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## Exploring Impact of Positive/Negative Valence Order on Repeated Exposure to Suspenseful Stories

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### Abstract

*This study investigates the psychological effects of positive/negative valence order in repeated exposure to a suspenseful text. Specifically, the study seeks to understand how the order in which positive and negative elements are presented in a narrative impacts the experience of suspense, arousal, and enjoyment in readers or listeners. Using a suspenseful short story, participants were exposed to narratives with varying valence orders in a repeated-measures design. The study employed self-report questionnaires and psychophysiological measurements to capture participants' psychological responses. The results supported the hypothesis that repeated exposure impacts suspense, with negative valence enhancing suspense and arousal. Moreover, the order of valence influenced participants' psychological responses, indicating that positive valence can mitigate the impact of repeated exposure. However, the influence on enjoyment was not significant. Psychophysiological measures, specifically skin conductance level (SCL), revealed trends of habituation over repeated exposure. The findings underscore the significance of negative valence in heightening suspense and suggest directions for future research in exploring diverse factors that contribute to suspense in both fictional and real-life contexts.*

**Keywords:** *suspense, repeated exposure, psychophysiological measurement, text-to-speech, Hoshi Shinichi*

### 1. INTRODUCTION

The psychological state of suspense, characterized by the experience of anxiety and tension, holds a pivotal position within narrative consumption, encompassing mediums such as literature and film. Scholars posit that suspense manifests as an apprehensive cognitive state, engendering within readers or viewers who exhibit empathy for protagonists while following a sequence of events with an uncertain outcome [1] [2].

The phenomenon of suspense extends beyond the realm of fictional constructs, incorporating not only narrative contents such as literary texts and suspenseful films but also involving commonplace scenarios characterized by the anticipation of significant outcomes, such as the attainment of a lottery victory or the outcome of a job interview. [3]. Among these phenomena, narrative suspense is one of the prevalent ubiquitously observed experiences within the domain of entertainment media. For instance, many individuals engage in the consumption of suspense-laden movies such as action and thriller films, alongside suspenseful narratives, including detective novels and mysteries. This engagement is predominantly driven by entertainment motives. In its psychological appeal, suspense is regarded as one of the key elements of the

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narrative experience [4]. The distress of readers or viewers is alleviated through the observation of the resolution of conflicts or uncertainties engendered by suspense. As suspense is unraveled, their enjoyment proportionally amplifies.

Suspense can be experienced in both visual narrative media (e.g., films, soap operas, and animation) as viewers, and within narrative texts (e.g., short stories and novels) as readers. In the study of narrative text, a short detective story was employed as a stimulus to observe readers' psychological responses, which were assessed through self-report measures [5]. Even though a suspenseful experience entails a continuous and prolonged emotional and cognitive process during the evaluation of a film or text over an extended duration, multiple preceding studies have assessed suspense through self-report questionnaire items administered at the culmination of the appreciation. Psychophysiological measurement, which observes the cognitive and emotional processing of media users, proves valuable in supplementing self-report methodology. It aids in surmounting the limitations of prior studies and facilitates an exploration of the intricate phenomena associated with suspenseful narrative experiences. This study aimed to observe and analyze psychological responses of readers engaged in suspenseful texts, utilizing not only self-report questionnaires but also psychophysiological measurements.

## 2. RESEARCH QUESTIONS AND HYPOTHESIS

Suspense appears as a mental state situated between uncertainty about a significant outcome and eagerness to resolve that uncertainty. However, it has been argued that suspense can be experienced repeatedly even after the uncertainty of the outcome has been resolved [6] [7]. This argument is commonly referred to as the paradox of suspense. This phenomenon represents a controversial issue, as suspense may not be experienced repeatedly due to the possibility of diminished narrative uncertainty resulting from repeated exposure to suspenseful texts.

In this study, the impact of repeated exposure to a suspenseful text was examined. Specifically, distinctions between repeated exposure to a positive valence text and negative valence text were explored. The evidence suggests that humans actively process negative information and respond to it more strongly [8] [9]. Furthermore, the negative valence of the narrative structure can potentially cultivate the probability of a negative event, consequently eliciting heightened arousal and suspense. Upon this theoretical background, the following hypotheses were formulated:

*Hypothesis 1.* The degree of self-reported suspense is expected to differ between the group exposed to a repetitive sequence of narrative with a negative-to-positive valence order, and the group exposed to a repetitive sequence of narrative with a positive-to-negative valence order.

*Hypothesis 2.* The degree of self-reported arousal is expected to differ between the group exposed to a repetitive sequence of narrative with a negative-to-positive valence order, and the group exposed to a repetitive sequence of narrative with a positive-to-negative valence order.

Enjoyment is another important factor in the appreciation of narratives with positive or negative valence. As Madrigal et al. (2011) found, the resolution of suspenseful uncertainty stands as a pivotal mediating factor influencing the enjoyment derived from narrative experiences [10]. Similarly, it can be assumed that the audience's enjoyment may vary based on the sequence of repetitive exposure, whether it follows a positive-to-negative or a negative-to-positive order. Based on this perspective, this study hypothesized:

*Hypothesis 3.* The degree of self-reported enjoyment is expected to differ between the group exposed to a repetitive sequence of narrative with a negative-to-positive valence order, and the group exposed to a repetitive sequence of narrative with a positive-to-negative valence order.

Psychophysiological measures prove valuable in exploring emotional arousal, a factor intricately linked to the level of suspense experienced by the audience during exposure to narrative media. In particular, SCL (Skin Conductance Level) and HR (heart rate) are commonly employed to observe emotional arousal [11]. The psychophysiological measure of SCL, considered to be a direct indicator of arousal, was observed in this experiment. Specifically, SCL during the instances of repeated segments was compared between the two groups. Within the same theoretical framework as the hypotheses concerning self-reported suspense and arousal, the following hypothesis was formulated:

*Hypothesis 4.* SCL is expected to differ between the group exposed to a repetitive sequence of narrative with a negative-to-positive valence order, and the group exposed to a repetitive sequence of narrative with a positive-to-negative valence order.

HR can be interpreted as indicative of various cognitive and emotional responses, including information acquisition, positive/negative emotional experiences, and internal cognitive activities. In this study, it could be challenging to precisely delineate the specific implications of HR in the context of repeated exposure to a suspenseful text, due to the experimental design encompassing the influences of negative valence, attention, and suspense. It was anticipated that manipulating the groups differently would elicit distinct responses from the audience members. Hence, the disparity in HR was to be observed in accordance with the subsequent hypothesis:

*Hypothesis 5.* HR is expected to differ between the group exposed to a repetitive sequence of narrative with a negative-to-positive valence order, and the group exposed to a repetitive sequence of narrative with a positive-to-negative valence order.

### 3. EXPERIMENT

#### 3.1 Material

The short-short story (also known as a Conte) “3-stage Hypnotics” (Japanese title: “三段式”, published in 1972 by the publisher 短編集 and translated into Korean), written by Hoshi Shinichi, a Japanese science fiction writer, has been selected as an experimental material after a careful review of candidate suspenseful short stories [12]. This story has a repetitive structure, which is appropriate for observing the repeated exposure to suspenseful moments. Additionally, it features a suspenseful narrative structure in which the threat towards the main character becomes increasingly intense. The narrative suspense evoked by drama is rooted in the audience’s concern for their favorite protagonist, and the character should be placed in a situation with a high likelihood of a significant threat. In the story, the protagonist is pursued by unidentified assailants wielding swords. He runs desperately but trips over a jagged stone. He narrowly escapes the assassins’ attack and awakens on a battlefield where bullets whiz by. He faces yet another dire moment as soldiers press into his trenches. Suddenly, he awakens again, realizing he’s in the midst of a massive flood with tremendous waves crashing around him. Once more, he wakes, only to discover he’s a lone pilot traversing the deep universe. He takes a medicine that induces a hypnotic dream filled with thrilling events. In essence, he undergoes three suspenseful and critical moments, all within the realm of a hypnotic experience.

The experimental material was created using the original story. The structure of the story consists of four sequences:

<1> The first hypnosis: the protagonist being chased by assassins.

<2> The second hypnosis: the protagonist waking up on a battlefield, with enemies rushing into the trench.

<3> The third hypnosis: the protagonist waking up in a place where a tremendous wave is causing flooding.

<4> Awakening from the hypnosis: the protagonist as a lone pilot taking medication to alleviate the monotony of space travel.

The repeated segment comprises sequences (<1>) and (<3>), while the positive valence ending was crafted through adjustments to sequence (<4>). The negative valence ending was derived from sequence (<2>). Consequently, the positive valence version of the material consisted of the repeated segment (<1>+<3>) and a positive ending (<4>), while the negative valence version was composed of the repeated segment (<1>+<3>) and a negative ending (<2>).

Because psychophysiological measurement relies on time-dependent tools, measuring the reading of text is impractical due to variations in participants' reading speeds. To standardize exposure time to suspenseful text, the script was transformed into narrations using the Google TTS (Text-to-Speech) API. The resulting audio file has a duration of 2 minutes and 41 seconds, with both versions having identical durations.

### 3.2 Measures

Self-report items were employed to gauge suspense, arousal, and enjoyment in the study. To measure participants' suspense, a single-item, 9-point Likert scale question was utilized: "How much suspense did you experience while listening to the voice recording?" (1 = very little, 9 = very much). A similar question assessed participants' arousal: "To what extent were you aroused while listening to the voice recording?" (1 = very little, 9 = very much). For the arousal question, a 9-point scale Self-Assessment Manikin (SAM) pictogram was presented for selection. Additionally, participants were asked about their level of enjoyment while listening to the voice recording, with responses ranging from 1 (very little) to 9 (very much).

Psychophysiological responses in terms of SCL and HR were collected using Biopac MP150 systems as participants listened to the audio clip. The data, recorded at a frequency of 1,000 Hz, underwent down-sampling and averaging to the second for statistical analysis. The averaged value per second was adjusted by subtracting the baseline data collected from participants watching a blank screen for several seconds prior to each measurement, as SCL tends to decrease over time.

Regarding HR data, ECG (electrocardiogram) signals were gathered and converted into the IBI (inter-beat interval), representing the gap between heartbeats. IBI is inversely related to HR, where a higher IBI indicates a lower HR and vice versa.

### 3.3 Procedure

The experiment was conducted using a computerized test, and both psychophysiological data and self-report items were collected. A total of 50 graduate and undergraduate students were recruited and compensated for their participation. The participants consisted of 22 females and 28 males, with an average age of 26.4 years ( $SD = 4.15$ ). They were seated at desks equipped with computer systems and 24-inch monitors. Once bio sensors for measuring SCL and ECG were attached to the participants, they listened to a sample TTS (Text-to-Speech) audio clip and interacted with sample items displayed on the monitor. After the testing session, the participants were randomly assigned into two groups: the first group experienced the negative valence version (repeated segment + negative ending) following the positive valence version (repeated segment + positive ending), while the second group encountered the positive version after the negative version.

While listening to the TTS audio, physiological measurements were gathered using a biofeedback machine. After the listening session, participants responded to the self-report items by clicking on their choices. This process was repeated twice to observe the effects of repeated exposure, with a 5-minute break between the two exposures. The entire experimental procedure is illustrated in Figure 1.

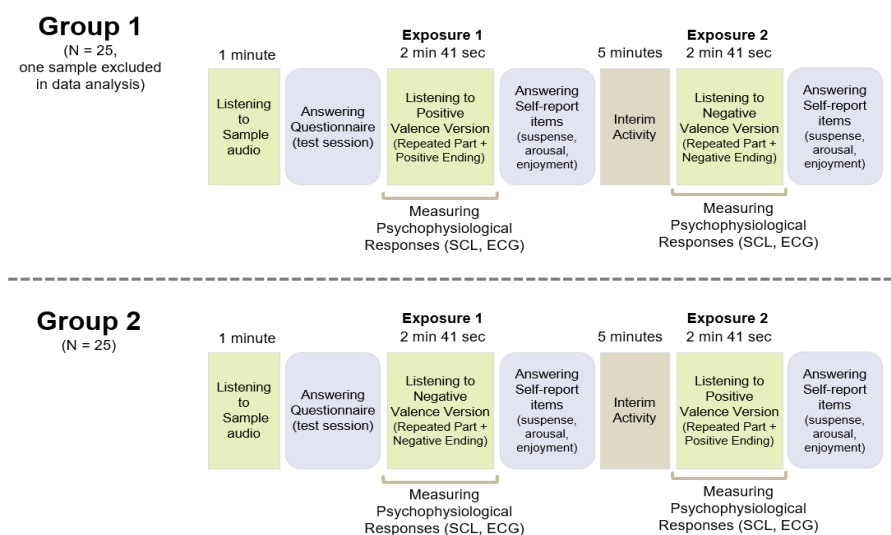


Figure 1. Experiment procedure

## 4. RESULTS

A 2 (group: order of positive/negative and negative/positive)  $\times$  2 (repeated listening: first exposure and second exposure) repeated-measures ANOVA was performed on self-reported items using IBM SPSS Statistics (version 22).

A significant main effect of repeated exposure on suspense was observed ( $F(2, 96) = 9.11, p = .004$ ), as well as an interaction effect between suspense and group ( $F(2, 94) = 13.70, p < .001$ ). Thus, statistical analysis supported the first hypothesis, indicating differences between groups in their response to repeated exposure with varying valence orders. The impact of repeated exposure on arousal  $\times$  group showed an almost significant result ( $F(2, 94) = 3.89, p = .055$ ), suggesting that while the second hypothesis wasn't definitively supported, the approaching significance still lent support to the first hypothesis, given that arousal can be interpreted as a measure of suspenseful emotional response. No discernible group difference emerged in enjoyment, rendering the third hypothesis unsupported. All main effects and interactions of the repeated-measures ANOVA are outlined in Table 1.

For the 2  $\times$  2 repeated measure ANOVA conducted on SCL and HR, no significant effect was found for "exposure  $\times$  group" in either SCL or HR. Consequently, statistical analysis did not support hypotheses H4 and H5.

**Table 1. Main effects and interactions of repeated-measures ANOVA**

	<i>F</i>	<i>df</i>	<i>p</i>
<b>Self-reported ratings</b>			
Self-reported suspense	9.11	2, 96	.004**
Self-reported suspense $\times$ Group	13.70	2, 94	<.001*
Self-reported arousal	1.51	2, 96	.225 (ns)
Self-reported arousal $\times$ Group	3.89	2, 94	.055 (as)
Self-reported enjoyment	3.30	2, 96	.076 (as)
Self-reported enjoyment $\times$ Group	0.035	2, 94	.852 (ns)
<b>Skin Conductance Level for the repeated part</b>			
Exposure	3.92	2, 96	.053 (as)
Exposure $\times$ Group	0.55	2, 94	.461 (ns)
<b>IBI Change for the repeated part</b>			
Exposure	0.89	2, 96	.351 (ns)
Exposure $\times$ Group	0.004	2, 94	.949 (ns)

Note: \*: significant at  $< .001$ , \*\*: significant at  $< .05$ , ns: not significant, as: approaching significant

## 5. DISCUSSION

The implication of the first hypothesis suggests an ordering effect of positive and negative valence when evaluating a suspenseful text. Specifically, the first group was exposed to the positive valence text followed by the negative valence text, while the second group listened to the negative valence text prior to the positive one. As depicted in Figure 2, during the first exposure, the second group reported higher suspense for the negative valence text compared to the first group exposed to the positive text. Conversely, the suspense level of the second group, exposed to the positive text, decreased rapidly, while the suspense level of the first group slightly increased. Interestingly, it appeared that the effect of repeated exposure might hasten the decline in suspense levels in the second group, likely due to the positive valence of the repeated segment. Meanwhile, in the first group that listened to a negative text during the second exposure, the response could

be influenced both by the habituation effect resulting from repeated exposure and the elevating effect of the negative valence, which was expected to heighten suspense levels. This implies that the impact of a negative valence text could be mitigated by repeated exposure.

The results of self-reported suspense reflect responses not only to the repeated segment but also to the positive or negative outcomes integrated within the repeated clip. The higher suspense level during the first exposure of the second group could be attributed to the negative outcome of that initial exposure. Similarly, the increased suspense rating in the second exposure is likely to have been influenced by the negative narrative.

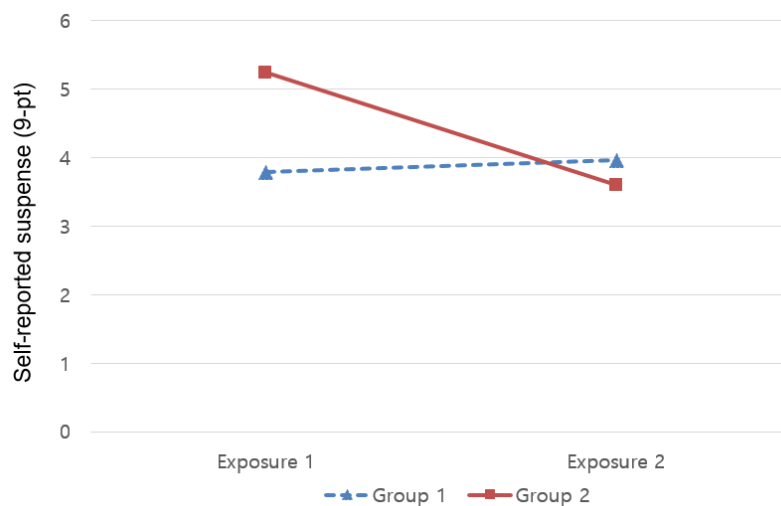


Figure 2. Profile plot of self-reported suspense

While the statistical outcome regarding SCL did not definitively endorse the existence of group differences, an overall decrease in SCL during the repeated exposure of both groups was evident. The nearly significant effect for exposure on SCL [ $F(2, 96) = 3.92, p = .053$ ] suggested that SCL might decline with repeated exposure. This pattern was observed in both the first group and the second group, as depicted in Figure 3.

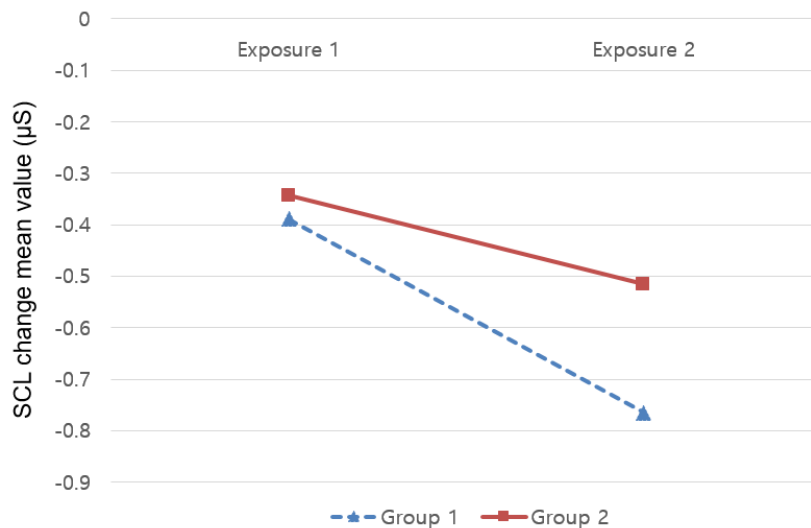


Figure 3. Profile plot of SCL mean value for 1st and 2nd exposure

SCL was exclusively measured during the repeated segment of the audio clip, unlike the self-reported suspense and arousal assessments which encompassed the cumulative narrative of the repeated suspenseful portion and positive/negative outcomes. This indicates that SCL could capture responses solely to the repeated segment. Consequently, the observed decline in SCL could be attributed to the habituation or desensitization effect associated with the repeated segment. Similar findings were explored in prior research exploring the consequences of repeated exposure to suspenseful films [13].

Furthermore, the extent of the decrease in SCL was more pronounced in the first group compared to the second group. This can be attributed to the expectation that the audience in the first group experienced a positive valence during the repeated exposure due to the positive valence of the previous (first) exposure's narrative. Likewise, the audience in the second group was presumed to engage with a negative valence narrative during the second exposure. Consequently, the positive valence of the repeated exposure could contribute to a more substantial decrease in SCL, while the negative valence might lead to a less pronounced decrease. This suggests that the effect of negative valence heightened both suspense and arousal during repeated exposure.

## 6. CONCLUSION

In conclusion, this study investigated the effects of positive/negative valence order in repeated exposure to a suspenseful text, which was generated using TTS (text-to-speech) technology. As anticipated by the hypotheses, the experiment revealed the impact of negative valence. Negative valence, which increased attention, appeared to elicit higher levels of suspense and arousal, thereby enhancing the overall suspenseful experience. Given that tension is one of the primary responses to suspenseful content, it can be reasonable to conclude that suspense is closely intertwined with negative valence. However, there are instances in which positive suspense can arise, such as in scenarios like lottery wins or watching sports games. For instance, in a lottery win, an individual may experience suspense while expecting a positive outcome, such as winning a large sum of money. This type of suspense differs from the one driven by negative valence. Experiencing suspense while watching a sports game is uniquely characterized by the intersection of positive anticipation for a favored team or athlete's victory and the negative fear or avoidance of losing the game or match. The exploration of such suspenseful experiences with positive valence remains an area for future study.

Several limitations of this study can be addressed. The empirical experiments utilized only one text as the material, a relatively small sample within the broader scope of suspenseful literature. Among the various factors contributing to suspense, this study primarily concentrated on repeated exposure and positive/negative valence. Additional factors that contribute to suspense include uncertainty, discourse structure, threats and conflicts involving beloved characters, and the information gap between characters and the audience. These elements influencing suspense, as well as the intricate mechanisms underlying the experience of suspense, require further empirical and theoretical exploration.

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