



# Profiling Media Outlets and Audiences on Facebook: COVID-19 Coverage, Emotions and Controversy

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**Keywords:** Social Media, Facebook, Covid-19, Media Coverage, Audience, Emotion Detection, Controversy.

**Abstract:** The outburst of the COVID-19 pandemic was accompanied by a steeply rise of worldwide media coverage of the phenomena, in which social media were deemed as critical platforms and became a popular place to receive and share information, as well as express personal views. In this paper, we present the preliminary results of an ongoing work devoted to analysing the media coverage of the COVID-19 outburst in Portugal (March-May 2020), the subsequent emotional engagement of audiences and the entropy-based emotional controversy generated. Using a cross-sectional descriptive methodology, we analyse the activity of the three major news outlets in the country for the category of general news. Our results reveal three distinct profiles of media coverage, negativity as the core engine for interacting with news and spreading information, negative and volatile Facebook reactions (“Angry”, “Haha” and “Wow”) as main inputs for controversy, prevailing on COVID-19 news, and a general tendency of audiences to share controversial news.

## 1 INTRODUCTION


The SARS-CoV-2 virus wielded from Wuhan in December 2019. The World Health Organization (WHO) later confirmed 41 cases and one death on 12<sup>th</sup> January, 2020, and by 11<sup>th</sup> March a global pandemic was declared. Since then, the world has been transformed into a highly infected environment with the community-sustaining transmission. Daily activities were halted or limited across the globe, and people were confined to their homes in an unprecedented circumstance, totally unprepared and unsure of how the crisis would unfold. The stay-at-home movement drove news outbreaks into social media, where viewers had quick access to material that would have been otherwise unavailable via conventional means.


Social media platforms have been transforming the journalism business dramatically in recent years (Ferrucci, 2020; Poell, 2020). While the news industry conventional value generation process has been company-centric and self-contained, with little contact with consumers, the consumer value creation in the social era is part of a larger transformation of

the media and society (Serrano, Greenhill, & Graham, 2015). Network journalism is a structural concept that spans the global journalistic sphere, affecting journalists, organisations and audiences, as the journalistic narrative began to rely on audience participation in a public and immediate manner (Dalmaso, 2017). As stated by (Castells, 2004), we currently live in an informational and networked society as a result of the digital and global communication era.

Moreover, pandemics pose collective health dangers but also daily challenges for mental and public health. Strong (1990) states that every epidemic causes three social epidemics: fear (being a carrier of the illness), morality (moral reactions to the epidemic itself, which may be good or bad), and action (rational or irrational changes in daily habits in response to the disease). He also emphasises that these are produced by language and gradually nourished by it via different social interactions.

People's expression of views, emotional state and how they react to a subject may be used to assess the effect of events and news on their life. Collective emotions arise when a large number of people share

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one or more emotional states, which tends to happen in online communities (Kappas, 2017), and they can spread like a virus (Ferrara & Yang, 2015). Moreover, collective feelings tend to last longer than individual emotional responses (Garcia, Kappas, Küster, & Schweitzer, 2016), amplifying the extent of a crisis. Thus, understanding the behaviour of the general population may help identify abnormal affective dynamics, which have even been associated with mental illnesses like depression (Koval, Pe, Meers, & Kuppens, 2013; Su et al., 2021).

In this context, social media were deemed critical platforms and became a popular place to receive and share news updates and express personal views on the pandemic. With the enormous influx of health, normative, political, and social information, social media rapidly became the venue to which communication and engagement converged, fostering the sharing of thoughts and emotions. For this reason, it has also become a thriving field for understanding how people cope with the crisis and react to uncertainty as a window into the current social landscape.

In this paper, we present the preliminary results of an ongoing work devoted to profiling news outlets in Portugal, based on the media coverage of the COVID-19 outburst (March-May 2020), the emotional engagement of audiences and the entropy-based emotional commotion generated, which is translated in the controversy produced around the phenomena.

## 2 BACKGROUND

In this section we briefly refer to the media coverage of COVID-19, the use of click-based reactions as proxies to analyse public emotions and emotion-based controversial news on social media.

### 2.1 COVID-19 Media Coverage

The media is an essential link between science and society since citizens use mass media to inform their attitudes, views, and behaviour. Peoples' views about the epidemic's origins, attitudes about suitable governmental solutions, and general politicisation of the situation have been shown to be significantly influenced by media coverage of the pandemic (Bolsen, Palm, & Kingsland, 2020; Pearman et al., 2021).

Pearman et al. (2021) reported on a steeply rise in worldwide media coverage of COVID-19 events in 102 high-circulation newspaper sources across 50 countries around the world, as other pressing matters,

such as climate change, dropped drastically. The authors also state that, despite the fact that the COVID-19 epidemic continues to spread quickly across the world, its media coverage has diminished since the first flurry of attention it got at the start of the crisis in early 2020. Oliveira, Sequeira, Oliveira, Silva, and Mesquita (2021) also confirm the same pattern in Portugal, stating that media coverage remained relatively low after the first wave of the pandemic, even as the country passed through the second, and even most severe, the second wave of infections. As argued by the authors, we believe that this is a reflection of the normal and expected variation of the attention given to the public issue, as it is explained by the issues-attention cycle model proposed by Downs (1972).

The issue-attention cycle refers to the fluctuations of public or media attention given to a particular topic (Downs, 1972), and includes five stages. The first is the pre-problem phase when an issue does not get much public notice. Only a few individuals, like specialists or interest groups, are aware of it. In the second phase, public awareness grows, and a time of alarming discovery may ensue. But this is frequently coupled with the idea that taking action would fix the issue. The third stage occurs when individuals realise that addressing the issue is bigger and more resource-intensive than they thought. The fourth phase is characterised by a gradual loss of public attention and a sense of detachment, even though the issue persists. In the last phase, issues are replaced by new ones, causing "spasmodic recurrences of interest" (Downs, 1972, p. 39).

As devised by Downs, the issues-attention cycles applies both to the media coverage of news and to the interest and engagement of audiences with those same issues, as they can evolve at different paces.

### 2.2 Social Media Emotions

Social media emotions have been increasingly used to gain better insights into the audiences' behaviour.

Emotion detection involves categorising text into several emotion categories. Some studies in this domain have identified sentiment analysis and emotion identification under sentiment analysis, but they are different (Balahur, 2013). Emotions are more expressive than sentiments since they do not need a feeling to exist (Liu, 2012; Wang & Pal, 2015).

Emotion models may be dimensional or categorical (Wang & Pal, 2015). Valence, arousal, and dominance are three temporal dimensions of the dimensional models (Ekkekakis, 2013). A contemporary example is Pellert, Schweighofer, and

Garcia's model of emotional dynamics on social media (2020). The most well-known categorical emotion model includes the emotions anger, disgust, fear, happiness, sadness, and surprise (Ekman, 1992). The author sees emotions as distinct, instinctive reactions to global, cultural, and personal events (Ekman & Cordaro, 2011). Several studies have utilised Ekman's work to assess public mood by automatically classifying social media content. For example, Ofoghi, Mann, and Verspoor (2016) studied Twitter emotions linked to Ebola, and Li et al. (2020) studied cultural emotional disparities between America and China to portray public affection dynamics during COVID-19.

Giuntini et al. (2019) and Oliveira et al. (2021) believe that the attribution of emotions and polarity suggests that there may be a connection between the emotions felt and the reactions exhibited in the virtual world.

On Facebook, users often utilise emoticons in posts, chats, and comments to convey more meaning without having to write. Emoticons are tiny pictures or combinations of diacritical symbols designed to replace nonverbal components of communication (Giuntini et al., 2019). Emoticons have become the most popular way to communicate feelings on social media (Oleszkiewicz et al., 2017), and several studies have built upon emotions and emoticon reactions on social media (such as Cazzolato et al. (2019); (Giuntini et al., 2019; Tian, Galery, Dulcinati, Molimpakis, & Sun, 2017).

Giuntini found significant links between the set of fundamental emotions and the Facebook click-based reactions set. For instance, "Angry" means angry, "Wow" means surprised, "Sorrowful" means sad, and "Love" means pleasure. "Like" is ambiguous in terms of polarity and sentiment. Fear is the only fundamental emotion that has no corresponding visible reaction (Giuntini et al., 2019). However, click-based responses remain an underused resource in social media research, despite quick-draw, ready-made expressive features are becoming more common across various platforms, attracting research interest in recent years (Freeman, Alhoori, & Shahzad, 2020).

### 2.3 Controversy on Social Media

It is known that the media attention has been disproportionately directed toward COVID-19 news, with little consideration for how the pandemic-related media coverage might influence people's mental health (Su et al., 2021). Some of the most recent risks and potential dangers of social media communication

have been aggravated by the tremendous spread of COVID-19 news and information. In fact, along with a pandemic caused by a lethal virus, the globe has been experiencing an "infodemic", as defined by the World Health Organization (Organization, 2020, 2021). This refers to the epidemic of misleading or incorrect information spreading rapidly via social media's fertile ground, fuelled by the fear, worry, and uncertainty generated by this new danger.

The tremendous number of efforts devoted to combating fake news, the creation of international alliances (like Poynter) and the growing cooperation between journalists and social networks have been ensuring that, at least, the legacy media outlets do not spread disinformation nor misinformation.

The spread of fake news, however, is not the only threat fostered by the COVID-19 infodemic. User-generated content (UGC) remains as one of the main challenges in controlling the spread of fake news (Ferrari, 2020), a challenge that escalates in the spread of hate speech, which requires a lot less creativity and effort from users. Dori-Hacohen, Sung, Chou, and Lustig-Gonzalez (2021) state that healthy online discourse is becoming less and less accessible beneath the growing noise of controversy, mis- and dis-information, and toxic speech.

Controversial heated discussions are a prolific field for hate speech on social media, and according to Dori-Hacohen et al. (2021), controversy is also saliently connected with disinformation. One of the main current challenges of hate speech recognition is the automatic detection of irony (MacAvaney et al., 2019) because people verbalise an idea while implying the opposite meaning; thus, textual features alone fail in recognising the implicit meanings of the discourse.

Irony serves the additional social and emotional functions of projecting emotions like humour or anger, and ironic comments may provoke stronger emotional responses than literal comments (Thompson, Mackenzie, Leuthold, & Filik, 2016). In their research about irony, the authors introduce paralinguistic features (emoticons) to improve the detection of praise and criticism in written messages. Such methods had already been employed by other studies such as Carvalho, Sarmiento, Silva, and De Oliveira (2009) and Derks, Bos, and Von Grumbkow (2008).

More recently, with the expansion of the Facebook like button into a full set of click-based emotional reactions to content, other studies emerged taking advantage of the convenience of the systematised and bulk emotional response that is

promptly captured to study the emotional irony conveyed by the audiences.

This research stream is predicated on the premise that controversial posts divide a community's preferences, garnering both substantial positive and negative responses or polarised towards extremes (e.g. "Love"- "Angry"). As such, these works build on the study of social media click-based emotions such as the one conducted by Freeman et al. (2020), who measured the Pearson correlation coefficients for all reaction pairs in their dataset of scholarly articles published on Facebook; or the work of Tian et al. (2017), who used a K-means to cluster reactions and investigate which reactions were most likely to be seen together on a post in UK, US, France and Germany.

Related research using Facebook reactions as proxies to identify controversy can be found in Sriteja, Pandey, and Pudi (2017), who have used this method for detecting controversial topics during the US Presidential elections 2016. Basile, Caselli, and Nissim (2017), also followed the same procedure to identify controversy among four major Italian newspapers and one media agency, using an entropy-based model to compute the 'disorderliness' of emotional reactions to posts. Finally, Gray (2020) studied gender bias in the Facebook pages of the United States 2020 Senate candidates, using the exact same method as Basile et al. (2017).

Agile methods for early detection of controversy may be helpful in assisting media outlets, journalists, social networks and fact-checkers in preventing hate speech and disinformation.

### 3 METHODS AND PROCEDURES

This work follows the general approach of quantitative content analysis (Bryman, 2016), and it consists of a cross-sectional descriptive study. We used the Facebook Graph API to retrieve the news posted by the three major daily news providers in Portugal, Sic Notícias (1,717,794 followers), TVI 24 (1,088,453 fans) and CMTV (580,703 followers) between the 1st March and 31st May, 2020. The choice of news outlets was based on two principles: a) high visibility, expressed through a high number of fans, and b) have a generalist editorial line, with a broad spectrum, not segmented for specific audiences. The timeframe for the analysis was delimited according to the first mandatory confinement imposed by the government, including the moment of detection of the first case of infection (first week of March 2020) and the announcement of

the first measures of deconfinement (May 2020). Thus, the full period of analysis consists of three months.

The dataset is composed of 30,607 news posted on the network, for which we collected the created date and time, link (news external URL), message (text included in the post), link text (the title of the news), description (news lead), Likes, Comments, Shares, Love, Wow, Haha, Sad, Angry and Care. We refer to "Like" (somewhat a default type of interaction with content), "Comment" and "Share" as forms of interaction with content; and to "Love", "Wow", "Haha", "Sad", "Angry" and "Care" as reactions, in the sense that these convey emotional responses. The dataset of news was manually categorised into two subsets: COVID-19 news and Other news and their subdomains (e.g. politics, education, prevention, etc.). For this stage of the research, we refer only to the top-level binary categorisation of COVID-19 and Other news, as our first set of goals is to a) characterise and compare the media coverage given to COVID-19 in news outlets, b) explore the public response to these news, namely their emotional state and c) identify the most controversial news and their content.

For the analysis of media attention and audiences' emotional involvement, we follow the general principles of the issues-attention cycles proposed by Downs (1972) and the detection of emotions through Facebook's click-based reactions, as used by Giuntini et al. (2019). For the analysis of controversial news, we follow Basile et al. (2017) model and compute the entropy (quantitative measure of disorder) of the Facebook's reaction set per post as a function to determine controversy.

Table 1 provides an overview of the data collected, depicting the post type for each news outlet and topic of news - COVID-19 news ("COV") and Other news ("Oth").

Table 1: Total posts per outlet and category.

Type	SICNotícias		TVI24		CMTV	
	COV	Oth	COV	Oth	COV	Oth
Link	11866	5760	4013	3966	1935	1941
Video	3	99	30	134	281	217
Photo	0	21	10	325	0	1
Status	0	3	0	0	0	2
NSub	11869	5883	4053	4425	2216	2161
NTot	17752		8478		4377	
N%	66.86	33.14	47.81	52.19	50.63	49.37

For all news outlets, “Link” is the most frequent post type, which is consistent with the current practice of sharing news links directly from their news portals. Photos and videos are rarely posted and are more frequent for CMTV and TVI24. The news outlet with the highest number of posts, i.e., the highest communication investment, is Sic Notícias, four times higher than CMTV and two times higher than TVI24. Additionally, this is the entity with the highest rate of COVID-19 news posted in the trimester (66.86%), followed by CMTV (50.63%) and TVI 24 (47.81%).

## 4 RESULTS

In this section, we present the results concerning the evolution of the media attention given to COVID-19 news, the emotional response from the audiences and the detection of emotion-based controversy. Findings are discussed in this section for a matter of simplicity.

### 4.1 Media Coverage

The analysis of the media attention given to COVID-19 news permits the contextualisation of the evolution of the public emotional response.

Figure 1 illustrates the evolution of the media attention given to COVID-19 and Other news during the fourteen weeks of the trimester for the three news outlets under analysis. For the sake of data visualisation quality, we present the corresponding audiences’ emotional engagement with the news side by side, depicting it in Figure 2, for the same trio of outlets. Five key moments are marked to provide a clearer insight on the national context regarding the (1) first case of infection in the country (2<sup>nd</sup> March), (2) first confinement measures (12<sup>th</sup> March), (3) declaration of the State of Emergency and total lockdown (19<sup>th</sup> March), (4) declaration of the State of Calamity and the first stage of deconfinement measures (3<sup>rd</sup> May), and (5) second stage of deconfinement measures (17<sup>th</sup> May).

It is possible to observe an overall tendency of confirmation of the issues-attention cycles proposed by Downs (1972), which is usually represented by a bell-shaped curve with a stretched right side to indicate that the subject takes more time to fade away than the one it took to reach its peak of interest. This stretched right side might then suffer from spasmodic occurrences of interest or events that lead to slight rises (small bumps), which never ascend to the first stance of alarming discovery. This is particularly visible in Figure 1c, concerning CMTV, where two

spasmodic occurrences happen in weeks 7 and 12, and in Figure 1b, concerning TVI24, in weeks 8 and 9. For the trio of news outlets, the stage of alarmed discovery happens in week 4, which includes all communication and news regarding the declaration of the State of Emergency and total lockdown. The reason why the percentages of news in week 14 for all outlets is very low is that this week only refers to one day, 31st May.

Despite this overall tendency, it is also possible to observe three distinct behaviours in terms of the intensity and duration of the attention given to COVID-19 news. CMTV (Figure 1c), despite having published the lowest absolute amount of COVID-19 news (Table 1) was the one with the highest percentage of media coverage of the phenomena, reaching a peak of nearly 14%, in a shorter time span (seven weeks straight), followed by a drastic reduction of coverage. We believe that this is consistent with the reputation for sensationalism that precedes this outlet, which is also enhanced by the fact the media coverage began later and with a more drastic increase.

Both TVI24 (Figure 1b) and Sic Notícias (Figure 1a) present a more gradual decline of media coverage keeping, with variation between 6% and 10% for nine weeks straight, after which the Other news surpasses the volume of COVID-19 news. It is also worth noticing that TVI24 (Figure 1b) was the only outlet with a lower discrepancy between the coverage of the COVID-19 phenomena and Other news.

### 4.2 Interaction and Emotional Engagement

Figure 2 illustrates the evolution of audiences’ interaction with the news (“Comments” and “Shares”) and their emotional engagement, computed according to the click-based reaction set of Facebook (“Love”, “Wow”, “Haha”, “Sad” and “Angry”). We intentionally left out “Likes”, as previously explained, and the reaction “Care”, because it was introduced mid-period in the first week of April, thus not permitting consistent comparisons.

Before contextualising the audiences’ emotional engagement in the trimester, we analyse the emotional profile of the audiences per news outlet. Table 2 provides an overview of the average interaction and emotions per outlet and news topic, highlighting the statistically significant differences detected by a one-way ANOVA test. An overall prevalence of sadness and anger is also visible in Figure 2.

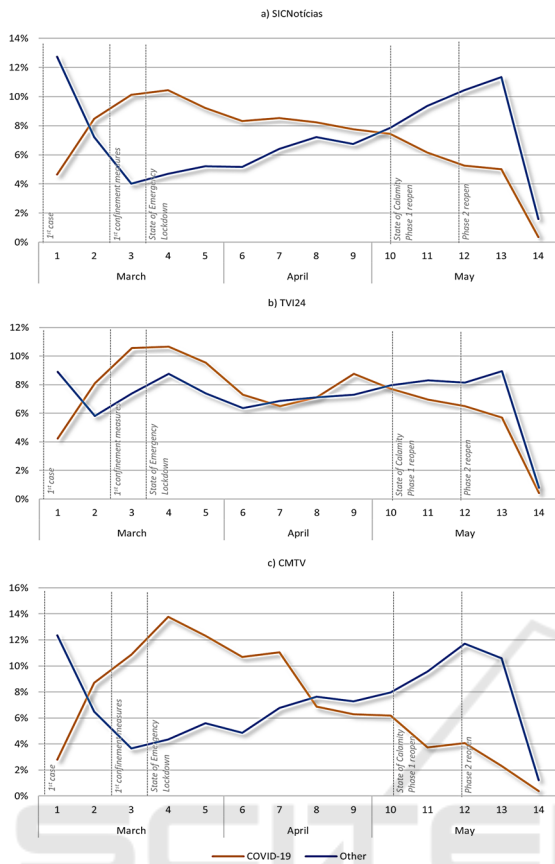


Figure 1: Evolution of the percentage of COVID-19 news and Other news per outlet – a) SICNoticias, b) TVI24, c) CMTV.

Table 2: Average interaction per outlet and news topic.

	SICNoticias		TVI24		CMTV	
Type	COV	Oth	COV	Oth	COV	Oth
Love	10	6	11	45	9	8
Wow	9	4	14	11	11	11
Haha	6	8	6	10	6	7
Sad	35	14	57	55	50	57
Angry	12	9	16	27	20	35
Com.	46	32	52	86	42	58
Shares	89	28	119	149	119	98

TVI24 is, undoubtedly, the news outlet generating the highest emotional commotion among audiences, for almost all types of reactions, [“Love” ( $p < .001$ ), “Wow” ( $p < .001$ ), “Haha” ( $p < .005$ ), “Sad” ( $p < .001$ )], except for “Angry”, which predominates in CMTV’s audiences ( $p < .001$ ). This commotion of emotions is quite visible in Figure 2b, for the entire period. The news outlet is also the one registering the highest average of “Comments” ( $p < .001$ ) and “Shares” ( $p < .001$ ) per post.

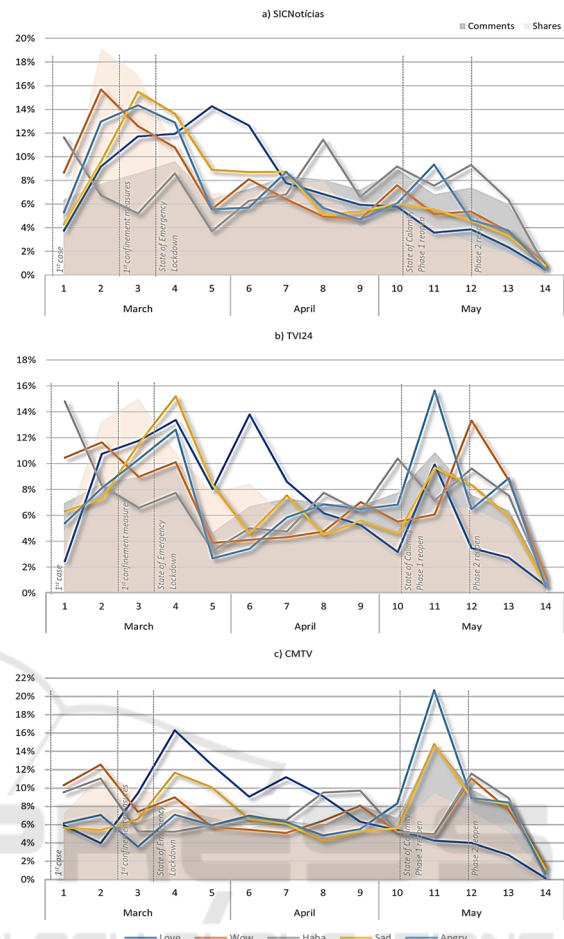


Figure 2: Evolution of the percentage of Facebook emotions, comments and shares – a) SICNoticias, b) TVI24, c) CMTV.

We deepened this analysis to find out if the variance of emotional expression is related to the presence of COVID-19 news or not. A series of t-tests were applied, and results are summarised in Table 3, where significant differences have been highlighted.

Table 3: Average emotions and interaction per outlet and news topic.

	SICNoticias		TVI24		CMTV	
Type	COV	Oth	COV	Oth	COV	Oth
Love	10.03	6.05	11.01	44.51	9.35*	7.63
Wow	9.33	4.49	13.61	11.35	10.57	10.86*
Haha	6.40	8.32	6.21	10.22	5.50	7.40*
Sad	34.60	13.92	57.33*	54.61	50.31	56.93*
Angry	12.12	9.01*	15.71	27.22	20.46	35.39
Com.	46.20	32.23	51.86	86.28	42.11	57.74
Shares	88.75	27.61	118.80	148.56*	118.81	98.28

\*n.s.

In the case of Sic Notícias, the emotional reactions “Love”, “Wow” and “Sad” are significantly associated with COVID-19 news ( $p < .001$ ), as well as the interactions “Comments” and “Shares” ( $p < .001$ ). “Haha” is more present in Other news ( $p < .001$ ). This is quite noticeable in Figures 1a and 2a, as the emotional expression of audiences mirrors the decrease in COVID-19 media coverage. For all news outlets, the sharing behaviour is more frequent in the first 6 weeks of the trimester and commenting is more frequent in the last 6, particularly for CMTV. This is consistent with spreading new information about the COVID-19 outbreak, followed by the public sharing of views after a period of information abundance.

In the case of TVI24, most of the emotional reactions are directed at Other news - “Love”, “Haha”, and “Angry” ( $p < .001$ ). The same occurs with “Comments” ( $p < .001$ ). Surprise, conveyed by “Wow”, is the most common reaction to COVID-19 news ( $p < .05$ ).

In the case of CMTV the only significant differences found reside in audiences sharing mainly COVID-19 posts ( $p < .05$ ), and commenting ( $p < .001$ ) and expressing anger ( $p < .001$ ) on Other news. For the remaining emotions, there are no statistically significant differences, as they are expressed towards both types of news.

It was only for Sic Notícias that COVID-19 news have expressively modelled the emotional attitude of audiences. The opposite applies to TVI24, in which Other news are more reactive. Emotional behaviour is more dispersed in CMTV, with a tendency of increased verbalisation (“Comments”) and emotional expression, particularly anger towards Other news.

This is, we believe, totally in line with the journalistic discourse adopted by each of the news outlets. For instance, in Figure 1c we observe that CMTV has an isolated shorter sequence of events on the news. On the audience side, we notice a predominance of sharing (spreading) of COVID-19 news/information, which is typical in the stages of alarmed discovery. For TVI24, the coverage of COVID-19 news was not so distinct as in the other outlets, with Other news never being overly neglected. On the audience side, most of the reactions tend towards Other news, as well as the “Comments”, while only the surprise (“Wow”) is mainly expressed towards COVID-19 news. In Sic Notícias, the most predominant, persistent, and extended coverage of COVID-19 news has resulted in a significant emotional expression of audiences’ love, surprise and sadness towards this type of news (except for laughter).

This leads us to ascertain that the media coverage and journalistic discourse greatly impact the audiences’ emotions and are provided with the ability to prolong sadness or joy, hope or frustration, depression or wellbeing, in any ordinary context, but especially in periods of crisis when people are more sensitive.

Given the three distinct emotional profiles of audiences, we further explored the correlations among emotions and interactions per news outlet, to determine how they mutually reinforce each other and assess their polarity. The following significant Pearson correlations were found ( $p < .01$ ).

#### Sic Notícias

- Moderate: Wow-Sad ( $r = .572$ )
- Moderate: Haha-Comments ( $r = .580$ )
- Moderate: Angry-Comments ( $r = .481$ )
- Weak: Sad-Angry ( $r = .324$ )

#### TVI24

- Strong: Love-Comments ( $r = .724$ )
- Strong: Love-Shares ( $r = .703$ )
- Moderate: Share-Comments ( $r = .531$ )
- Moderate: Sad-Shares ( $r = .436$ )
- Weak: Wow-Sad ( $r = .375$ )
- Weak: Angry-Comments ( $r = .345$ )
- Weak: Sad-Comments ( $r = .312$ )
- Weak: Sad-Angry ( $r = .275$ )
- Weak: Haha-Comments ( $r = .263$ )

#### CMTV

- Moderate strong: Angry-Comments ( $r = .643$ )
- Moderate: Wow-Shares ( $r = .588$ )
- Moderate: Comments-Shares ( $r = .558$ )
- Moderate: Sad-Shares ( $r = .533$ )
- Moderate: Angry-Shares ( $r = .530$ )
- Moderate: Sad-Angry ( $r = .471$ )
- Moderate: Sad-Comments ( $r = .445$ )
- Weak: Wow-Sad ( $r = .366$ )
- Weak: Haha-Comments ( $r = .342$ )
- Weak: Wow-Comments ( $r = .328$ )

Among the three news outlets, there is a prevalence of association between negative emotions (the pairs Sad-Angry and Wow-Sad) and between these and the highest interaction rates with the news (comments and shares). Negativity appears as the overall main engine for interacting with news and spreading information. There is one exception in TVI24, in which interaction is also strongly correlated with positivity regarding Other news (the pairs Love-Comments and Love-Shares). The pairs Angry-Comments and Haha-Comments are also evident among the trio of outlets.

Laughter and surprise, conveyed by the click-based reactions “Haha” and “Wow” consist of

volatile emotions, as they can acquire distinct polarity according to other prevalent emotions they are paired with. For instance, the pair Haha-Love can translate into passion, affection, friendship, happiness, amusement, joy and fun.

On the other hand, the pair Haha-Angry can translate into rage, fury, frenzy, indignation, scorn, disdain, cynicism, and irony. What we observe in the above analysis of correlations is the incidence of these latter types of associations, in which emotional volatility tends towards negative polarity. We also believe that this indicates the presence and/or prevalence of sarcasm, generally defined as content that attracts both positive and negative feedback (Hessel & Lee, 2019), or in our case, falling into two or more classes of emotion, which may or may not be opposed in terms of polarity.

Since our research at this stage is mainly focused on revealing cues for profiling the news outlets, we further explore their controversy profiles, considering the COVID-19 and Other news.

### 4.3 Controversy

Following Hessel and Lee (2019) methodology to determine controversy, we computed the entropy of the set of Facebook reactions per post, according to entropy formula shown below, where  $x_i$  is the number of each reaction for a post, and  $p(x_i)$  is the ratio of that reaction to the total reactions on a post.

$$H(X) = - \sum_{i=1}^n P(x_i) \log P(x_i) \quad (1)$$

We consider that if the users' reactions fall under two or more emotion classes with high frequencies, the controversy of a news item is higher; thus, the higher the entropy, the higher the controversy. Examples are provided in Table 4, for better clarification.

Table 4: Examples of variation of entropy per post.

	Love	Wow	Haha	Sad	Angry	H
a)	32	0	0	0	0	0
b)	12	12	13	9	9	2.30
c)	26	80	26	62	222	1.85

Users' differing responses indicate that a text is likely to be controversial, as shown by the high values of entropy ( $H$ ), as demonstrated in examples b) and c). The overall profile of controversy per news outlet, based on the entropy means is presented in Table 5.

Considering the overall average of entropy for the full news dataset, and according to our previous reasoning, Sic Notícias is the entity producing the news with the least controversial potential (below

average). The news outlet TVI24 has the highest overall average entropy (.993), followed by CMTV (.929) and SICNotícias (.795) ( $F(30604)=303.870$ ;  $p<0,001$ ). Both TVI24 and CMTV present above-average entropy values, and TVI24 leads in the amount of controversy produced.

Table 5: Overall profile of controversy per news outlet, based on entropy means.

	N	Mean	SD	Max
SICNotícias	17752	.795	.648	2.321
TVI24	8478	.993	.611	2.321
CMTV	4377	.929	.615	2.251
Total	30607	.869		2.321

Our overall entropy average is slightly lower than the one reported ( $H=.939$ ) by Basile et al. (2017), who analysed four Italian newspapers and one news agency. The Italian newspaper with the highest average of entropy is *Il Gionale* ( $H=1.127$ ), an openly biased right-wing newspaper. Although this was not a feature in the detection of sarcasm in the Italian case, it is curious to notice that the two Portuguese media outlets with higher entropy averages are also (not openly) right-wing news outlets, according to the European Journalism Observatory (Cardoso, Couraceiro, & Ana, 2019).

This reality, however, might be altered by the COVID-19 phenomena, as our dataset dates back to the outburst of the pandemic in Portugal. For this reason, we believe that it is relevant to analyse the amount of controversy specifically generated around COVID-19 news, which we depict in Table 6.

We found statistically significant differences between the average entropy among the types of news and news outlets. On average, COVID-19 news have higher entropy (.895) than Other news (.831) ( $t(26112)=8.529$ ;  $p<0,001$ ).), as depicted in Table 6. However, since we try to profile the news outlets, we analysed these differences within their subsets of news, also included in Table 6.

Table 6: Average entropy per news type and outlet.

Type	Outlet	N	Mean	Max	MeanTot
COVID-19 news	SICNotícias	11869	.855	2.321	.895
	TVI24	4053	.997	2.311	
	CMTV	2216	.924	2.252	
Other news	SICNotícias	5883	.674	2.252	.831
	TVI24	4425	.989	2.322	
	CMTV	2161	.934	2.246	

A set of independent samples t-Test only confirms significant differences of entropy between news categories for Sic Notícias (higher in COVID-19) and CMTV (higher in Other news), although with no significant differences for CMTV.



Still, the overall averages of entropy are relevant for both categories of news and overall more prevalent on COVID-19 news, namely when considering other entropy values reported in the literature (Basile et al., 2017; Gray, 2020). Thus, we analysed which Facebook reactions mostly contributed to the formation of controversy. To do so, we annotated the dataset considering as “Controversial” all news with entropy values one standard deviation above the mean entropy value for each given news outlet (c.f. Table 5). The results show significant differences in the average distribution of Facebook reactions and interactions per controversial and noncontroversial news (t-Test), which we depict by news category in Table 7.

Both for COVID-19 and Other controversial news, the most prevalent reactions, in decreasing order of average ( $p < .005$ ):

- “Angry”
- “Haha”
- “Wow”

The remaining emotions, “Sad” (47.36) and “Love” (11.11) are significantly associated with noncontroversial news ( $p < .005$ ).

Table 7: Average of reactions and interactions per (un)controversial news.

	COVID-19 news		Other news	
	Contr.	Uncont.	Contr.	Uncont.
Love	6.35	11.11	8.70	22.43
Wow	13.27	9.74	12.30	7.10
Haha	15.02	4.08	18.79	6.66
Sad	18.22	47.36	17.02	39.91
Angry	22.68	11.79	24.47	19.08
Comments	90.08	36.33	102.81	45.59
Shares	124.78	92.81	81.99	82.95

Considering the interactions with the news, “Comments” are always substantially higher in controversial news ( $p < .001$ ), but the average of “Shares” is significantly higher for COVID-19 controversial news.

This means that controversy is mainly built upon negative (“Angry”) and volatile emotions (“Haha”, “Wow”), which reinforces the notion of irony. Considering Hessel and Lee (2019) thoughts on controversy not being necessarily a bad thing, namely in bringing up a point that warrants a spirited debate that can improve community health, we believe this not to be the case. In fact, irony rarely permits the development of a civilised and constructive debate. However, this requires, for instance, content analysis over the comments posted in controversial news for further elaboration.

We also observe that the COVID-19 controversial news are the ones harvesting higher “Shares”, i.e., they consist of the news with the highest reach and potential of spread of controversy on social media. This contradicts Freeman et al. (2020), who state that content that is more likely to inspire a negative reaction from users is less likely to be shared. Below, we present the top five COVID-19 news with the highest number of “Shares”, which curiously were all posted by CMTV:

- “The heat takes the Portuguese people to the beaches the day the coronavirus pandemic was decreed.”
- “School deans urge early Easter holidays to combat coronavirus.”
- “Disrespect quarantine is punishable by five years in prison.”
- “761 inmates released since Saturday during the State of Emergency.”
- “Australian minister claims coronavirus was created in a lab.”

At this stage of research, not having conducted effective content analysis, we speculate that we will find hate speech towards people not complying with confinement measures (non-compliance), towards the educational system and/or educational professionals, towards minorities (criminal offenders) and towards politics or public figures.

## 5 CONCLUSIONS

We presented preliminary findings from an ongoing study of profiling Portuguese media outlets, based on the media coverage of the COVID-19 outburst (March-May 2020), the audience emotional engagement, and the entropy-based emotional commotion generated, manifested in emotional controversy.

Our results show three profiles of COVID-19 news coverage: (1) one more consistent (Sic Notícias), least controversial, with less drastic fluctuations of attention, which resulted in the significant emotional expression of audiences’ love, surprise and sadness; (2) another more diffuse with approximate levels of attention to COVID-19 news and Other news (TVI24), which generated higher emotional commotion among audiences towards COVID-19 unrelated news; (3) and a more spasmodic and reactive profile of COVID-19 related and Other news, which translates into the predominance of anger among audiences (CMTV).

We have also uncovered a prevalent association between negative emotions (the pairs Sad-Angry and Wow-Sad) and between these and the highest interaction rates with the news, mainly through comments and shares. We believe that this is a clear indication that negativity is the main engine for interacting with news and spreading information.

Finally, we have detected high levels of controversy among news outlets and among categories of news. Controversy is more prevalent in COVID-19 related news and is mostly fostered by negative and volatile Facebook reactions (“Angry”, “Haha” and “Wow”)

Controversial COVID-19 news were also the most shared news on Facebook during the outburst of the pandemic in Portugal.

These results have implications for media outlets, social media managers and society at large. The expedite methods of analysis used in this work encourage the persistent monitoring of social media to prevent the large spread of hate speech and unhealthy mindsets in such a way that is immediately recognisable by media outlets and people navigating news content on social media.

This work is not without its limitations. We focus on presenting preliminary tri-folded findings for profiling behaviour; thus, we have favoured diversity over depth in some stances. Future research stages are set to include the content analysis of the users' comments to the news providing effective insights on the nature of the speech surrounding the identified controversial news.

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