Outbreak News Affects the Attention in Everyday Life: A Cross-sectional Study

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Abstract

Objective: Capture of attention occurs when a goal-irrelevant salient stimulus appears in the field of attention. The COVID-19 pandemic seems to be salient enough to capture a great proportion of one’s attentional resources. The purpose of this study was to explore how the novelty of outbreak news affects attention in everyday life. Methods: 162 participants were recruited using an online invitation and divided into two samples (early and late sections). The variables—salience of news, intrusive thoughts, endogenous attention, and knowledge of COVID-19—have compared between two measurements using independent t-tests. Additionally, a correlational analysis was performed in order to reveal a model of relationships between variables. Results: It was found that despite the increase in infected cases, intrusive thoughts and attentional capture have decreased over time. To describe the relationship between salience of news and attentional capture a conceptual model is presented. Conclusion: In addition to the other physical properties of a stimulus, novelty also contributes to stimulus salience. In everyday life, novel situations can trigger intrusive thoughts and attentional capture. Nonetheless, it cannot be sustained after the novelty has worn off. The proposed model can be useful to understand further similar situations.

Keywords: Everyday Attention; Attentional Capture; Salience; COVID-19

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Introduction

Since we are not able to perceive all the information around us, except when we intentionally select what to focus on, our attention automatically draws to the most perceptually salient stimuli [1]. According to bottom-up theories of attention, salient physical properties of stimulus lead to capture of attention. Orienting to a salient stimulus is an effective process in attention and information processing [2, 3]. On the other hand, unintentional orientations can be associated with negative consequences, such as the loss of goal-related stimuli [4]. Distraction to a set of goal-irrelevant stimuli due to the properties of the stimulus itself is known as attentional capture [5, 6]. Attentional capture is believed to occur more frequently when salience is increased [7, 8]. Mostly, in the literature of attention, salience refers to some distinct physical features associated with an object or with the relationship between an object and its environment [9]. However, abrupt onset, distinct color, motion [10–13], and animacy [14] may also capture attention in a stimulus-driven manner. Yet a salient stimulus may be extreme, emotional, and rare [15]. According to Bruce and Gaines, salient stimuli are in different categories than their physical or temporal neighbors [16].

Previous studies have suggested novelty as a major aspect of stimulus salience [17–20]. Ghazizadeh, Griggs, and Hikosaka in their study on macaque monkeys have demonstrated that repeated exposure to novel objects is accompanied by a clear decrease in salience [21]. Also, it has been shown that novelty captures the attention even concerning physically low-salient stimuli [22].

COVID-19 as a novel phenomenon is now a massive threat to the world community which can have economic and political subsequences. The disease may also end to irrecoverable health impairments commonly and cause death in a not so unlikely manner. Once the news of the novel coronavirus was spreading, a major concern has emerged around the globe. Most individuals had an exaggerated understanding of the problem which was conceivable because the rate of diagnosed cases and death was exponentially growing and there were no reliable treatments.

Predictability of the situation had been considered before as an element that distinguishes bottom-up and top-down processes related to attentional capture [23]. Here, the focus is on novelty as an emerging property of stimulus. Due to the unpredictability of being novel, we assume it in the realm of bottom-up attentional capture. Nevertheless, top-down contributions in attentional capture have also been considered.

According to literature, as the physical salience of a threatening stimulus increases, it is more likely that involuntary attentional capture occurs. It also seems that as the stimulus gets older, it loses its ability to capture the attention. However, studying this, outside of the laboratory settings is not something that has received much attention before. We assume that the construct of salience, in its broader sense, consists of two parts: physical salience and temporal salience. In this paper, we aimed to investigate the simultaneous effects of these two factors on attentional capture in a real-life situation related to COVID-19 pandemic.

Methods

Participants

A hundred and sixty-two participants (54 males; age range: 15 – 65; age $M = 33.06$; age $SD = 9.95$; three excluded due to lack of information/outlier responses) have recruited through an online invitation. Because of the difficulty in access to the research sample (due to COVID-19 pandemic), data collection has been accomplished through an online survey via a snowball sampling method.
All the participants were selected from the general population, and based on their reports had no specific mental disorders or neuropsychologic conditions. This study followed all ethical considerations in accordance with the World Medical Association Declaration of Helsinki (World Medical Association, 2013) for human participants. Participation in the study was anonymous and voluntary. The participants were informed of the purpose of the study and signed a written informed consent form. It was informed to them that they could withdraw from the study whenever they wanted without any consequences regarding their care.

**Measures**

Thought Control Questionnaire (TCQ; subscale distraction): TCQ is a 30-item instrument which introduced by Wells and Davies (1994) to assess the effectiveness of strategies individuals use to control unpleasant and unwanted thoughts. The questionnaire includes five subscales (distraction, social, worry, punishment, and re-appraisal). The items are scored on a four-point Likert scale (e.g., when I experience an unpleasant/unwanted thought: I do something that I enjoy; 1 = never; 2 = sometimes; 3 = often; and 4 = almost always). In this study, only the subscale of distraction has been used. Distraction score is an indicator of the ability to disengage the attention from the goal-irrelevant stimulus endogenously. This subscale has been used as a measure of attentional capture. Its rationale was that the more one is biased towards an exogenous cue (threatening stimuli in the context of this study), the less he or she will distract his/her attention away from that stimulus. The internal consistency reliability of this subscale had an acceptable amount (α= 0.72) and the whole instrument had a great correlation with scores of a variety of other measures [25].

COVID-19 related knowledge: To measure individuals’ knowledge about COVID-19, a 15-items questionnaire was used [24]. In this questionnaire, three items were about etiology of COVID-19, two about symptoms and incubation time, one about diagnosis, two about transmission, four about public prevention, one about medical professionals' prevention, one about treatment and one about referring suspicious cases. A group of experts, including an infectious disease specialist, two epidemiologists, and two medical interns, evaluated the scale for its content validity. Correct answers were given 1 point, and incorrect answers or ‘I don't know' were given 0 points. Finally, scores are converted into percentile values. Scores above 75% are considered high, those between 50-75% moderate, and scores below 50% are considered low. According to Cronbach's alpha, the inter-item consistency in a pilot study (n = 30) and in the original study was 0.87 and 0.80, respectively. In the present study raw scores were utilized.

Explicit question of intrusive thought about COVID-19: To have a quantitative value of how much individuals think about COVID-19 unintentionally throughout the day since the outbreak (“On average, how much do you think about COVID-19 unintentionally throughout the day since the outbreak?”; 1= low, 2= medium, 3= high).

**Procedure**

The first official observation of the coronavirus in Iran was reported on 2020 February 19, and the data collection for the present study began on 2020 March 14 and ended on 2021 April 13. In a cross-sectional design, the first ten days of the aforementioned period were considered the early and the last ten days as the late phases of data collection. Meanwhile, a one-year gap was considered to separate the two sections. We assumed that the participants in the early phase (n = 70), due to their proximity to the onset of the disease outbreak may be in a different mental state than the participants in the late phase (n = 92).
In this study, physical salience, temporal salience, intrusive thoughts, knowledge about COVID-19, and endogenous attention, as study factors, were compared, and the relationships between them were examined. To compute physical salience, cumulative frequency of COVID-19 cases per day (previously infected in addition to daily new cases) that was released by the Ministry of Health and Medical Education of Iran, was used. Also, days Elapsed since the government of Iran confirmed the first case of patients with COVID-19 (19 February 2020) have considered as a measure of temporal salience. In addition, based on this measure, each participant has placed on a categorical variable of early and late participation in the study.

**Statistical analyses**

To compare the means, all of the participants were divided into two sections (early and late) based on the date on which they had been participated in the study. Afterwards, using the independent t-test, factors including physical salience, temporal salience, intrusive thoughts, knowledge about COVID-19, and endogenous attention, were compared between sections. To provide a model of relationships between the factors, Pearson correlation and Sobel mediation tests have been used. The data have analyzed via R statistical software.

**Results**

To test the hypothesis that after the first official announcement of COVID-19, by passing the days, the salience of stimulus decreases continually, we defined the factor “temporal salience” which was calculated from the inverse of the number of days since data collection had begun (e.g., 3rd day as $\frac{1}{3}$). Based on the independent t-test, from the beginning of data collection to the end, this variable had a descending order ($p < .001$). The other factor, physical salience was considered equal to the cumulative frequency of COVID-19 cases on each day of the data collection. Although it is clear that this factor has been increasing over time; statistical analysis also showed a significant difference between the early and late phases of the study ($p < .001$). The results of the independent t-test revealed that two factors, intrusive thoughts and endogenous attention, had significant differences between the two phases ($p < .001$). While knowledge about COVID-19 has observed as a non-significant factor ($p > .05$).

According to the literature of attention, a salient stimulus depends on both temporal and physical salience to capture the attention [20]. To consider the impact of these two factors on attentional capture simultaneously, a new factor called stimulus salience (SS) was defined as below:

$$SS = TS \times PS$$

Since the behavior of temporal salience and physical salience was different between groups (Table 1; one descending and the other ascending); we claim that by multiplying them, one can investigate their simultaneous effect. According to independent t-test, stimulus salience was significantly different between two phases of the study ($t = 17.68, p < .001$).
Table 1. Mean differences of factors between early and late sections

| Factors                        | Early (n = 70) | Late (n = 92) | T     | P   |
|--------------------------------|----------------|---------------|-------|-----|
|                                | M     | SD | M     | SD   |     |     |
| Temporal salience              | .33   | .14 | .03   | .004 | 20.89 | .001 *|
| Physical salience              | 15451.61 | 1375.41 | 62216.66 | 7837.51 | 49.31 | .001 *|
| Intrusive thoughts             | 2.33  | .65 | 1.70  | .62  | 6.26  | .001 *|
| COVID-19 related knowledge     | 8.73  | 1.82 | 8.49  | 1.68 | -1.73 | .09  |
| Endogenous attention           | 15.56 | 4.46 | 21.45 | 4.74 | -8.04 | .001 *|

Note. * p < .001

The results of Pearson correlation test between variables (figure 1) shows that stimulus salience and intrusive thoughts had a positive and significant correlation relationship ($r = .37, p < .001$) and endogenous attention had significant but negative correlation relationship with both stimulus salience and intrusive thoughts ($r = -.45, p < .001; r = -0.58, p < .001$, respectively).

Figure 1. Partial correlation between pairs of variables

Note. A. Pearson correlation test shows a positive significant relationship between stimulus salience and intrusive thoughts; B. negative significant relationship between stimulus salience and endogenous attention; C. as well as endogenous attention and intrusive thoughts.
Mediation analysis shows that stimulus salience had an indirect effect on endogenous attention through intrusive thoughts ($z = -4.21$, $p < .001$). More precisely, it could be said as the stimulus salience decreases, endogenous attention will increase (figure 2).

![Diagram](image)

**Figure 2.** Conceptual model for relationships between stimulus salience and attentional capture as mediated by intrusive thoughts

**Abbreviations:** PS, physical salience; TS, temporal salience.

**Note.** * $p < .001$

**Discussion**

As it has been found in this study there is a considerable difference between the early and late phases of the study in terms of physical salience and temporal salience. It means that over time, the total number of patients and the novelty of the situation has increased and decreased respectively. These results confirm the way we decided to separate sections. Prior knowledge as a top-down process is an influential factor related to the capture of attention [26]. The measurement of knowledge about COVID-19 was used as a control variable. It has been found that the level of knowledge had no differences between the two sections. Therefore, the results of this study are not influenced by the level of knowledge individuals had about COVID-19. The differences between the samples of individuals who participated in the early and late phases were significant in terms of how long they used to think about COVID-19 and how much they could distract themselves from that subject (endogenous attention). According to the results, over time, people had less intrusive thoughts about the current situation, and they have been more capable of orienting their own attention to the subjects of interest in a controlled manner.

Studies on novel threatening stimuli have shown that recent life-threatening events are more likely to change people's behavior than the same sorts of events that have happened in the distant past. For instance, it has been found that right after an earthquake, the purchase rate of earthquake insurance increases dramatically. But after a while, purchases decrease steadily. It is also reported that immediately after the September 11 attacks, people had been less interested in air travel. However, they gradually resumed their using of airplanes like before. Presumably, that is because at first, the news is so novel that people overestimate the probability of an earthquake occurrence near their hometown or being on a hijacked plane (see Vasiljevic et al., 2013 for a review). A well-established opinion posits that endogenous and exogenous systems compete over the orienting of the focus of attention [28]. It has been suggested that familiarity with the novel stimuli ends to more control over attention [21, 29].

To provide a model of attentional capture through salient stimuli, at first, the construct of stimulus salience was made from physical salience and temporal salience. The comparison of stimulus
salience between the early and late phases of the study shows a significant difference. Such that, despite the increase in physical salience, the decrease in temporal salience leads to an overall decrease in stimulus salience.

In the following, correlations between the components of the model were examined. It has been found that there is a high correlation between stimulus salience and attentional capture. Accordingly, as the salience of stimulus increases, attentional capture shows a clear increase. Also, the mediation analysis showed a mediatory role for intrusive thoughts between stimulus salience and attentional capture. Therefore, as a model, physical salience, and temporal salience together form the stimulus salience. Stimulus salience can lead to attentional capture either directly and through intrusive thoughts.

It seems that individuals tend to disengage their attention from COVID-19 and this ignorance increases by the day since the initial release of the news. Therefore, the negative threatening news at first leads to capture of attention and intrusive thoughts, but after it gets to lose its novelty, both attentional capture and intrusive thoughts start to diminish gradually. this is while the physical salience of news is still increasing. In this situation, one is faced with the news that is growing in importance but becoming old.

It may be a problem for us to think too much about a single issue for a long period of time. Because overthinking, in the long-term is not cognitively economic [30], the whole cognitive system has a certain and limited resource for maintenance and manipulation of intrusive thoughts. This is the reason why after a while, one tends to reduce the perceived importance of the risk even though the problem is worsening. So, the solution is in being released of the persistent intrusive thoughts as soon as possible. Gradual decrement of stimulus salience provides a way to take control over the attention. That is how one can think about other important subjects as well. We suggest that the findings of this study are not just about the current pandemic disease, but can be generalized to all future similar situations. Also, regarding any other real-life related salient stimuli (news, events, etc.) it would be discussable.

Conclusion

Physical salience alone cannot determine the amount of salience of a threatening stimulus. Temporal salience should also be noticed as a major determinant of attentional capture. How much each of these two, influence the stimulus salience independently, is a topic for further studies. Utilizing both behavioral and neurological studies in controlled experimental settings may lead to more reliable evidence of other similar phenomena. Because of the relationship between anxiety and capture of attentional [31, 32], it is also suggested for subsequent studies to take the level of anxiety into account as another influential factor.

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Conflict of interest

The authors did not receive any grants for this project and declare that there are no conflicts of interest to disclose.
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