,000$ of them
- A sample of 1 385 users for manual labelling through crowdsourcing (Crowdfunder)

	Non-admins	Admins	Total
Men	1 087	1 526	2 613
Women	68	97	165
Unknown	6 850	2 603	9 453
Total	8 005	4 226	12 231

Table: Users with ≥ 100 comments by gender and administrator status.

- Gender could be identified only for $\approx 50\%$ of users:
 - real name or username (50% of those identified)
 - implicitly stated gender (27% of women, 20% of men)
 - pronoun (15% of women, 10% of men)
 - other indicators: userboxes, pictures, links to personal blogs...



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- relying on three different instruments:
 - Affective norms for English words (ANEW)
 - Linguistic Inquiry and Word Count (LIWC)
 - SentiStrength

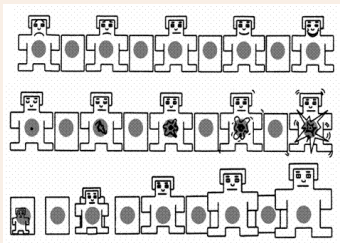


Measuring the Emotional Content of Discussions

Method 1: Affective norms for English words (ANEW)

Rates a list of 1060 frequent words on a 9 point scale in three dimensions:

- Valence
- Arousal
- Dominance



- assign emotion scores to each word from the lexicon



Bradley and Lang. (1999).

Affective norms for English words (ANEW) Technical report C-1.

The Center for Research in Psychophysiology, University of Florida, FL.

Measuring the Emotional Content of Discussions

Method 2: Linguistic Inquiry and Word Count (LIWC)

- Two scores for basic emotion (compared with ANEW valence)
 - positive emotion
 - negative emotion
- Discrete measures of emotions (anger, anxiety, sadness, affect)
- Other classes of words to characterize language (i.e. personal pronouns, tentative words, fillers...)

→ Count the proportion of words belonging to each class



Pennebaker J, Chung C, Ireland M, Gonzales A, Booth R (2010).

The development and psychometric properties of LIWC2007. Austin, TX.



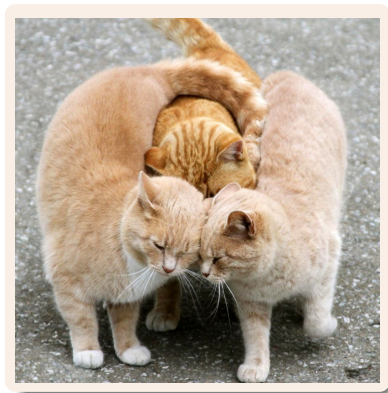
Measuring the Emotional Content of Discussions

Method 2: Linguistic Inquiry and Word Count (LIWC)

	Dictionary size	Examples
Anger	91	hate, kill, annoyed
Anxiety	84	worried, fearful, nervous
Sadness	101	crying, grief, sad
Tentative	155	maybe, perhaps, guess
Certainty	83	always, never
Fillers	9	blah, you know
Past	155	went, ran, had
Present	169	is, does, hear
Future	48	will, gonna
Social words	455	mate, talk, child

Table: Description of LIWC measures (as per <http://www.liwc.net>).





Definition

- Communication that promotes social affiliation and emotional connection:
 - preoccupation with others (use of personal pronouns, e.g., I, you)
 - preoccupation with the larger social domain (e.g., references to friends and family)
 - expression of positive emotion

Examples

- *We are glad to have you. If I can help at all let me know :)*
- *A-giau has smiled at you. Smiles promote WikiLove and hopefully this one has made your day better...Happy editing*
- *Congrats! Thank you for your dedication.*

Measuring the Emotional Content of Discussions

Method 3: SentiStrength

SentiStrength

- Based on LIWC and developed for short web texts
- Accounts for modes of textual expression specific to the online environment, e.g. emoticons and abbreviations
- Provides a positive and a negative score for emotional valence
- Emotion score is the strongest positive and negative emotion expressed in a comment
- Final scores are averages over comments in a given category



Thelwall M, Buckley K, Paltoglou G, Cai D, Kappas A (2010)

Sentiment strength detection in short informal text.

Journal of the American Society for Information Science and Technology 61: 2544 – 2558.



Example: results with three different emotional lexica

Table: Example messages with their corresponding Valence(ANEW) or positive & negative scores (*LIWC*, **SentiStrength**)

	ANEW	LIWC		SentiSt.	
	Valence	+	-	+	-
<p>Sounds like a good challenge - to be proven or disproven. I'm happy if it can be shown to go further using closed cubic polynomial solutions. The nice thing about these are that they are pretty easy to test numerically . . .</p> <p style="text-align: center;">-in "Exact trigonometric constants"</p>	7.4	12.5	0	3	-2
<p>Seems you have not yet seen female lover after having sex who do not wish to have sex with the same lover any more :) Once you've seen it, you understand very well what war of Venus means compared to war of Mars.</p> <p style="text-align: center;">-in "House (astrology)"</p>	5.5	6.8	4.5	4	-3
<p>What about the whirlie hazing, the alcohol abuse, the emotional poverty, the suicide in 1995/6, the biotech plans which were stopped by pitzer protests . . .</p> <p style="text-align: center;">-in "Harvey Mudd College"</p>	1.6	4	8	1	-4



Sentiment analysis

Statistical tests

- Compute average values with the three lexica for each user
- Compare distribution of values for two groups of users (e.g.: admins vs regulars, women vs men)
 - Most variables are not normally distributed



Mann-Whitney U-test

Compare distributions of rankings



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Emotions and Status

Table: Emotions and Status: Administrators promote a generally neutral tone on article talk pages. Regular editors express more negative emotion, and are more emotional.

(Article Talk)	Regular	Admin	Mann-Whitney U-Test	p-value
LIWC				
Positive	2.369	<u>2.409</u>	-4.308	p < 0.001
Negative	<u>1.368</u>	1.120	-18.578	p < 0.001
Affect	<u>3.784</u>	3.661	-8.466	p < 0.001
Anxiety	<u>0.180</u>	0.166	-5.834	p < 0.001
Anger	<u>0.554</u>	0.446	-19.217	p < 0.001
Sadness	<u>0.175</u>	0.166	-4.450	p < 0.001
SentiStrength				
Positive	<u>1.805</u>	1.774	-14.603	p < 0.001
Negative	<u>-2.005</u>	-1.912	-23.046	p < 0.001

When difference is statistically significant (p-value in bold) the larger absolute value is underlined



Admins:

- more positive emotion (ANEW and LIWC)
- generally, emotionally reserved compared to regular users (LIWC)

Regular users:

- more emotional
 - more affect, and more anxiety, anger and sadness (LIWC)
- stronger positive and negative words than admins (SentiStrength)

Personal talk pages

- In personal talk pages, admins are more emotional compared to the article talk pages
 - more positive emotion compared to regular editors, but also more anxiety and sadness

Dialogue and Status

Table: Dialogue and Status: Administrators are more impersonal in article talk pages. Regular editors are more concerned with others.

(Article Talk)	Regular	Admin	Mann-Whitney U-test	p-value
Relationship-orientation				
Personal pronouns	<u>5.135</u>	4.815	-13.561	p < 0.001
Use of "I"	2.456	2.429	-1.733	p=0.083
Use of "You"	<u>1.043</u>	0.892	-12.573	p < 0.001
Use of "Shehe"	<u>0.609</u>	0.526	-8.657	p < 0.001
Social words	<u>6.320</u>	5.810	-19.013	p < 0.001
Certainty				
Certainty	<u>1.426</u>	1.317	-16.824	p < 0.001
Tentativeness	<u>3.199</u>	3.169	-2.210	p < 0.001
Filler words	<u>0.168</u>	0.155	-6.687	p < 0.001
Temporal Orientation				
Past	<u>2.376</u>	2.305	-5.696	p < 0.001
Present	<u>8.011</u>	7.841	-8.060	p < 0.001
Future	1.114	<u>1.166</u>	-9.887	p < 0.001

When difference is statistically significant (p-value in bold) the larger absolute value is underlined



Admins

- more neutral and impersonal tone
- less relationship oriented
- more concerned with the future
- tend to "rule with reason"



Regular users

- more relationship-oriented
 - more personal pronouns and more social words
- more concerned with past
- more insecure, but not in personal spaces
 - more certainty, tentative and filler words in article talk pages



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- Women use words associated to more positive emotions
 - Result consistent and significant with the three lexicons
 - ANEW: Difference is not significant when normalising by article
 - difference might be due to topic selection: women choose to participate in topics which have more positive discussions
- No significant difference in expression of negative emotions



Topics, emotions and gender

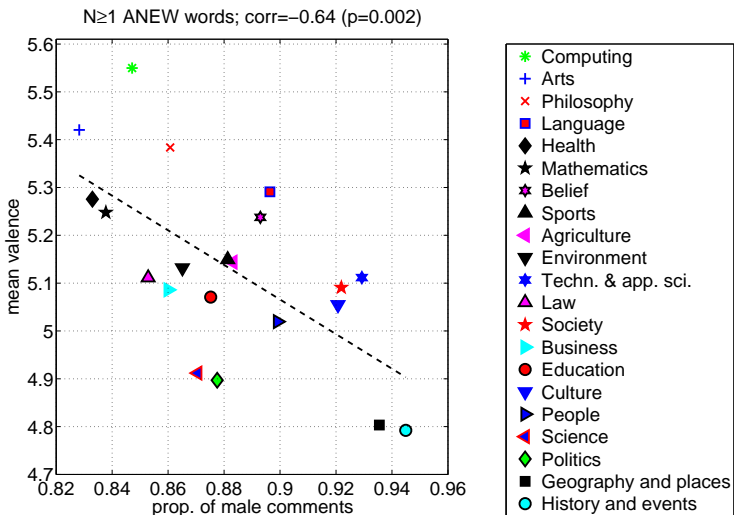


Figure: Mean valence (ANEW) for discussions of articles in different topic categories, vs the proportion of comments written by men

Dialogue and gender

Table: Dialogue and Gender: Women use a more relationship-oriented speech style.

(Article Talk)	Men	Women	Mann-Whitney U-test	p-value
Relationship-orientation				
Personal pronouns	4.964	<u>5.420</u>	-4.375	p < 0.001
Use of "I"	2.488	<u>2.764</u>	-3.945	p < 0.001
Use of "You"	0.936	0.957	-0.926	p=0.355
Use of "Shehe" pronouns	0.541	<u>0.713</u>	-4.657	p < 0.001
Social words	5.960	<u>6.353</u>	-3.487	p < 0.001
Certainty				
Certainty	1.346 (<u>1397</u>)	1.300 (1263)	-2.078	p = 0.038*
Tentativeness	3.150	3.215	-1.162	p=0.245
Filler words	0.161	0.160	-0.137	p=0.891
Temporal Orientation				
Past	2.325	<u>2.543</u>	-4.305	p < 0.001
Present	7.897	<u>8.180</u>	-3.086	p = 0.002
Future	1.168	1.147	-1.008	p=0.314

When difference is statistically significant (p-value in bold) the larger absolute value is underlined. Cases where the averages are not informative are marked with an asterisk * and include the mean ranks Mann-Whitney U-test next to the averages in parentheses.



- Women write longer messages
- Women are more relationship-oriented
 - more personal pronouns, in particular “I”, more social words
- Women are not more insecure
 - Less certainty words, no significant difference for tentativeness and filler words
- Women admins are more relationship oriented than men admins
 - Different leadership style



- Manual classification of 100 comments
 - Three main types of comments high in relationship-orientation:
 - inviting comments that explain the edit in a friendly tone, and call for further intervention and collaboration
 - common perspective-building comments that are focused on understanding others and solving debates in a constructive manner
 - appreciative comments that contain positive emotions and celebrate others' actions
- ⇒ This suggests that relationship-orientation may be conducive to successful collaboration



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Emotional congruence

- Comparison of each comment with the comment it replies to
 - not based only on our set of users, but on all comments (from all users)

Emotions: editors tend to reply with:

- more positive emotion
- less negative emotion
- less anger, anxiety and sadness
- stronger words, both positive and negative (SentiStrength)

Dialogue: editors tend to reply with:

- more relationship oriented speech
- less tentative and certainty words



Emotional homophily

Mixing patterns: do users interact preferentially with similar users?

Disassortativity by activity

users who write more comments tend to reply preferentially to less active users, and viceversa

Assortativity by gender

Men interact more with other men, and women with other women

Assortativity by emotion and language

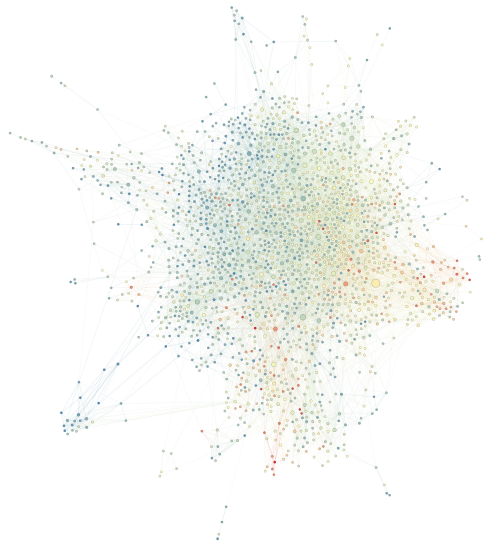
Users interact more with others similar in emotional expression and communication style

- also in the network of communication on personal talk pages



Emotional homophily

Example: homophily by expression of anger



- edges connect users who have exchanged at least 10 replies
- node color represents the level of anger expressed by a user, from low to high
- node size → proportional to the number of connections of a user



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Administrators and experienced users play a pivotal role

- they tend to interact especially with less experienced users
- they promote a positive and impersonal environment

Women have a different communication style

- they work on topics where discussions have a more positive tone
 - they interact more with each other than with men editors
 - they are more concerned with others (more relationship-oriented)
 - also women administrators have a different leadership style
- ⇒ promoting relationship orientation leadership could lead to a more positive environment
- ⇒ being able to give women more space in the community could result in a virtuous cycle of women participation

Longitudinal analysis

- how do emotional styles of editors change over time and with increasing experience?
- how do emotions in the discussion affect participation?

Need for qualitative analysis and human annotation

- include non-textual emotional aspects such as emoticons, *barn stars* and virtual gifts
- cover also less experienced users
- deal with sarcasm, measure the extent of condescending or paternalistic language in comments addressed at women editors



Some references



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Questions?

