

Report on “Radiation Disaster Recovery Studies”

Course : Radioactivity Social Recovery Course

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○Regarding “Radiation Disaster Recovery Studies”

Radiation disasters cause a wide range of impacts on the natural environment, the socioeconomy, and the physical and mental health of the residents. According to reports from past major nuclear accidents, it has been concluded that the long-term impact on the mental health of residents, in particular, is significant (WHO, 2005). One of the factors contributing to poor mental health is anxiety about the adverse effects of radiation on physical health, and it has been observed that residents' anxiety increases after radiation disasters (e.g., Fukasawa et al., 2017; Niitsu et al., 2014).

The development of such anxiety involves information obtained from the external environment. For instance, a study examining the correlation between disaster-related information from the media and the mental health of residents after a man-made disaster revealed that exposure to such information enhances residents' anxiety (Vasterman et al., 2005). Moreover, research has demonstrated that an increased volume of media reporting on disaster-related information intensifies the risk perception (Renn et al., 1992). Another study investigating the relationship between disaster-related information and radiation anxiety after the Fukushima Daiichi nuclear power plant (FDNPP) accident revealed that individuals who relied on Internet media as their source of disaster-related information were more anxious about radiation (Nakayama et al., 2019). Therefore, it is necessary to take disaster-related information into account when addressing the mental health of the residents in the event of a radiation disaster.

From the perspective of information processing, when considering the relationship between disaster-related information and anxiety, there is a possibility that the self-prioritization effect (SPE;

Sui et al., 2012) enhances the relationship between the two. The SPE refers to the phenomenon where information relevant to oneself is prioritized over information that is not relevant. Specifically, it is known that self-relevant information is more likely to be attended to and remembered (e.g., Moray, 1959; Rogers et al., 1977). As our capacity to process information is limited, the SPE contributes to the efficient acquisition of important information from the external environment. However, in the case of radiation disasters, the SPE could contribute to heightened anxiety. Disaster-related information, such as exposure risks and health effects, is considered self-relevant information concerning one's physical health. Given that disaster-related information can contribute to the development of anxiety, prioritizing the processing of such information may lead to heightened radiation anxiety.

Considering the role of the SPE in radiation disasters, gaining a deeper understanding of the mechanisms that give rise to the SPE may offer insights into maintaining the mental health of residents during such disasters from an information processing perspective. Therefore, the factors contributing to the emergence of the SPE were investigated in the doctoral thesis. Specifically, I examined the influence of interoception, which refers to the sensation of the internal bodily states (e.g., Kobayashi et al., 2021), on the SPE, drawing on insights from previous studies.

○Title of Doctoral Thesis

Impact of Interoception on the Self-Prioritization Effect

○Summary of Doctoral Thesis

The FDNPP accident is also referred to as an information disaster, and it has been demonstrated that information related to radiation disasters is closely linked to the development of radiation anxiety among the residents (Nakayama et al., 2019). When considering the human information processing, it is known that we selectively process external information based on its relevance to ourselves, giving priority to self-relevant information (SPE; Sui et al., 2012). Radiation-related information is crucial for avoiding the physical adverse effects of radiation, especially after radiation disasters. Therefore, in such situations, the SPE can be considered a potential factor that may further heighten radiation-related anxieties. However, the underlying mechanisms of the SPE remain unclear. Gaining a deeper understanding of the SPE could provide insights into how to reduce radiation anxieties induced by disaster-related information.

When considering the mechanism underlying the emergence of the SPE, valuable insights can be derived from research on its neural basis. Previous studies have indicated that the insular cortex is involved in the SPE (Qin et al., 2020; Zhang et al., 2023). Given that the insular cortex is closely associated with the processing of interoception (Critchley et al., 2004), it suggests that interoception, sharing a common neural basis, may play a role in the emergence of the SPE. However, the actual relationship between interoception and the SPE has not been examined. Therefore, this study aims to gain a better understanding of the mechanism behind the emergence of the SPE and to examine the relationship between interoception and the SPE.

Study 1 examined the correlation between interoceptive sensibility, one of the individual differences in interoception, and the SPE. Interoceptive sensibility refers to the awareness of changes in interoceptive sensations in daily life and is assessed through self-report questionnaires (Garfinkel et al., 2015). However, no significant correlation was found between the two, indicating no evidence

of an association between the SPE and interoceptive sensibility.

In Study 2, the relationship between interoceptive accuracy, another individual difference in interoception, and the SPE was examined. Interoceptive accuracy refers to the ability to accurately perceive interoception and is assessed through experimental tasks (Garfinkel et al., 2015). Additionally, to investigate the impact of interoception on the SPE, external stimuli synchronized with the participants' cardiac cycle were presented during the task to measure the SPE. As a result, a significant negative correlation was observed between interoceptive accuracy and the SPE under the cardiac systole condition, where external stimuli were synchronized with the interoceptive signals. However, no significant correlation was found under the cardiac diastole condition, where such synchronization was absent. These findings suggest that interoception may inhibit the emergence of the SPE. However, this cannot definitively rule out the possibility of a spurious correlation between interoceptive accuracy and the SPE, considering they are both dependent variables. Additionally, there is a concern regarding the validity of the task used to measure interoceptive accuracy. Consequently, doubts remained regarding the suggested relationship in Study 2.

Therefore, in Study 3, to validate the findings obtained in Study 2, the relationship between interoceptive accuracy and the SPE was examined by introducing a manipulation involving vagus nerve stimulation, in addition to presenting stimuli synchronized with the cardiac systole. The result of the experiment demonstrated that the SPE was more likely to emerge when the vagus nerve was activated, or in other words, when the processing of interoceptive signals was activated. In contrast to Study 2, these results indicated that interoception facilitates the emergence of the SPE. The reason for the different results between Study 2 and Study 3 can be attributed to the nature of the interoceptive accuracy assessed in Study 2. It is speculated that in Study 2, interoceptive accuracy reflected a tendency to process non-interoceptive signals as interoception, rather than accurately perceiving interoception. In the processing of self-relevant information, the integration of external stimuli and interoceptive signals is necessary. However, the interference caused by the noise might have hindered the integrated processing of external stimuli and interoceptive signals, potentially

inhibiting the emergence of the SPE.

As a result of the series of studies, it has become evident that interoception enhances the emergence of the SPE. The SPE is a phenomenon that aids in the efficient acquisition of important information from the external environment. However, there is a concern that when disaster-related information heighten anxiety, the SPE may function as a risk factor that amplifies anxiety. The fundamental insights gained from this thesis suggest the possibility of reducing anxiety caused by the excessive prioritization of disaster-related information by modulating individual interoceptive processing. The radiation disaster at the FDNPP is often referred to as an "information disaster," and the role of disaster-related information in developing residents' anxiety is significant. Based on the findings presented in this thesis, future practical investigations are expected to contribute to the preservation of residents' mental health after radiation disasters, with a focus on the perspective of information processing.

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