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THE IMPACT OF SENTIMENT ON USER'S REACTION ON FACEBOOK: THE CASE OF THE AMERICAN CHAMBER OF COMMERCE IN UKRAINE

ВПЛИВ НАСТРОЮ НА РЕАКЦІЮ КОРИСТУВАЧІВ FACEBOOK: НА ПРИКЛАДІ АМЕРИКАНСЬКОЇ ТОРГІВЕЛЬНОЇ ПАЛАТИ В УКРАЇНИ

This study investigates the relationship of sentiments expressed in Facebook posts by the American Chamber of Commerce (ACC) in Ukraine on audience reactions. By employing AI-driven sentiment analysis, we categorize ACC's posts into five categories: Empowerment category, Excitement and enthusiasm category, Gratitude category, Optimism category, and Resilience category. Our findings reveal that posts signaling resilience and optimism receive significantly more reactions compared to those communicating empowerment and excitement. As sentiment analysis continues to evolve, incorporating multimodal approaches and leveraging advancements in AI and NLP, businesses that effectively utilize these tools will be better equipped to make informed decisions and adapt to the ever-changing digital landscape. Furthermore, posts classified as displaying empowerment are more likely to be shared/reposted by the readers. These results highlight the importance of tailoring communication strategies to elicit desired audience responses and provide valuable insights for organizations navigating complex environments.

Keywords: *AI-driven sentiment analysis, primary emotion, reactions, audience engagement.*

Стаття присвячена аналізу зв'язку реакції аудиторії та її настрою, на пости у Facebook від American Chamber of Commerce (ACC) в Україні. В дослідження був застосований аналіз реакції, який був здійснений за допомогою технологій штучного інтелекту (ШІ). За результатами аналізу настроїв, який здійснив ШІ, була запропонована їх класифікація на п'ять основних категорій, які мають наступні назви та характеристики: 1. Категорія розширення прав і можливостей, яка, за поясненнями ШІ, передбачена для вибору повідомлень, зміст яких містить саме розширені права та можливості. 2. Категорія азарту та ентузіазму, яку ШІ асоціював з різні оголошення про події та досягнення, які

пов'язані або містять інформацію, з азартом та ентузіазмом. 3. Категорія вдячності – це єдине почуття, де призначення первинної емоції, здається, керується лише наявністю слова «вдячність» у тексті. 4. Категорія оптимізму – саме ця категорія включає висловлювання майбутнього оптимістичного настрою та потенціалу, в якому явно виражено віру і/або надію в майбутнє України. 5. Категорія стійкості – почуття стійкості базується як на позиції, так і на заявах, які включають слово «стійкість» та повідомлення про позиції, які демонструють рішучість продовжувати зусилля зі зміцнення, відновлення та реформування країни. За результатами аналізу визначено, що пости, які сигналізують про стійкість та оптимізм, отримують значно більше реакцій порівняно з тими, хто передає розширення можливостей та хвилювання. Крім того, визначено, що повідомлення, класифіковані як розширення прав і можливостей, більш імовірно, будуть передані/переслані читачам. Слід зазначити, що аналіз настроїв продовжує розвиватися, включаючи мультимодальні підходи та використання досягнень у сфері штучного інтелекту та нейролінгвістичного планування, і відповідно підприємства, які ефективно використовують ці інструменти, будуть краще оснащені для прийняття обґрунтованих рішень та адаптації до постійно мінливого цифрового ландшафту. Отримані, під час досліджень результати підкреслюють і доводять важливість розробки комунікаційних стратегій, які направлені на отримання бажаної аудиторії, та мають особливо важливе значення для організацій, які знаходяться в складних умовах.

Ключові слова: штучний інтелект, аналіз настроїв, первинні емоції, реакції, залучення аудиторії.

Formulation of the problem. Social media is one of the primary tools for organizations to connect with their audiences. Social media platforms do not just disseminate information, they have become important instruments in shaping public opinions.

Understanding how sentiments expressed in social media posts shape the reactions of the target audience is particularly important for organizations operating in complex environments. The American Chamber of Commerce (ACC) in Ukraine is one such organization – navigating a very challenging environment driven by the war.

Analysis of recent research and publications. Frankwatching blog shows that the main benefits of using social media for organizations include increased exposure (86%), increased traffic (76%), generated leads (64%), developed loyal fans (56%), and improved sales (55%) [5].

The use of sentiment analysis can be traced back to the early 20th century with studies on public opinion analysis and text subjectivity [12]. Before the advent of the internet, the personal exchange of opinions was a key aspect of decision-making processes. For organizations, figuring out public sentiment was quite important, and it was often achieved through traditional methods such as opinion polls and surveys. These tools were instrumental in capturing the collective attitudes and perceptions of the public toward a company's products or services [10]. With the advent of Web 2.0, internet users moved from being passive viewers of content to being active participants in creating content [10].

Recent technological developments also gave a boost to sentiment analysis. Artificial Intelligence (AI) as advanced technology using Natural Language Processing (NLP), enables computers to analyze texts written by humans, understanding emotions, context, and sentiment [14].

Formulation of the purpose of the article. This study focuses on ACC's engagement with their target audience via Facebook which is the most important platform for organizations to engage with their audiences, taking 45% of all social media use by organizations [13].

Presentation of the main material. There are two approaches to sentiment analysis done by computers: rule-based and machine learning (ML). Rule-based approach relies on lexicons (word and phrase lists) classified as positive or negative statements. When working with the text, AI compares the words against these lists and defines the sentiment expressed in each text. ML approach is focused on algorithms that help software determine the sentiment expressed in the text. ML allows AI to continue learning using new data. Sometimes these two approaches are combined, and a hybrid approach is used. Currently,

the machine learning approach is the most prevailing of the three approaches [3], and it is considered very reliable as a tool for this type of analysis [9].

The growing importance of sentiment analysis is evident across various industries. Organizations are leveraging sentiment analysis to monitor brand reputation, conduct market research, and gain insights into customer opinions and preferences. The global sentiment analysis software market is expected to reach USD 4.94 billion by 2028, with a compound annual growth rate of 18.2% [6]. As we move into 2025, sentiment analysis will continue to play a crucial role in helping businesses stay ahead of the curve. The incorporation of multimodal sentiment analysis, which considers visual content alongside text, will provide a more comprehensive understanding of public sentiment [6].

Emotions and Reactions. In the rapidly evolving digital landscape, social media has emerged as a powerful tool for communication and content sharing. As individuals and organizations increasingly rely on social media platforms to disseminate information and engage with their audience, understanding the factors that drive emotional responses and sharing behavior has become crucial. Different levels of engagement have been identified by Kim and Yang (2017): likes are the lowest level since they require just a click, comments are intermediate level as they require investment of time and effort, and shares are the highest level of engagement since people make the post part of their personal profiles, identifying themselves with what is being conveyed by the post.

Tellis et al. [15] found that information-focused content has a negative effect on sharing, while positive emotions such as amusement, excitement, inspiration, and warmth move people to share them with others. This finding aligns with prior research suggesting that emotional content is more likely to be shared than purely informational content [2].

The role of emotions in driving sharing behavior has been extensively studied in various contexts, including online advertising [1], electronic word of mouth (Lovett et al., 2013), and news articles [2]. Across these domains, the consensus is that emotional content, particularly content that evokes positive emotions, is more likely to be shared than neutral or informational content.

The phenomenon of emotional contagion, whereby individuals' emotions are influenced by the emotions expressed by others, has been identified as a key driver of social sharing. Kramer et al. [8] demonstrated that emotional states can be transferred to others through emotional contagion, leading people to develop similar emotions to the ones they are perceiving in Facebook posts.

The purpose of this research is twofold. First, to explore how AI interprets sentiments from text. Second, to understand the relationship between primary sentiments evoked by the messages and the effectiveness of those messages as measured by likes and reposts.

Our focus is on the sentiments expressed by AmCham Ukraine in their Facebook posts and how these sentiments influence public perceptions, as reflected in likes and shares. Emotional responses to posts can capture the attention of other users, encouraging them to engage more deeply with the content and seek additional information [4]. This, in turn, strengthens the audience's connection with the organization that shared the post.

Data. Ukraine has a broad set of business associations that serve various industries and sectors – industry-specific, general business, professional as well as regional associations. Each plays a role in advocating for business interests, providing networking opportunities, and supporting economic development. Overall, there are about 80 business associations in Ukraine. The most prominent associations in the general business category include the European Business Association (EBA), the Association of Ukrainian Entrepreneurs (SUP), Board, and the Ukrainian Chamber of Commerce and Industry (UCCI) to name a few. Each association plays an active role in advocating for business interests, providing networking opportunities to its members, and supporting broader economic development efforts.

For this research we collected data on Facebook posts by the American Chamber of Commerce in Ukraine. The primary reason to collect data for this organization is that

it's Facebook posts are in English language which allows us to use AI-driven sentiment analysis models that have been extensively trained. Other business associations in Ukraine understandably communicate with its members in Ukrainian language and there is currently no reliable solution to perform AI-driven sentiment analysis on text that is in Ukrainian language.

To measure the effectiveness of communication as it relates to the emotional tone of the communication, we collected all Facebook posts (199 posts) of AmCham Ukraine from April 1, 2023 to October 1, 2023. The association's Facebook page has about 23,000 subscribers which is comparable with other business associations operating in Ukraine (see Table 1).

The posts were collected manually, and each post was classified by AI Chat Perplexity. ai into five categories: (1) empowerment, (2) excitement, (3) gratitude, (4) optimism, and (5) resilience. Table 2 provides a summary of the collected data and the breakdown across the five categories. As a part of the sentiment analysis, the system was prompted to give reasoning for sorting the posts into their respective categories. Here is a sample of the types of posts in each category and the probable reasons ML algorithm leverages to classify the posts.

Empowerment category. According to the explanations AI provided for its choice of texts for empowerment, it is possible to see two trends: (1) usage of the words associated with empowerment, and (2) the mentioning of training and conferences – activities that can be seen as contributing factors to strengthening of Ukrainian business in the time of war. Here are a few examples of the kind of posts classified as empowering:

(1) Discussing the establishment of a Political Risk Insurance mechanism aims to empower businesses by providing security and risk mitigation strategies.

(2) The Knowledge Webinar on Political Risk Insurance for projects during martial law aims to empower businesses by offering information on how to navigate and secure projects under challenging conditions.

Table 1

Number of subscribers for select business associations in Ukraine

Organization	Number of Subscribers
ACC (American Chamber of Commerce)	**23,000**
EBA (European Business Association)	34,000
SUP (Association of Ukrainian Entrepreneurs)	24,000
Board (Association "Board")	23,000
UCCI (Ukrainian Chamber of Commerce and Industry)	16,000

Source: compiled by the authors

Table 2

Primary emotion of Facebook communication by AmCham Ukraine

Primary Emotion	Number of Posts	Minimum Number of Reactions	Maximum Number of Reactions	Average Number of Reactions	Average Number of Reposts
Epowerment	33	4	46	14.2	1.73
Excitement	38	1	76	16.7	1.05
Gratitude	7	9	50	19.0	0.29
Optimism	57	5	122	18.0	0.67
Resilience	64	4	103	22.8	0.78
TOTAL	**199**			**18.1**	**0.90**

Source: compiled by the authors

(3) The meeting with Deputy Ministers and a project manager on digital development and transformation aims to empower stakeholders with strategic insights for digital initiatives.

Excitement and enthusiasm category. It is apparent that AI associated different announcements about events and achievements with excitement and enthusiasm. The following posts serve as an example of messaging that communicated excitement and enthusiasm:

1. The announcement of an online meeting with MP Halyna Yanchenko with a call to join shows enthusiasm for engaging with key political figures.

2. Welcoming of AMS Sustainable Development Solutions FZE as a new member is expressed with happiness and excitement about new membership.

3. The announcement of AmCham Ukraine winning the 2023 AmCham in Europe Creative Network Award is filled with excitement and pride for the achievement.

Gratitude category. This sentiment is the only one where assignment of the primary emotion seems to only be driven by the presence of the word "gratitude" in the text. Such an approach is problematic because AI-driven systems' categorization can be easily biased by using specific words. Here are some examples in the gratitude category.

1. The expression of gratitude to the Government of Ukraine for supporting the continuous and uninterrupted export of Ukrainian grain and other agricultural products highlights a strong sense of appreciation.

2. The expression of thanks to the members, partners, and friends who attended the Business Networking Reception in Kyiv, despite the war, reflects a strong sense of gratitude for their resilience and commitment.

3. The gratitude expressed towards members providing humanitarian support following the Kakhovka dam destruction highlights appreciation for their efforts and compassion.

Optimism category. The optimism category includes statements of future potential and explicitly expressed belief and/or hope in the future of Ukraine. The sample messages are as follows:

1. Upcoming US-Ukraine Partnership Forum aimed at advancing the development and modernization of Ukraine's critical infrastructure, emphasizing rapid recovery, economic growth, and EU integration, which inherently carry messages of hope and optimism.

2. Samantha Power's remarks about investing in Ukraine as an investment in democracy's future highlight a hopeful and optimistic perspective on Ukraine's potential and the broader implications for global democracy.

3. The Security & Defense Event in London, discussing joint initiatives and strengthening Ukraine's defense potential, indicates a hopeful outlook on enhancing national security through international cooperation.

Resilience category. The sentiment of resilience is based both on 1 position the statements that include the word "resilience" and 2 position messages that show determination to continue the effort of strengthening, rebuilding, and reforming the country moving forward. a few messages in this category are:

1. The meeting with Dilawar Syed on how resilient businesses operate in Ukraine underscores the determined efforts to sustain and rebuild business operations in a war-torn country.

2. Lenna Koszarny's statement about tech driving resiliency in Ukraine highlights the country's determination to leverage technology for resilience.

3. Taras Kachka's comments on not slowing down the pace of reforms demonstrate a strong determination to continue progressing despite challenges.

The data analysis section uses the abovementioned categorization of Facebook posts to understand the relationship between primary emotions evoked by the post and the effectiveness of the communication as measured likes and reposts.

Data Analysis. The data analysis section addresses the main research question: What are the differences in the effectiveness of Facebooks posts across the five categories as defined by the primary emotion evoked by the post? In short, we want to understand if posts that

elicit certain emotions are associated with higher effectiveness as measured by the average number of reactions per post.

First, we conducted a two-tailed t-test to compare the average number of reactions across the five categories. Table 3 shows the results. "Yes" indicates that the difference in the average number of reactions for the relevant pair is statistically significant at the 5% level while "No" indicates that the observed difference is not statistically significant.

Only one pair exhibits significant differences in the average number of reactions. Facebook posts classified as displaying resilience as a primary emotion (with the average of 22.8 reactions per post) receive significantly more reactions as compared to the posts that communicate empowerment (with the average of 14.2 reactions per post). There are no statistically significant differences for other pairs. The results seem to indicate that the messages of resilience produce a stronger response from the audience of AmCham Ukraine as captured by the highest average number of reactions across the five categories (see Table 2) and the statistical significance of such difference for one of the pairs (see Table 4).

Second, we conducted a similar comparison for the average number of reports. Table 4 displays the results.

The results from the analysis of reposts produce a different picture. First, while messages of empowerment and excitement receive the lowest number of reactions, they are reposted more often (see Table 2).

In fact, the repost rate of empowerment posts (with the average rate of reposts at 1.73) differs significantly from the messages of resilience (0.78), optimism (0.67), and gratitude (0.29); posts that signal excitement (1.05) are reposted more often than those that display gratitude (0.29) (Table 5). No other pairs exhibit statistically significant differences.

The results presented in Table 3 and 4 might be driven by outliers. As a robustness check we cleaned the data from outliers using the box plot method. After removing the outliers, a two-tailed t-test was used to compare the average number of reactions and the average number of reposts.

Table 4 summarizes the impact of removing outliers. Tables 6 and 7 show the results of the t-test.

Removing Outliers. Removing the outliers impacts the statistical significance of the differences in the average number of reactions across the categories – four pairs now exhibit

Table 3

Results of T-test for average reactions by the primary emotion category

	Empowerment	Excitement	Gratitude	Optimism	Resilience
Resilience	Yes	No	No	No	
Optimism	No	No	No		
Gratitude	No	No			
Excitement	No				
Empowerment					

Source: compiled by the authors

Table 4

Results of the T-test for average reposts by the primary emotion category

	Empowerment	Excitement	Gratitude	Optimism	Resilience
Resilience	Yes	No	No	No	
Optimism	Yes	No	No		
Gratitude	Yes	Yes			
Excitement	No				
Empowerment					

Source: compiled by the authors

Table 5
Average number of reactions and shares without outliers

Primary Emotion	Total Number of Posts	Number of outliers in Reactions	Number of outliers in Reposts	Average Number of Reactions		Average Number of Reposts	
				Full Data	w/o Outliers	Full Data	w/o Outliers
Epowernment	33	4	0	14.2	10.4	1.73	1.73
Excitement	38	5	3	16.7	10.8	1.05	0.66
Gratitude	7	1	0	19.0	13.8	0.29	0.29
Optimism	57	3	3	18.0	15.0	0.67	0.48
Resilience	64	5	2	22.8	17.8	0.78	0.56
TOTAL	**199**			**18.7**	**14.4**	**0.94**	**0.75**

Source: compiled by the authors

Table 6
T-test for average reactions by primary emotion (w/o outliers)

	Empowerment	Excitement	Gratitude	Optimism	Resilience
Resilience	**Yes**	**Yes**	No	No	
Optimism	**Yes**	**Yes**	No		
Gratitude	No	No			
Excitement	No				
Empowerment					

Source: compiled by the authors

Table 7
T-test results for average reposts by primary emotion (w/o outliers)

	Empowerment	Excitement	Gratitude	Optimism	Resilience
Resilience	**Yes**	No	No	No	
Optimism	**Yes**	No	No		
Gratitude	**Yes**	No			
Excitement	**Yes**				
Empowerment					

Source: compiled by the authors

statistically significant differences. Facebook posts that signal resilience and optimism (with the average of 17.8 and 15.0 reactions per post respectively) receive significantly more reactions as compared to the posts that communicate empowerment and excitement (with the average of 10.4 and 10.8 reactions per post respectively). There are no statistically significant differences for other pairs. The results confirm the initial finding that the messages of resilience produce a stronger response and add optimism as another category of messages that seems to resonate stronger with the audience. Furthermore, after adjusting for the outliers the lower performing category of empowerment posts looks very similar to the posts that signal excitement. In short, messages of resilience and optimism seem to elicit a stronger response than the posts that primarily communicate empowerment and excitement.

Performing comparisons of reposts on the data without outliers confirms the previously established result – messages of empowerment are reposted more often than posts from any other category. This result is statistically significant. Interestingly, the total number of reactions is higher for the posts that are classified as messages of resilience and optimism relative to the empowering posts. More research is needed to understand

why the posts that are more likely to generate a reaction are less likely to be reposted and vice versa.

Conclusions. This study contributes to the growing body of research on sentiment analysis and its applications in social media communication. As sentiment analysis continues to evolve, incorporating multimodal approaches and leveraging advancements in AI and NLP, businesses that effectively utilize these tools will be better equipped to make informed decisions and adapt to the ever-changing digital landscape.

In this paper we examined Facebook posts of the American Chamber of Commerce in Ukraine to see if the primary emotion of the post (as determined by AI-driven algorithm) is related to the effectiveness of the post as measured by the number of reactions and the number of reposts. Ther results of this research can be used by various organizations that seek to improve their communication approach in a way that maximizes audience engagement and organization's impact.

Two major results are as follows: (1) Facebook posts that signal resilience and optimism receive significantly more reactions as compared to the posts that communicate empowerment and excitement. In general, the messages of resilience and optimism are associated with approximately 40–70% higher number of total reactions; (2) the posts that are classified as displaying empowerment as a primary emotion are reposted more often than posts from any other category. Overall, the messages of empowerment were 2.3–6 times more likely to be reposted. It's important to note that the absolute differences in average repost rates are small as they range from 0.29 for gratitude post to 1.73 for empowerment posts.

In conclusion, messages of resilience and optimism seem to elicit a stronger response (as measured by the total number of reactions) than the posts that primarily communicate empowerment and excitement. On the other hand, posts that communicate empowerment are more likely to be reposted relative to all other categories of posts.

More research is needed to better understand the relationship between the emotion elicited by the post and the effectiveness of the communication as determined by measurable statistics. In that regard future research should (1) compare human-driven and AI-based mechanisms of determining primary emotion to create reliable systems of understanding human emotion based on textual data; (2) control for additional factors that influence audience's engagement to better understand the role of emotion in effective communication; (3) consider tracking the real-world engagement indicators (e.g. donations, deciding to attend an in-person event) as opposed to virtual ones (e.g. likes, reposts, comments).

Sentiment analysis has evolved from its early roots in public opinion analysis to become an indispensable tool for organizations in the digital age. The advancements in AI and NLP have enabled the development of sophisticated sentiment analysis techniques that can process vast amounts of data and provide valuable insights. As the demand for sentiment analysis continues to grow, businesses that effectively leverage these tools will be well-positioned to make informed decisions and stay competitive in their respective markets.

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