

# COVID-19, Social Distancing and Social Media: Evidence from Twitter and Facebook Users in Korea

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## ABSTRACT

The novel Coronavirus disease 2019 (COVID-19) is unprecedentedly changing the world since its outbreak in late 2019. Using the collected the data related to COVID-19 and the social media user data from a mobile application market research agency from January 25 to April 7, this study empirically examines the effect of the number of confirmed COVID-19 cases worldwide, the number news COVID-19, and the enforcement of social distancing measures on the daily active users (DAU) of two social media services – Twitter and Facebook – in South Korea. There are three important findings from the results of econometric analysis. First, the number of confirmed COVID-19 cases worldwide has a negative effect on the DAU of social media. Second, the number of COVID-19 news is negatively associated with the DAU of social media. Finally, the implementation of social distancing measures has no significant effect on the DAU of the social media. Theoretical implications and managerial guidelines are also discussed.

*Keywords:* Coronavirus, COVID-19, Traglc Event, Social Media, Social Distancing

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## I . Introduction

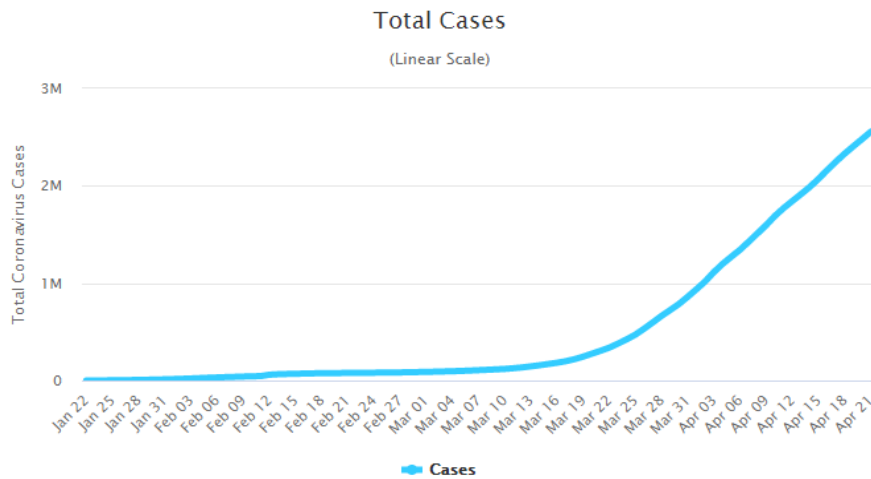
“Humankind is now facing a global crisis. Perhaps the biggest crisis of our generation. The decisions people and governments take in the next few weeks will probably shape the world for years to come. They will shape not just our healthcare systems but also our economy, politics and culture. (···)”

(Yuval Noah Harari, 2020)<sup>1)</sup>

The novel Coronavirus disease 2019 (COVID-19) is unprecedentedly changing the world since its outbreak in late 2019. Regarding its severity, the World Health Organization (WHO) declared the worldwide outbreak of COVID-19 a pandemic on March 11, 2020. In terms of its infectivity and fatality, it has been reported that there are over 2,720,000 confirmed cases of COVID-19 and over 190,000 deaths world-

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<Figure 1> Total COVID-19 Cases Worldwide

Note: <https://www.worldometers.info/coronavirus/coronavirus-cases/#total-cases>

wide and that there are over 10,000 confirmed cases and 240 deaths in South Korea as of April 24, 2020.<sup>2)</sup> <Figure 1> shows the trend of total COVID-19 cases worldwide since January 22, 2020.

In order to alleviate the speed of spread and reduce the possibility of widespread community transmission, the WHO and governments implemented measures including quarantines, isolations, social distancing, and disruptions to public events. For instance, the government of France banned all indoor public gatherings of more than 5,000 people on February 29, 2020<sup>3)</sup> and it has closed all unnecessary multiplex facilities including restaurants, cafes, and theaters since March 14, 2020.<sup>4)</sup> In the United States, several governors of states including New York, New Jersey, Illinois, and so on, issued stay-at-home order that makes people work at home and closes un-

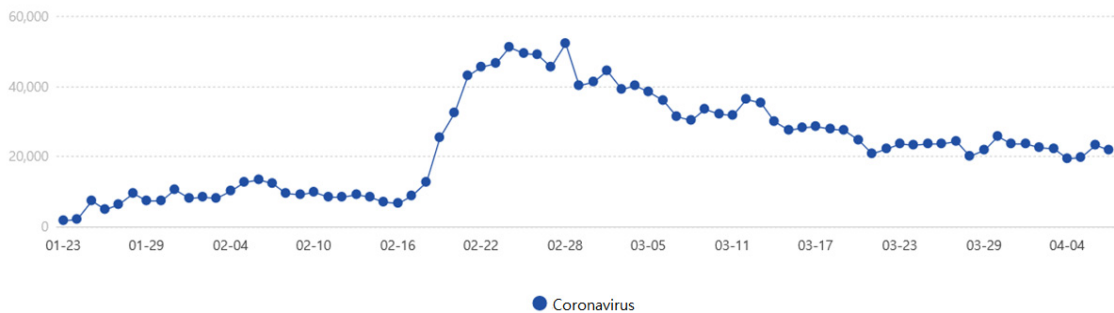
necessary workplaces by force.<sup>5)</sup> In South Korea, the government initiated social distancing measures including restriction of operating indoor gym, religious facilities, and clubs on March 21 2020.<sup>6)</sup>

Due to the governmental measures, people have changed their lifestyles. According to Coronavirus Impact Report by Criteo (2020), consumers in South Korea planned to increase in online activity and decrease in outdoor activity after hearing the news about the spread of COVID-19. Specifically, people would purchase online, watch online streaming videos, and work at home rather than visiting shopping malls and movie theatre, doing exercise at gym, and eating at restaurant. Also, as shown in <Figure 2>, the number of tweets mentioning COVID-19 has increased on social media, indicating that social media is over-cast with mentions about COVID-19.

Changes in lifestyle may also come from the con-

1) Source: <https://www.ft.com/content/19d90308-6858-11ea-a3c9-1fe6fedcca75>  
 2) Source: <https://www.worldometers.info/coronavirus/>  
 3) Source: <https://www.france24.com/en/20200229-france-ban-s-large-public-gatherings-to-slow-coronavirus-spread>  
 4) Source: <https://edition.cnn.com/2020/03/14/world/france-coronavirus-measures/index.html>

5) Source: <https://www.npr.org/sections/coronavirus-live-updates/2020/03/20/818952589/coronavirus-n-y-gov-cuomo-says-100-of-workforce-must-stay-home>  
 6) Source: <https://www.hankyung.com/politics/article/20200320851i>



<Figure 2> Trend of Tweets Mentioning COVID-19

Note: <http://lucy.realsn.com/twitter/twitter>

cern about infection of COVID-19. 66.5 percent of people in Korea are worried that there would be confirmed cases in their neighbourhood, 63.5 percent of people are concerned that they would be the confirmed cases (MOHW, 2020). Concerning about spread and infection of COVID-19, people who suffer from stress can cause mental illness, such as feeling socially isolated, increased levels of distress, or insomnia; increased use of alcohol, tobacco, or drugs; or worsening of chronic health problems.<sup>7)</sup> To relieve stress, it is recommended that people connect with others to talk about concerns and share their feelings.<sup>8)</sup> “Coupled with the governmental measures to alleviate the spread of COVID-19 and the recommendations from CDC to relieve concerns about infection of COVID-19, social media could be a helpful channel to achieve the goal of both sides.”

However, there has been little empirical study that examines the relationship between the outbreak and spread of an epidemic, social distancing measures, and social media usage. As such, this study aims to address this gap and empirically examine the effect of the number of confirmed COVID-19 cases world-

wide, the number of news related to COVID-19, and the enforcement of social distancing measures on the daily active users of the two social media services - Twitter and Facebook - in Korea. The detailed research questions are as follows:

1. How does the number of confirmed COVID-19 cases worldwide affect the DAU of social media?
2. How does the number of COVID-19 news affect the DAU of social media?
3. How does the enforcement of social distancing measures affect the DAU of social media?

To test our research hypotheses, we collected the daily number of confirmed COVID-19 cases worldwide, the daily number of COVID-19 news online, and social media user data, i.e., active daily users of Facebook and Twitter in Korea, from a mobile application market research agency. We conducted econometric analysis to investigate and measure causal relationship between variables. The result shows that the number of confirmed COVID-19 cases worldwide and COVID-19 news have a negative effect on the DAU of social media. On the other hand, the enforcement of social distancing measures has no significant effect on the DAU of social media.

The organization of this paper is as follows: In

7) Source: <https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html>

8) Source: <https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html>

the following section, we review three research streams – tragic events, social media, and social distancing. Then, in the third section, we develop a set of hypotheses about how the number of confirmed COVID-19 case worldwide and the news related to COVID-19 affect social media usage, and how the implementation of social distancing measures affects social media usage. In the fourth section, we explain the research setting including data collection procedures and definition of the variables. In the fifth section, we present results of the data analysis. In the last section, we provide theoretical contributions, managerial implications, limitations of the study, and suggestions for future research.

## II. Literature Review

### 2.1. Tragic Events

Tragedies change people's lives in many aspects. For instance, the terrorist attacks towards the United States on September 11, 2001, not only killed hundreds of people in the airplanes and the Pentagon but also deeply affected millions of other people who watched, heard, and read about the news (Fredrickson et al., 2003). Indeed, early surveys conducted few days after the incident revealed that more than half of the respondents had cried about the tragedy, felt depressed, had insomnia, and had difficulties in performing daily activities (Swanbrow, 2001). The same applies to the Boston Marathon Bombings, a tragic incident that killed three people and injured hundreds of runners during the marathon. As one of the victims expressed, it has altered many peoples' "perceptive of the world and the community". Streets were emptied, public transportations stopped, people became quiet and vigilant, and backpacks were considered

as suspicious objects (Piwowarczyk et al., 2016).

Such changes in peoples' lives are also evident in the cases of epidemic outbreaks, such as SARS and Ebola outbreaks. When Severe Acute Respiratory Syndrome (SARS), a transmissible infectious disease, spread in 2003, researchers have discovered that numerous people suffered from posttraumatic stress disorder (PTSD) and depressions (Hawryluck et al., 2004). The long duration of quarantine and acquaintance or direct exposure to the SARS patients were associated with such psychological distress. It is important to note that, even after the disease was successfully contained, peoples' level of stress and psychological distress sustained without signs of decrease (Lee et al., 2007). Furthermore, in 2014, when Ebola virus spread in the US, researchers revealed that people showed fear of the disease in terms of general distress, contamination cognitions, disgust sensitivity, body vigilance, and anxiety sensitivity-related physical concerns; The distress from diseases has caused people to show a significant level of anxiety and compensatory safety behaviors, such as avoiding taking airplanes (Blakey et al., 2015).

Recently, COVID-19 has brought a significant number of changes in peoples' lives as well. COVID-19 is an epidemic of cases with respiratory infections, which has spread to 129 countries around the world after the first case was confirmed in Wuhan, China, on December 1, 2019 (Casella et al., 2020). As of April 24, 2020, there were over 2,720,000 confirmed cases and over 190,000 deaths caused by the disease.<sup>9)</sup> People were highly recommended to physically distance themselves from others; the WHO insisted that they maintain at least 1 meter from each other.<sup>10)</sup> Due to such protective measures, peoples'

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9) Source: <https://www.worldometers.info/coronavirus/>

10) Source: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>

social lives have been prohibited, too; people had to work at home, could not go to restaurants or shopping malls, and could not meet friends and colleagues after school closures. Moreover, Centers for Disease Control and Prevention (CDC) warned that the outbreak of COVID-19 may put a psychological burden on many people; The stress caused by the disease may change peoples' sleep or eating patterns, worsen the mental health conditions, cause sleep or concentration difficulties, and increase the use of alcohol, tobacco, or other drugs.<sup>11)</sup> As the disease has been prolonged and has become pandemic, the COVID-19 has affected people on a world-level.

Tragic events arouse grief and horror in the social audience, not just the victims (Lattanzi-Licht and Doka, 2004). Indeed, traumas resulting in such events change the structure of the community in which they occur (Zinner, 2013). For instance, September 11 is designated as Patriot Day in the United States and people participate in an annual ritual of mourning. The recent COVID-19 outbreak has also brought changes in the society; Many terminologies and concepts that were unfamiliar to many people, such as "lockdown" or "social distancing", have been widely known to the public (Deb et al., 2020). Many researchers emphasize the increased role of online activities as the one of the most evident changes in Post-Corona Era (Herstatt and Tiwari, 2020). As such, we expect that a tragic event not only affects people's behaviors in offline environment but alters their activities in online environment as well.

## 2.2. Social Media

Social media facilitates peoples' communications;

Users post pictures and videos, write about their thoughts, like, share, comment, send messages, form communities, follow each other, and even buy products on social media platforms (Park et al., 2016). Instead of performing work-related tasks or critically assessing the information, social media users prefer to just connect with their friends and enjoy its entertainment features (Johnson and Kaye, 2015).

After the tragic events, people actively discuss their thoughts and emotions related to the incidents on social media. For instance, Hyvärinen and Beck (2019) reveal that social media users collectively coped with the terrorist attacks of Boston Marathon Bombings. Indeed, studies show that social media enables them to cope with their posttraumatic emotional pains by sharing information about the incidents, memorializing the victims, and sending well-wishes to the affected (Huang et al., 2010). As such, social media platforms provide sanctuaries in which users could alleviate their distress by joining in enjoyable and healing communications.

Nevertheless, COVID-19, the focal event of our study, is quite different from other incidents in terms of its procedures. Usually, tragic incidents, such as terror attacks, shootings, or bombings, occur in a short period. After the unprecedented tragedies, people mourn for the victims and empathize with them as audiences. However, COVID-19 is an epidemic that has been virulent for more than four months; It has not ended yet, and people are still in the middle of the crisis. Moreover, unlike other incidents in which victims and audiences are distinguished, everyone is a potential victim of COVID-19. Therefore, the horror and distress that people feel is exacerbated in the situation of COVID-19 (Wang et al., 2020).

In this paper, we focus on the well-established notion that social media users have hedonic mindset rather than utilitarian mindset (Kim et al., 2019;

11) Source: <https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html>

Kim and Dennis, 2019; Moravec et al., 2019). According to the hedonic principles, people with hedonic mindset are motivated to approach pleasure and avoid pain (Freud, 1915). That is, when people in a hedonic mindset are deeply stressed, they cope with their distress with avoidance, which involves cognitive and behavioral efforts to deny stressful demands (Holahan et al., 2005). Likewise, social media users tend to become cognitive misers who resist to think critically, seek entertainment and enjoyment, avoid effortful activities, and become selective in choosing articles that make them feel good (Kim and Dennis, 2019; Simon 1979). Therefore, when social media users are in the middle of a tragedy, the characteristic of social media in which a popular topic dominates the entire platform would do more harm than good (Asur et al., 2011). In other words, if the contents on social media mainly include the spread of the novel virus and the disastrous consequences of this, people who use social media with hedonic intentions, who prefer to view the world as they desire it to be rather than what they know to be real, will not be satisfied enough (Hirschman and Holbrook, 1982). In this paper, we aim to examine how actual social media users behave in the middle of the crisis.

### 2.3. Social Distancing

At the beginning of an epidemic, when effective vaccines or antiviral drugs are not readily available to the general population, one of the most effective ways to prevent transmission is social distancing (Consultation, 2005). As briefly mentioned earlier, social distancing means keeping a distance from other people; It advises people to stay out of crowded places and avoid mass gatherings.<sup>12)</sup> Social distancing introduced in 1918 measure has been adopted to pre-

vent the number of epidemics prior to COVID-19, such as SARS in 2003 and swine flu in 2009 (Bondy et al., 2009; McKinsey et al., 2018; Teh et al., 2012).

Along with isolation and contact tracing, social distancing is an essential measure in the COVID-19 pandemic. Many governments have actively adopted and promoted the measure. For instance, a German politician rejected a handshake from his head of state, Chancellor Angela Merkel<sup>13)</sup>. Moreover, the Italian government has put the entire country on lockdown<sup>14)</sup>.

As can be inferred from the name, social distancing includes not only physical isolation but also *social* isolation. Numerous forms of social interactions, from casual meetups to religious gatherings, have been restricted for months. Worse still, recent research predicts that social distancing would have to continue until 2022 if no vaccine becomes available (Kissler et al., 2020). In response, people have proposed alternative ways to continue with their daily lives via online. For instance, lectures and conferences have been proceeded in online environment via video chat services such as Zoom and examinations (e.g., TOEFL and GMAT) were taken online. Social media platform, an online venue of social interactions with friends and acquaintances, is also viewed as an alternative method of socialization for people who are quarantined and thus not able to meet each other face-to-face (Merchant and Lurie, 2020). Whether online social interaction can replace face-to-face relationships is a critical factor in evaluating the value of social media. As such, it is vital to understand the impact of social distancing on people's social media usage.

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12) Source: <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html>

13) Source: <https://edition.cnn.com/2020/03/03/world/coronavirus-etiquette-intl-scli/index.html>

14) Source: <https://www.businessinsider.com/coronavirus-italy-updates-lock-down-pandemic-2020-3>

### III. Hypotheses Development

#### 3.1. Confirmed Case, News, and Social Media Usage

In the present situation of record-breaking increase of confirmed COVID-19 cases, television news and radio broadcasts about the status of COVID-19 are flourishing in everyday life since its first outbreak in late 2019. People are getting tired of similar news on COVID-19 and want to get fresh or good news. Since there is little chance to obtain new information or news on COVID-19 on traditional media channels, people move to social media. Previous studies revealed that one of the motivations of using social media to share news is information seeking, which refers to the extent to which news shared in social media provide relevant and timely information to users (Lee and Ma, 2012), also pointed the motivation of sharing information on social media (Chung et al., 2012). It is highlighted that information searching is important to use social media (Dunne et al., 2010). Moreover, Whiting and Williams (2013) showed that people use social media to seek out information. That is, people use social media to find information on events or parties. In addition, Pee and Lee (2016) investigated how social media users develop trust on user-generated information during crises.

In addition to information seeking, hedonic factor is also important to make people use social media. Extant studies suggested that contents contributed by users on the platforms can be a good source of entertainment (Chua et al., 2012, Lee et al., 2010). Entertainment, which refers to the way social media can be a means for lessening pressure and entertaining, is related to the use of social media (Lee and Ma, 2012). According to Whiting and Williams (2013), people also use social media for enjoyment

from entertainment activities and for comic relief and sense of humor such as listening to music and joke, watching videos, playing games, and reading comments. Moreover, enjoyment has a positive effect on continued intention to use social media (Lin and Lu, 2011).

However, as mentioned above, COVID-19 is different from other incidents such as terror attacks, shootings, or bombings in terms of its duration. COVID-19 is an epidemic that has been virulent for more than four months and is expected to last over a year. Since it is proved that social media users can collectively share news content to other users (LaRose and Eastin, 2004), and that news can spread across social media by people around the world within just a few minutes (Lee and Ma, 2012), the news on social media is full of the status of confirmed cases and the rapid spread of COVID-19 worldwide since its outbreak in last December 2019. Thus, it can be assumed that people are tired of similar information on social media and updated information about COVID-19 mainly from TV news, acquaintances including family, internet portals, and messages from the government. Therefore, social media would lose its position of information seeking channel.

Moreover, as deaths and confirmed cases increase, there are many pessimistic perspectives of the future including unemployment, layoff, lockdown, and so forth. Therefore, people who use social media to find enjoyable contents and activities cannot consume playful or enjoyable information on social media and people are getting tired of monotonous and gloomy news and feeds on social media. In terms of both informativeness and enjoyment on social media in COVID-19 pandemic, such phenomenon leads to our first two hypotheses:

*H1a: The number of confirmed COVID-19 cases worldwide*

*will decrease the number of daily active users of social media.*

*H1b: The number of COVID-19 news will decrease the number of daily active users of social media.*

### 3.2. Social Distancing and Social Media Usage

The enforcement of social distancing measures have deprived people of their offline social activities including talking with friends at cafés, eating at restaurants, going movie theaters, and so forth. Hence, people with limited channels to interact with other people will find a safer way to communicate with other people. In this point of view, social media is the best way to connect with others without violating social distancing measure and being restricted to geographical limitations.

It has shown that social interaction is a major motivation for people who use media. Social interaction (Harridge-March et al., 2010; Ko et al., 2005; Liu and Guo, 2015), social relationship (Parker and Plank, 2000), and communication (Charney and Greenburg, 2002) have a positive effect on the use of the Internet. Similar constructs such as social motivation (Korgaonkar and Wolin, 1999), companionship (Palmgreen and Rayburn, 1979), and interpersonal utility (Papacharissi and Rubin, 2000) also positively influence the use of media. In addition, social interaction increases the use of the video-sharing website (Haridakis and Hanson, 2009). For social media, interactivity is known as important needs (Lee and Cho, 2011) and one of the factors related to social media usage (Whiting and Williams, 2013).

Social media can bring people a valuable way to interact with others in the current situation where they are forced follow social distancing measures. People can communicate with friends, family, and

colleagues by using social media wherever they are whenever they want. This leads to our second hypothesis:

*H2: Enforcement of social distancing measures will increase the number of daily active users of social media.*

## IV. Research Setting

### 4.1. Data Collection

We exploit the changes in Facebook and Twitter's daily active users to measure the effect of the outbreak of COVID-19 and corresponding public opinions on the use of social media. DAU refers to the total number of users who have entered the social media application in one day. By measuring DAU, it is possible to grasp the daily status of app users. The total number of installations may overstate the use of the application because there are many users who do not actually run the application after installing it (Claussen et al., 2013). On the contrary, the DAU is determined by only the actual app users. Hence, we adopt DAU, rather than the total number of installations, as our key variable. Previous researches studied Twitter as the social media for sharing emotions between victims and acquaintances of tragic events (Hyvärinen and Beck, 2019). Facebook or Twitter, a text-based social media, could be a more efficient tool than photo-based applications such as Instagram when expressing feelings or sharing opinions about tragic events. By investigating the DAU through Facebook and Twitter, we could draw whether the impact of COVID-19 on the use of social media is consistent across these platforms.

We have collected DAU of Facebook and Twitter



within South Korea from January 23 to April 6, 2020. During the period, most of the COVID-19 cases were confirmed in China and nearby countries including Korea, rather than other regions. As the Chinese government blocks Twitter and Facebook, it is appropriate to use Korean data to study the early stages of the COVID-19 epidemic. We gathered Facebook and Twitter DAU in Korea by web scraping from the website that analyzed DAU of applications and measured the number of news about COVID-19 in a portal site that has the largest number of daily visitors in Korea. It is not appropriate to simply consider the number of times ‘COVID-19’ is mentioned on social media as the number of the news on these platforms because users could just retweet news articles about COVID-19 or create hashtags related to COVID-19 to entice visitors. Social media are used as an important means of distributing news and information. Media companies are also using the power of social media as a tool to reach the audience. News agencies are distributing breaking news through Twitter feeds (Broersma and Graham, 2012). Therefore, news and articles overwhelm the social media platform. In addition, social media audiences are most likely to use the ability to interact with the news by following the news on the newspaper website (Armstrong and Gao, 2010; Chung, 2008). Therefore, we measured the number of COVID-19-related news posted on the largest portal site in Korea as social media news. We also measured the number of confirmed cases by web scraping the website that announces the status of the daily number of confirmed cases in the world.

## 4.2. Model specification and Measurement

To examine the effect of the outbreak of COVID-19 and corresponding public opinions on the use of social media applications, we used an econometric approach. We formulated that the daily use of social media (i.e., Twitter and Facebook) measured by DAU on day  $t$  ( $t = 1, 2, \dots, 76$ ) is determined by the number of cases and news related to COVID-19 as well as whether the social distance is implemented. Considering that we are analyzing the data from the early stages of the COVID-19 epidemic, it is appropriate that the unit of time is a day. As such, we first specified our model as following: See equation (1) below.

*Daily Active Users<sub>t</sub>* includes the total number of daily active users on Facebook and Twitter. *TNC<sub>t</sub>* is the total number of cases, and we expected  $\beta_1 < 0$  if the number of confirmed cases reduce activities in social media (H1a). *TNN<sub>t</sub>* refers to the total number of news related to COVID-19 and was measured by the number of news including the word “COVID-19 (referred to as Corona 19 in Korea)” on the portal site with the highest number of visitors in Korea. As discussed earlier, users primarily use social media for hedonic intent. Thus, when the impact of tragic events goes online and users are no longer able to seek pleasure in social media, they can reduce their use of social media. We expect  $\beta_2 < 0$  if the number of news related to decrease the daily active users in social media (H1b). *Social Distance<sub>t</sub>* is a dummy variable that takes one on days after the social distancing campaign and zero otherwise.  $\beta_3$  represents the change in the number of daily active users in Twitter and Facebook

$$\begin{aligned}
 \text{Daily Active Users}_t &= \alpha + \beta_1 TNC_t + \beta_2 TNN_t + \beta_3 SocialDistance_t + \beta_4 OnlineCourse_t \\
 &+ \beta_5 FineDust_t + \beta_6 Weekend_t + \varepsilon_t
 \end{aligned}
 \tag{1}$$

*Daily Active Users<sub>t</sub>*

$$= \alpha + \beta_1 NKC_t + \beta_2 NWC_t + \beta_3 TNN_t + \beta_4 Social\ Distance_t + \beta_5 OnlineCourse_t + \beta_6 FineDust_t + \beta_7 Weekend_t + \varepsilon_t \tag{2}$$

after the campaign of the social distance. Positive  $\beta_3$  indicates that the number of social media users increases after the social distancing campaign. We also selected online courses, fine dust, and weekend as our control variables. Korean Twitter users in their twenties are the largest group with 30.9% of the total users<sup>15)</sup>. The online course could stimulate communication among users in their 20s via social media. Therefore, we control the effect of online courses on the usage of social media applications. *OnlineCourse<sub>t</sub>* is an indicator variable that is coded as one if it is after the online courses started and zeroed otherwise.  $\beta_4$  captures the effect of online courses on the number of daily active users of the two social media platforms. As fine dust reduces outdoor activities, we could distinguish the indoor activities caused by COVID-19 and those induced by other causes using fine dust as a control variable. The unit of *FineDust<sub>t</sub>* is  $\mu g/m^3$ , indicating the amount of dust in the space of  $1m^3$ .  $\beta_5$  shows the effect of fine dust on our dependent variable. Lastly, we considered that people might use social media more on weekends as a means of leisure while they are not able to actively use social media due to work and other duties on weekdays (Alyami and Toze, 2014). As such, we used the weekend as a control variable. *Weekend<sub>t</sub>* is a dummy variable that coded as one if it is on the weekend and zero otherwise.  $\beta_6$  refers to the effect of the weekend on social media users.  $\varepsilon_t$  denotes the idiosyncratic component of the error term.

Note that we include the lagged effect in our re-

search model. The number of confirmers increased over time and related news articles of COVID-19 were spread to the public through social media or mass media. Therefore, it may take time for people to access and accept relevant information. In the same vein, social distancing campaign and online course could have the lagged effect because campaigns take time to reach the public. We included the lagged effect of our variables from one day to four days in the model. We did not apply the lagged effect of the weekend and the fine dust since these variables influence the social media users' behavior on the right day.

We also considered that confirmed cases in Korea and confirmed cases in other regions might have different impacts on social media users. Therefore, we performed additional analysis by separating the total number of cases into confirmed cases in Korea and confirmed cases in other regions. Alternative model is as follows: See equation (2) above.

*NKC<sub>t</sub>* is the number of Korean active cases on day *t*, and  $\beta_1$  captures the effect of *NKC<sub>t</sub>* on the number of daily active users on Facebook and Twitter in Korea. *NWC<sub>t</sub>* is the number of active world cases on day *t*, and  $\beta_2$  refers to the effect of *NWC<sub>t</sub>* on the Korean users on Facebook and Twitter. <Table 1> summarizes the definitions of all the variables and <Table 2> presents summary statistics for these variables. The correlations of the variables are shown in <Table 3>.

Note that we confirmed variance inflation factors (VIFs), which are below 10 for all variables and TNC was not included in the correlation table because it is the sum of *NKC* and *NWC* variable.

15) Source: <https://dashboard.appa.pe/#/analytics/usage/android/kr/com.twitter.android/demographic>

<Table 1> Definition of Variables Used in the User-Level Analysis

Variable	Definition
<i>Daily Active Users<sub>t</sub></i>	The number of users who run Facebook (Twitter) on day <i>t</i>
<i>TNC<sub>t</sub></i>	The total number of global confirmed cases of COVID-19 on day <i>t</i>
<i>TNN<sub>t</sub></i>	The total number of news including the word of "COVID-19" on day <i>t</i>
<i>SocialDistance<sub>t</sub></i>	Whether a social distancing campaign is implemented on day <i>t</i>
<i>OnlineCourse<sub>t</sub></i>	Whether an online course is implemented on day <i>t</i>
<i>FineDust<sub>t</sub></i>	μg of fine dust contained in 1m <sup>3</sup> on day <i>t</i>
<i>Weekend<sub>t</sub></i>	Whether the day <i>t</i> is a weekend
<i>NKC<sub>t</sub></i>	The number of Korean confirmed cases of COVID-19 on day <i>t</i>
<i>NWC<sub>t</sub></i>	The number of global confirmed cases of COVID-19 except Korean confirmed cases on day <i>t</i>

<Table 2> Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
<i>Daily Active Users (for Facebook)</i>	5142233	280884.1	3365902	5459190
<i>Daily Active Users (for Twitter)</i>	2305089	61170.56	2164675	2446346
<i>TNC</i>	18956.99	27563.77	265	101652
<i>NKC</i>	135.9211	190.4444	0	909
<i>NWC</i>	18821.07	27589.36	265	101566
<i>TNN</i>	16031.03	12633.59	50	34248
<i>SocialDistance</i>	0.223684	0.419482	0	1
<i>OnlineCourse</i>	0.171053	0.379057	0	1
<i>FineDust</i>	42.90789	16.40096	11	82
<i>Weekend</i>	0.31579	0.467918	0	1

<Table 3> Correlation Table

	Daily Active Users (for Facebook)	Daily Active Users (for Twitter)	NKC	NWC	TNN	Social Distance	Online Course	FineDust
<i>Daily Active Users (for Twitter)</i>	0.5520							
<i>NKC</i>	-0.0089	-0.0572						
<i>NWC</i>	-0.7470	-0.5574	-0.1102					
<i>TNN</i>	-0.4022	-0.4266	0.4523	0.3074				
<i>SocialDistance</i>	-0.6583	-0.4840	-0.1032	0.7141	0.2668			
<i>OnlineCourse</i>	-0.6614	-0.3387	-0.0722	0.6819	0.1969	0.8052		
<i>FineDust</i>	-0.3169	-0.2908	0.0329	0.2911	0.0760	0.2216	0.2670	
<i>Weekend</i>	-0.0607	-0.0046	-0.0889	0.0020	0.1854	0.0166	-0.0577	0.1267

Note: that we confirmed variance inflation factors (VIFs), which are below 10 for all variables and TNC was not included in the correlation table because it is the sum of NKC and NWC variable.

<Table 4> Main Result (for Twitter)

	(1)	(2)	(3)	(4)	(5)
Variables	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)
$TNC_t$	-1.979*** (0.692)				
$TNN_t$	-1.562*** (0.500)				
$SocialDistance_t$	11,271 (33,519)				
$OnlineCourse_t$	54,637 (34,314)				
$TNC_{t-1}$		-2.293*** (0.733)			
$TNN_{t-1}$		-1.214** (0.474)			
$SocialDistance_{t-1}$		14,533 (35,263)			
$OnlineCourse_{t-1}$		69,636* (35,169)			
$TNC_{t-2}$			-2.732*** (0.701)		
$TNN_{t-2}$			-1.128** (0.438)		
$SocialDistance_{t-2}$			20,052 (34,188)		
$OnlineCourse_{t-2}$			97,348*** (34,651)		
$TNC_{t-3}$				-2.960*** (0.696)	
$TNN_{t-3}$				-1.294*** (0.444)	
$SocialDistance_{t-3}$				41,005 (33,646)	
$OnlineCourse_{t-3}$				99,082*** (34,305)	
$TNC_{t-4}$					-2.751*** (0.731)
$TNN_{t-4}$					-1.189** (0.464)
$SocialDistance_{t-4}$					13,517 (35,111)

&lt;Table 4&gt; Main Result (for Twitter) (Cont.)

	(1)	(2)	(3)	(4)	(5)
Variables	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)
<i>OnlineCourse<sub>t-4</sub></i>					119,039*** (35,514)
<i>FineDust</i>	-391.7 (336.7)	-322.8 (349.9)	-380.2 (347.0)	-500.9 (345.2)	-610.9* (358.0)
<i>Weekend</i>	-20,227 (12,979)	-4,383 (12,527)	9,241 (11,611)	12,702 (11,709)	13,300 (12,364)
<i>Constant</i>	2.379e+06*** (17,169)	2.367e+06*** (16,721)	2.365e+06*** (16,023)	2.370e+06*** (15,989)	2.370e+06*** (16,560)
Observations	76	75	74	73	72
R-squared	0.503	0.491	0.517	0.524	0.495

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . The robust standard errors were shown in parentheses.

## V. Data Analysis and Results

### 5.1. Main Result

As we have explained above, we exploit the daily active users of Facebook and Twitter as the proxy variables for the application usage of the social media.

The main results are shown in <Table 4> and <Table 5>. Column (1) shows a significant effect of global confirmed cases and the news related to COVID-19. For example, in <Table 4>, a one-person increase in TNC is associated with 1.979 person decrease in the Daily Active Users in column (1). Furthermore, the more news related to COVID-19 are generated, the less Korean Twitter users there are. Similarly, One-article increase in TNN leads to 1.562 person decrease in the Daily Active Users in column (1). However, social distancing campaign does not influence the daily active users of Twitter. Columns (2) to (5) reflecting the lagged effect represent consistent results with some differences among

the coefficients. In addition, Twitter users have gradually increased since online classes began in Korea. We also examine the same model to the daily actual user on Facebook. In <Table 5>, the results are similar to those derived from Twitter users except that the effect of TNN is not significant in column (1). Collectively, the number of Korean daily active users of social media (i.e., Twitter and Facebook) decreases as the number of the world confirmed COVID-19 cases increases (supported H1a). Likewise, the number of news related to COVID-19 reduces daily active users (supported H1b). However, there is no association between the social distancing campaign and the use of social media (not supported H2). The social distancing policy implemented during the data collection period allowed people to eat in restaurants or commute to work. Therefore, people can communicate with others by engaging in external activities for livelihood, even under this policy. A previous study shows that when social distancing policies were implemented after the COVID-19 outbreak, Internet use at home did not increase significantly during

<Table 5> Main Result (for Facebook)

	(1)	(2)	(3)	(4)	(5)
Variables	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)
$TNC_t$	-11.11*** (2.806)				
$TNN_t$	-2.675 (2.029)				
$SocialDistance_t$	173,292 (135,896)				
$OnlineCourse_t$	108,136 (139,119)				
$TNC_{t-1}$		-16.04*** (2.460)			
$TNN_{t-1}$		-2.946* (1.592)			
$SocialDistance_{t-1}$		360,910*** (118,318)			
$OnlineCourse_{t-1}$		223,250* (118,002)			
$TNC_{t-2}$			-9.226*** (2.843)		
$TNN_{t-2}$			-4.356** (1.775)		
$SocialDistance_{t-2}$			151,284 (138,630)		
$OnlineCourse_{t-2}$			-25,411 (140,508)		
$TNC_{t-3}$				-8.144*** (2.884)	
$TNN_{t-3}$				-4.537** (1.840)	
$SocialDistance_{t-3}$				87,042 (139,454)	
$OnlineCourse_{t-3}$				-40,707 (142,185)	
$TNC_{t-4}$					-8.092*** (2.967)
$TNN_{t-4}$					-4.218** (1.884)
$SocialDistance_{t-4}$					77,690 (142,571)

<Table 5> Main Result (for Facebook) (Cont.)

	(1)	(2)	(3)	(4)	(5)
Variables	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)
<i>OnlineCourse<sub>t-4</sub></i>					-63,553 (144,208)
<i>FineDust</i>	-1,102 (1,365)	-567.3 (1,174)	-1,817 (1,407)	-1,951 (1,431)	-1,801 (1,454)
<i>Weekend</i>	-68,680 (52,621)	-6,748 (42,032)	20,391 (47,082)	10,385 (48,530)	-10,954 (50,206)
<i>Constant</i>	5.407e+06*** (69,609)	5.391e+06*** (56,104)	5.410e+06*** (64,973)	5.410e+06*** (66,271)	5.399e+06*** (67,242)
Observations	76	75	74	73	72
R-squared	0.612	0.728	0.621	0.611	0.605

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . The robust standard errors were shown in parentheses.

the week. This phenomenon is even more pronounced in the low-income group who have to make a living. (Chiou and Tucker, 2000). If the intensity of social distancing policy is such that it ultimately limits an individual’s external activities, the results would be different.

### 5.2. Additional Analysis

In this subsection, we further examine how domestic and overseas cases separately affect the daily active users of the social media platform in Korea. We applied the same set of dependent and control variables to estimate the model in Equation (1) but replaced one of independent variables with two measures of confirmed cases (i.e., Korean cases and world cases except for Korea). <Table 4> and <Table 5> refer to the results of daily active users on Twitter and Facebook, respectively. There is a salient point to note in the results of our additional analysis. Although for some period (the day and the day before), the increase in the number of confirmed

COVID-19s in Korea affects the growth of daily active users on Twitter in column (1) and (2) in <Table 6>. In other words, if NKC increases by one person today, the daily active users on Twitter increase by 90.64 person and yesterday, if NKC increases by one person, Twitter’s daily active users expand by 68.82 person in column (1) and (2).

On the other hand, the global cases except Korean cases still have a negative impact on the use of Twitter users. A possible explanation is that the communication through Twitter is temporally increased by the domestic confirmed cases of COVID-19 rather than the cases in any other region because people are more aware of events that occurred in nearby places and want to collect information about those through social media. However, Facebook’s daily active users were not related to the number of confirmed Koreans in <Table 7>. In doing so, we could explore different characteristics across Twitter and Facebook.

<Table 6> Result of Supplement Analysis (for Twitter)

	(1)	(2)	(3)	(4)	(5)
Variables	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)	Daily Active Users (for Twitter)
$NKC_t$	90.64*** (33.93)				
$NWC_t$	-1.694** (0.670)				
$TNN_t$	-2.597*** (0.611)				
$NKC_{t-1}$		68.82** (33.12)			
$NWC_{t-1}$		-1.943*** (0.733)			
$TNN_{t-1}$		-1.882*** (0.557)			
$NKC_{t-2}$			25.77 (32.63)		
$NWC_{t-2}$			-2.624*** (0.713)		
$TNN_{t-2}$			-1.364** (0.515)		
$NKC_{t-3}$				19.37 (33.00)	
$NWC_{t-3}$				-2.869*** (0.711)	
$TNN_{t-3}$				-1.491*** (0.532)	
$NKC_{t-4}$					3.374 (34.62)
$NWC_{t-4}$					-2.722*** (0.753)
$TNN_{t-4}$					-1.244** (0.563)
Constant	2.380e+06*** (16,420)	2.367e+06*** (16,295)	2.364e+06*** (16,079)	2.369e+06*** (16,064)	2.370e+06*** (16,693)
Observations	76	75	74	73	72
R-squared	0.552	0.524	0.523	0.527	0.495

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . The robust standard errors were shown in parentheses. We do not report the coefficients for control variables for brevity.



&lt;Table 7&gt; Result of Supplement Analysis (for Facebook)

	(1)	(2)	(3)	(4)	(5)
Variables	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)	Daily Active Users (for Facebook)
$NKC_t$	37.51 (144.8)				
$NWC_t$	-10.96*** (2.859)				
$TNN_t$	-3.218 (2.606)				
$NKC_{t-1}$		73.07 (114.4)			
$NWC_{t-1}$		-15.61*** (2.531)			
$TNN_{t-1}$		-3.783* (1.924)			
$NKC_{t-2}$			45.03 (132.9)		
$NWC_{t-2}$			-9.021*** (2.904)		
$TNN_{t-2}$			-4.807** (2.100)		
$NKC_{t-3}$				198.6 (134.8)	
$NWC_{t-3}$				-7.301** (2.907)	
$TNN_{t-3}$				-6.358*** (2.174)	
$NKC_{t-4}$					22.13 (140.6)
$NWC_{t-4}$					-7.953** (3.058)
$TNN_{t-4}$					-4.493* (2.288)
Constant	5.408e+06*** (70,066)	5.391e+06*** (56,270)	5.409e+06*** (65,494)	5.406e+06*** (65,640)	5.398e+06*** (67,775)
Observations	76	75	74	73	72
R-squared	0.613	0.730	0.622	0.625	0.606

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . The robust standard errors were shown in parentheses. We do not report the coefficients for control variables for brevity.

## VI. Discussion and Implications

### 6.1. Theoretical Implication

The study of sharing social phenomena and sharing emotions has been applied in many contexts. In particular, research on social media's effect on various social phenomena has been actively conducted as the expression of personal thoughts and feelings online have become more common. However, research on social media's role in the outbreak of a disease has been of little attention because there has been no global pandemic such as COVID-19 in recent decades. Hyvärinen and Beck (2019) highlighted the ability to share sentiment via social media during tragic social events. Besides, Herstatt and Tiwari (2020) argued that social media activity would increase in the Post-Corona era. On the other hand, although not observing the impact of social media, Chiou and Tucker (2020) have shown that the Internet has less impact on self-isolation when income is low or high-speed Internet facilities are not in place. Among these conflicting perspectives, our research has a value as an early study observing the role of social media as an unprecedented pandemic sweeps the world. Our paper makes outstanding contributions to the social media literature. To our knowledge, our study is one of the first to examine the effect of worldwide infectious diseases on the usage of media. With actual usage data, we could find that Facebook and Twitter are not used as a means of communication when people cannot meet due of the social distancing campaign. Our findings lend credence to the hedonic aspect of social media in the pandemic environment. People mainly exploit social media to share joyful and pleasurable experiences rather than tragic events. If social media are overwhelmed by depressing news, people turn away

from these because they have fewer opportunities to feel pleasure with the platforms.

### 6.2. Practical Implication

The government is implementing a social distancing policy to protect the health and lives of the people. However, due to these policies, there is also a problem in the public sentiment called 'Corona Blue.' The government and policymakers are considering a number of ways to alleviate these emotional problems. One of them is to use social media. Since face-to-face contact is limited, direct interaction among people is reduced. Therefore, social media is considered as the solution to enhance interactions online. However, it has not been verified whether interactions through social media actually increased after the implementation of the social distancing policy. In other words, it is unclear whether online social media will serve as a substitute for face-to-face interaction. Our empirical findings show that the implementation of social distancing does not affect the use of social media. It implies that, in the case of a situation where the interaction among people is physically restricted, people do not communicate through social media. As a cause, the degree of social distancing policy can be considered. The social distancing policy implemented during the data collection period enabled people to live their daily lives. Systems of this period, for example, allowed eating in restaurants or going to work. A previous study shows that when social distancing policies were implemented after the COVID-19 outbreak, Internet use at home did not increase significantly during the week. In the case of the low-income group, there was little increase in indoor Internet use during weekdays (Chiou and Tucker, 2000). It can be interpreted that this is because people can communi-

cate with others by engaging in external activities for livelihood, even during the implementation of this policy. If policymakers begin a more intensive social distancing policy, they have to excogitate ways to quench people's thirst for communication within online social media. Our research also provides managerial implications for social media companies that are striving to increase their users. Although previous study showed that people share the sadness of tragic events through social media (Hyvärinen and Beck, 2019), our study empirically examined that people tend to reduce their social media use when unfortunate events strike their lives. These results can be interpreted that people want to have fun on social media and tend to avoid severe and depressing news on social media. Therefore, social media companies should consider a function for users' entertainment when the tragic social issue overwhelms the valence of contents on social media.

## VII. Conclusion

COVID-19 has developed into a pandemic in just a few months of onset and is still affecting the world. The tragic event has hit the world economically and changed the way people live. Our study investigated what happens to the behavior of social media users as COVID-19 patients and related news increase in the early stages of the spread of the disease. Furthermore, we examined whether to increase the use of social media applications as an alternative if government-led social distance campaigns reduce the chance of face-to-face communication. Focused on hedonic intention to use social media, we anticipated that social media use would decline when people faced an environment where it was difficult for them to enjoy themselves through social media because of the

spread of the epidemic. In addition, since news related to COVID-19 is pouring out, social media can hardly function as a source of information provision from an informativeness perspective.

We classified the spread of the disease into the number of global confirmed cases and the news related to COVID-19, respectively, to check the effect of these variables on the daily active users of social media. Besides, the lagged effect of variables was applied to the model in consideration of the time when such events and information were transmitted to people. The results showed that the number of daily active users on Facebook and Twitter decreased along with the number of global confirmed cases and related news. We also expected that the social distancing campaign would ease the decline in social media users because more people who are blocked from communicating offline will shift to online. However, our results showed that the social distancing campaign was insignificant to the social media use. Such effect may be different under more intensive social distancing policies because it results from the initial stage of social distancing policy. If the policy is enforced to the extent that outside activities are prohibited, people may increase their use of social media to communicate with others. Therefore, future research can scrutinize social media use under social distancing policies with various intensity at different times.

Even though our research is in the early phase of COVID-19, there is a limitation because we focused on the use of social media in a particular country. Therefore, future research can expand the research domain to confirm whether the spread of COVID-19 reduces the use of social media in countries other than Korea. However, the world is still struggling with COVID-19 and looking for ways to improve people's lives online in such a situation. This study

thus provides the implication that social media companies should enhance the enjoyment elements in

order to satisfy users' hedonic intention to use under tragic events.

### <References>

- [1] Alyami, E., and Toze, S. (2014). Where to go on the weekend? Trends for local information seeking in leisure settings using social media. *International Conference on Information Society(i-Society)*, IEEE, 169-172.
- [2] Armstrong, C. L., and Gao, F. (2010). Now tweet this: How news organizations use Twitter. *Electronic News*, 4(4), 218-235.
- [3] Asur, S., Huberman, B. A., Szabo, G., and Wang, C. (2011). Trends in social media: Persistence and decay. *Fifth International AAAI Conference on Weblogs and Social Media*, Barcelona, Spain.
- [4] Blakey, S. M., Reuman, L., Jacoby, R. J., and Abramowitz, J. S. (2015). Tracing Fearbola: Psychological predictors of anxious responding to the threat of Ebola. *Cognitive Therapy and Research*, 39(6), 816-825.
- [5] Bondy, S. J., Russell, M. L., Laffèche, J. M., and Rea, E. (2009). Quantifying the impact of community quarantine on Sars transmission in Ontario: Estimation of secondary case count difference and number needed to quarantine. *BMC Public Health*, 9(1), 488.
- [6] Broersma, M., and Graham, T. (2012). Social media as beat: Tweets as a news source during the 2010 British and Dutch elections. *Journalism Practice*, 6(3), 403-419.
- [7] Cascella, M., Rajnik, M., Cuomo, A., Dulebohn, S. C., and Di Napoli, R. (2020). *Features, evaluation and treatment Coronavirus(Covid-19)*, in *Statpearls [Internet]*. StatPearls Publishing.
- [8] Chua, A. Y. K., Goh, D. H., and Lee, C. S. (2012). Mobile content contribution and retrieval: An exploratory study using the uses and gratifications paradigm. *Information Processing & Management*, 48(1), 13-22.
- [9] Chung, D. S. (2008). Interactive features of online newspapers: Identifying patterns and predicting use of engaged readers. *Journal of Computer-Mediated Communication*, 13, 658-679.
- [10] Chung, N., Han, H. J., and Koo, C. (2012). Mediating roles of attachment for information sharing in social media: Social capital theory perspective. *Asia Pacific Journal of Information Systems*, 22(4), 101-123.
- [11] Claussen, J., Kretschmer, T., and Mayrhofer, P. (2013). The effects of rewarding user engagement: The case of Facebook Apps. *Information Systems Research*, 24(1), 186-200.
- [12] Consultation, W. C. O. T. W. H. O. (2005). Avian influenza a (H5n1) infection in humans. *New England Journal of Medicine*, 353(13), 1374-1385.
- [13] Criteo (2020). *Coronavirus impact*. Available at [https://www.criteo.com/kr/wp-content/uploads/sites/7/2020/04/200429\\_%ED%81%AC%EB%A6%AC%ED%85%8C%EC%98%A4\\_%EC%BD%94%EB%A1%9C%EB%82%9819-%EC%86%8C%EB%B9%84%ED%8A%B8%EB%A0%8C%EB%93%9C-%EB%B6%84%EC%84%9D-%EB%B3%B4%EA%B3%A0%EC%84%9C-%EB%B0%9C%ED%91%9C.pdf](https://www.criteo.com/kr/wp-content/uploads/sites/7/2020/04/200429_%ED%81%AC%EB%A6%AC%ED%85%8C%EC%98%A4_%EC%BD%94%EB%A1%9C%EB%82%9819-%EC%86%8C%EB%B9%84%ED%8A%B8%EB%A0%8C%EB%93%9C-%EB%B6%84%EC%84%9D-%EB%B3%B4%EA%B3%A0%EC%84%9C-%EB%B0%9C%ED%91%9C.pdf)
- [14] Deb, P., Furceri, D., Ostry, J. D., and Tawk, N. (2020). The effect of containment measures on the COVID-19 pandemic. *Covid Economics: Vetted and Real-Time Papers*, (18), 53-86.
- [15] Dunne, Á., Lawlor, M., and Rowley, J. (2010). Young people's use of online social networking sites-A uses and gratifications perspective. *Journal of Research in Interactive Marketing*, 4(1), 46-58.
- [16] Fredrickson, B. L., Tugade, M. M., Waugh, C. E., and Larkin, G. R. (2003). What good are positive emotions in crisis? A prospective study of resilience and emotions following the terrorist attacks on the United States on september 11th, 2001. *Journal of Personality and Social Psychology*, 84(2), 365-376.
- [17] Freud, S. (1915). Repression. In *The standard ed. of the complete psychological works of Sigmund Freud*.

- ed. and translated by J. Strachey, Vol, XIV. London: Hogarth.
- [18] Haridakis, P., and Hanson, G. (2009). Social interaction and co-viewing with Youtube: Blending mass communication reception and social connection. *Journal of Broadcasting & Electronic Media*, 53(2), 317-335.
- [19] Harridge-March, S., Dunne, Á., Lawlor, M. A., and Rowley, J. (2010). Young people's use of online social networking sites-A uses and gratifications perspective. *Journal of Research in Interactive Marketing*, 4(1), 46-58.
- [20] Hawryluck, L., Gold, W. L., Robinson, S., Pogorski, S., Galea, S., and Styra, R. (2004). SARS control and psychological effects of Quarantine, Toronto, Canada. *Emerging Infectious Diseases*, 10(7), 1206-1212.
- [21] Herstatt, C., and Tiwari, R. (2020). Opportunities of frugality in the post-Corona era. *Working Paper*, Center for Frugal Innovation.
- [22] Hirschman, E. C., and Holbrook, M. B. (1982). Hedonic consumption: Emerging concepts, methods and propositions. *Journal of Marketing*, 46(3), 92-101.
- [23] Holahan, C. J., Moos, R. H., Holahan, C. K., Brennan, P. L., and Schutte, K. K. (2005). Stress generation, avoidance coping, and depressive symptoms: A 10-year model. *Journal of Consulting and Clinical Psychology*, 73(4), 658-666.
- [24] Huang, C. M., Chan, E., and Hyder, A. A. (2010). Web 2.0 and internet social networking: A new tool for disaster management?-Lessons from Taiwan. *BMC Medical Informatics and Decision Making*, 10(1), 57.
- [25] Johnson, T. J., and Kaye, B. K. (2015). Reasons to believe: Influence of credibility on motivations for using social networks. *Computers in Human Behavior*, (50), 544-555.
- [26] Kim, A., and Dennis, A. R. (2019). Says who? The effects of presentation format and source rating on fake news in social media. *MIS Quarterly*, 43(3), 1025-1039.
- [27] Kim, A., Moravec, P. L., and Dennis, A. R. (2019). Combating fake news on social media with source ratings: The effects of user and expert reputation ratings. *Journal of Management Information Systems*, 36(3), 931-968.
- [28] Kissler, S. M., Tedijanto, C., Goldstein, E., Grad, Y. H., and Lipsitch, M. (2020). Projecting the transmission dynamics of Sars-Cov-2 through the postpandemic period, science. *Science*, 368(6493), 860-868.
- [29] Ko, H., Cho, C. H., and Roberts, M. S. (2005). Internet uses and gratifications: a structural equation model of interactive advertising. *Journal of Advertising*, 34(2), 57-70.
- [30] LaRose, R., and Eastin, M. S. (2004). A social cognitive theory of internet uses and gratifications: Toward a new model of media attendance. *Journal of Broadcasting & Electronic Media*, 48(3), 358-377.
- [31] Lattanzi-Licht, M., and Doka, K. (2004). *Living with grief: Coping with public tragedy*. Routledge.
- [32] Lee, A. M., Wong, J. G., McAlonan, G. M., Cheung, V., Cheung, C., Sham, P. C., and Chua, S. E. (2007). Stress and psychological distress among SARS survivors 1 year after the outbreak. *The Canadian Journal of Psychiatry*, 52(4), 233-240.
- [33] Lee, C. S., Goh, D. H., Chua, A. Y. K., and Ang, R. P. (2010). Indagator: Investigating perceived gratifications of an application that blends mobile content sharing with gameplay. *Journal of the American Society for Information Science and Technology*, 61(6), 1244-1257.
- [34] Lee, C. S., and Ma, L. (2012). News sharing in social media: The effect of gratifications and prior experience. *Computers in Human Behavior*, 28(2), 331-339.
- [35] Lee, S., and Cho, M. (2011). Social media use in a mobile broadband environment: Examination of determinants of Twitter and Facebook use. *International Journal of Mobile Marketing*, 6(2), 71-87.
- [36] Lin, K. Y., and Lu, H. P. (2011). Why people use social networking sites: An empirical study integrating network externalities and motivation theory. *Computers in Human Behavior*, 27(3), 1152-1161.
- [37] Liu, C. T., and Guo, Y. M. (2015). The role of

- sense of belonging in social media usage: A tale of two types of users. *Asia Pacific Journal of Information Systems*, 25(2), 403-422.
- [38] McKinsey, D. S., McKinsey, J. P., and Enriquez, M. (2018). The 1918 influenza in Missouri: Centennial remembrance of the crisis. *Missouri Medicine*, 115(4), 319.
- [39] Merchant, R. M., and Lurie, N. (2020). Social media and emergency preparedness in response to novel coronavirus. *JAMA*, 323(20), 2011-2012.
- [40] MOHW(Ministry of Health and Welfare) (2020). *Regular briefing of central disaster and safety countermeasure headquarters on COVID-19*. Available at [http://ncov.mohw.go.kr/upload/viewer/skin/doc.html?fn=1584681416341\\_20200320141656.pdf&rs=/upload/viewer/result/202005/](http://ncov.mohw.go.kr/upload/viewer/skin/doc.html?fn=1584681416341_20200320141656.pdf&rs=/upload/viewer/result/202005/)
- [41] Moravec, P. L., Minas, R. K., and Dennis, A. (2019). Fake news on social media: people believe what they want to believe when it makes no sense at all. *MIS Quarterly*, 43(4), 1343-1360.
- [42] Park, J. W., Cho, E. Y., and Kim, H. W. (2016). Examining context-specific social media marketing strategies. *Asia Pacific Journal of Information Systems*, 26(1), 143-162.
- [43] Parker, B. J., and Plank, R. E. (2000). A uses and gratifications perspective on the internet as a new information source. *American Business Review*, 18(2), 43-49.
- [44] Pee, L. G., and Lee, J. (2016). Trust in user-generated information on social media during crisis: An elaboration likelihood perspective. *Asia Pacific Journal of Information Systems*, 26(1), 1-21.
- [45] Piwowarczyk, L., Rous, D., Mancuso, A., Flinton, K., Hastings, E., Forbush, L., and Shepherd, A. (2016). Impact of the Boston marathon bombing and its aftermath on refugees and survivors of torture. *Journal of Immigrant and Minority Health*, 18(4), 764-770.
- [46] Simon, H. A. (1979). Rational decision making in business organizations. *The American Economic Review*, 69(4), 493-513.
- [47] Swanbrow, D. (2001). *How America responds University of Michigan*. Available at <http://ns.umich.edu/Releases/2001/Oct2001/r100901b.html>
- [48] Teh, B., Olsen, K., Black, J., Cheng, A. C., Aboltins, C., Bull, K., Johnson, P. D., Grayson, M. L., and Torresi, J. (2012). Impact of swine influenza and quarantine measures on patients and households during the H1N1/09 pandemic. *Scandinavian Journal of Infectious Diseases*, 44(4), 289-296.
- [49] Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., and Ho, R. C. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *International Journal of Environmental Research and Public Health*, 17(5), 1729.
- [50] Whiting, A., and Williams, D. (2013). Why people use social media: a uses and gratifications approach. *Qualitative Market Research: An International Journal*, 16(4), 362-369.
- [51] Zinner, E. S. (2013). *The connection between grief and trauma: An overview, in when a community weeps*. Routledge, 33-48.

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