

# Science Fiction Prototyping Method Improves Readers' Narrative Experiences

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## Abstract

Science fiction (Sci-Fi) is one of the most creative literary genres, and it is useful to identify ways to support the development of works in this genre. Science Fiction Prototyping (SFP) is one promising method for facilitating the collaborative creation of Sci-Fi works. However, as SFP is used to support innovation and technological progress rather than produce Sci-Fi itself, its effectiveness has not been evaluated in this regard. Therefore, this study explored whether SFP could produce higher-quality Sci-Fi texts, as evaluated by the narrative experience of readers. Five authors were recruited to produce 10 Sci-Fi texts; each author created two texts, one using SFP (SFP text) and one without SFP (non-SFP text). A total of 253 native Japanese speakers read two Sci-Fi works, each by the same author. The readers' ratings were recorded using the Narrative Experience Scale of Science Fiction developed in our previous study. The results showed that SFP texts had higher narrative experience scores than non-SFP texts, although the effects differed by author and presentation order. Despite some limitations, we conclude that the SFP is an effective method to support the creation of Sci-Fi texts.

*Keywords:* Science Fiction, Science Fiction Prototyping, Comprehension, Immersion, Speculation.

## 1 Introduction

Science fiction (Sci-Fi)—one of the most creative literary genres—is characterized by its ability to enable people to imagine the future. For example, readers can become more interested in addressing climate change when reading Sci-Fi [1]. Futurologists and Human-Computer Interaction researchers have paid considerable attention to Sci-Fi because it provides ample scope for innovation and invention for the future [2].

However, despite its popularity among readers, previous studies have paid little attention to how Sci-Fi works are created; neither have they identified effective methods for supporting their creation. Generally, many Sci-Fi writers create works based on the “three-act structure” by Syd

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Field [3]. Many writers have also used the method introduced in Orson Scott Card's book [4]. While many authors have found these methods useful based on their experiences, their effectiveness has not been empirically tested. Additionally, these methods were developed assuming that Sci-Fi works are created by a single author, not by a group.

Science fiction prototyping (SFP) is a method of using Sci-Fi to design the future [5][6]. This method is often utilized for new business development in companies and other organizations. This method differs from existing collaborative methods, such as road-mapping-based workshops [7]. In SFP, employees and writers engage in a dialogue to explore new business possibilities by jointly creating a Sci-Fi work set in the future. However, Sci-Fi works produced using SFP are somewhat different from the conventionally produced ones. First, SFP aims to create a fictionalized image of future society. Second, creating Sci-Fi texts is not the main goal of SFP but a means of achieving other goals. Third, SFP involves collaboration with people other than Sci-Fi writers. Previous studies have focused on the effectiveness of the SFP for purposes other than creating Sci-Fi works [8] and have not examined whether the SFP facilitates the production of Sci-Fi itself because the creation of Sci-Fi is not the main goal of SFP. Nevertheless, this method has considerable potential for facilitating the development of Sci-Fi.

Given this context, the present study explores whether SFP enhances the quality of Sci-Fi works. The quality of Sci-Fi was evaluated using the Narrative Experience Scale of Science Fiction developed in our previous study [9]. The scale comprises three subscales: Comprehension, Immersion, and Speculation. Comprehension consists of the items related to readers' cognitive understanding of sci-fi, and Immersion consists of the items related to readers' emotional attributes toward sci-fi. Speculation consists of the items related to the change in readers' future perspective. To control for the effects of the author, we used two Sci-Fi works created by the same author; one made using SFP (SFP text) and the other created without SFP (non-SFP text). We then compared readers' narrative experience scores. We hypothesized that the SFP would facilitate Sci-Fi creation; therefore, readers would have better narrative experiences from SFP texts than from non-SFP texts.

## 2 Method

### 2.1 Participants

We recruited 347 native Japanese speakers via Lancers, a Japanese online working system, to complete a survey we developed. A total of 253 participants (117 women and 136 men) completed the survey. A summary of the demographic variables is presented in Table 1. Each participant received 999 yen for their participation.

### 2.2 Measures

We used the Narrative Experience Scale of Science Fiction, developed in our previous study [9], to measure the participants' narrative evaluation of Sci-Fi texts. This scale comprised 18 items, originally drawn from the Narrative Engagement Scale [10] and other Sci-Fi studies [11][12][13]. The items on each subscale are listed in Table 2.

### 2.3 Materials

We used 10 Sci-Fi texts written by five authors. Each author produced two texts, one collaboratively, using SFP (SFP texts) [14][15][16][17][18], and the other individually, without

using SFP (non-SFP texts) [19][20][21][22][23]. All texts were written in Japanese, and permission was obtained from each author and publisher to use them in the study.

Table 1: Summary of the demographic variables

Categories		<i>N</i>
Age (years)	18–19	2
	20–29	44
	30–39	84
	40–49	77
	50–59	28
	60–69	17
	70–79	1
Educational attainment	Junior high school	4
	High school	63
	Technical college	23
	Junior college	21
	University	121
	Graduate school: Master’s degree	11
	Graduate school: Doctorate	3
	Others	6
No answer	1	

Table 2: Items in the Narrative Experience Scale of Science Fiction.

Subscale	Item
Comprehension	Sometimes it was hard to understand what was going on in the sci-fi story. *
	I didn’t understand the personas very well. *
	I sometimes lost track of the plot of this sci-fi. *
	My mind was wandering while I was reading. *
	While I was reading the sci-fi story, I was thinking about other things. *
Immersion	While I was reading the sci-fi story, I had a hard time focusing on reading. *
	The story affected me emotionally.
	While I was reading, I felt happy, when the main characters succeeded; I felt sad when they suffered in some way.
	While I was reading sci-fi, I empathized with a character.
	While I was reading, my body was in the room, but my mind was inside the world created by the story.
	The sci-fi story created a new world, which suddenly disappeared when it ended.
	Sometimes, the story world was closer to me than the real world.
Speculation	After reading the sci-fi story, I thought that the rules and values of the real world that I had believed in were not the only absolute ones.
	After reading the sci-fi story, I felt that having a different society from ours is possible.
	Modern technologies and mechanisms that appear in sci-fi consistently support the sci-fi plot deployment.
	The deployment of the sci-fi story is plausible.
	Reading sci-fi gave me a new perspective.
	Reading sci-fi made me think of social problems in the real world.

Asterisk indicates reversed items.

The SFP texts were created in a workshop conducted in 2020 by the Mitsubishi Research Institute as a part of its 50th-anniversary celebration [24]. Each workshop group explored one of the following topics: health, connectedness, self-actualization, safety and security, and sustainability. Mitsubishi Research Institute employees and Sci-Fi writers attended the workshop. Each group participated in two workshops. In the first one, the participants worked together to develop ideas for the abovementioned topics while imagining Japanese society in 2070. After the workshop, the authors prepared a draft plot of several hundred words. Additional material was prepared for the second workshop. Finally, the writers wrote their Sci-Fi texts, and the editorial team from the Mitsubishi Research Institute helped edit and publish them.

## 2.4 Procedure

After explaining the purpose of the study to the participants and obtaining their permission, their native languages were checked so that only native Japanese speakers could participate in the study. Next, one pair of texts written by the same author was randomly assigned to each participant. Each text was presented so that each page had approximately 1,000 characters, and the participants were asked to read it silently and complete the reading in about 30 minutes. They were, however, allowed to exceed 30 minutes should they need to. Their reading time was recorded per page. The order of the presentation was counterbalanced. After reading, the participants responded to 50 items concerning the text, including the Narrative Experience Scale of Science Fiction on a 5-point Likert scale. This procedure was repeated twice. Finally, the participants provided their demographic information, including gender, age, occupation, education domain, educational attainment, average reading time per month, and reading time of creative work per month.

## 3 Results

Data from participants whose log-transformed total reading time was three *SD* shorter than the mean reading time for each text were regarded as outliers; data with at least one outlier were excluded from the analyses. The reading times for the first page of the non-SFP texts by Authors 2, 3, and 4 could not be recorded due to a setup problem. Therefore, outliers for these texts were determined based on the means and *SDs* of the total reading time from the second page onward. After accounting for all outliers, data from 249 participants were included in the analyses.

The mean score of the items was calculated for each subscale and was used in subsequent analyses. We conducted a  $2 \times 2 \times 5$  mixed analysis of variance (ANOVA) on each subscale score by considering the Sci-Fi creation method (SFP/non-SFP), presentation order (SFP first/non-SFP first), and author (1–5) as factors. Method was a within-participant factor, and presentation order and author were between-participant factors. The significance level was set at .05. Tables 3–5 show the means and *SDs* of the subscale scores as a function of author and method.

For Comprehension, the main effect of method was significant [ $F(1, 239) = 4.22, \eta_p^2 = 0.02$ ], indicating that the participants scored SFP texts ( $M = 3.44, SD = 0.91$ ) higher than the non-SFP texts ( $M = 3.32, SD = 0.92$ ). The interaction between author and method was also significant [ $F(4, 239) = 36.42, \eta_p^2 = 0.38$ ]. Pairwise comparisons using paired *t*-tests with a Bonferroni adjustment showed that the score was significantly higher for SFP texts than for non-SFP texts for Authors 1 and 3, but the reverse pattern was observed for Authors 2 and 4, and no significant difference was observed for Author 5 (See Table 3). Other main effects and interactions were not significant

[author:  $F(4, 239) = 0.57, \eta_p^2 = 0.01$ ; presentation order:  $F(1, 239) = 0.38, \eta_p^2 = 0.00$ , author  $\times$  presentation order:  $F(4, 239) = 0.34, \eta_p^2 = 0.01$ ; method  $\times$  presentation order:  $F(1, 239) = 2.25, \eta_p^2 = 0.01$ ; author  $\times$  presentation order  $\times$  method:  $F(4, 239) = 0.18, \eta_p^2 = 0.00$ ].

Table 3: Means and SDs of Comprehension as a function of author and method.

Author	N	SFP		non-SFP	
		Mean	SD	Mean	SD
1	52	4.01	0.90	2.80	0.90
2	51	2.99	0.75	3.84	0.81
3	49	3.53	0.87	2.98	0.91
4	53	3.28	0.87	3.60	0.78
5	44	3.37	0.85	3.35	0.78

For Immersion, the method had a significant main effect [ $F(1, 239) = 10.65, \eta_p^2 = 0.04$ ], indicating that the score was higher for SFP texts ( $M = 2.95, SD = 0.86$ ) than for non-SFP texts ( $M = 2.78, SD = 0.87$ ). The interaction between author and method was also significant [ $F(4, 239) = 10.90, \eta_p^2 = 0.15$ ]. Pairwise comparisons using paired  $t$ -tests with a Bonferroni adjustment showed that the score was significantly higher for SFP texts than for non-SFP texts for Authors 1 and 3, the reverse pattern was observed for Author 2, and no significant difference was observed for Authors 4 and 5 (See Table 4). The interaction between presentation order and method was also significant [ $F(1, 239) = 10.66, \eta_p^2 = 0.04$ ]. Pairwise comparisons using paired  $t$ -tests with a Bonferroni adjustment showed that SFP texts received significantly higher scores (SFP:  $M = 3.07, SD = 0.80$ ; non-SFP:  $M = 2.72, SD = 0.87$ ) when they were presented before non-SFP texts, but not when they were presented second (SFP:  $M = 2.82, SD = 0.90$ ; non-SFP:  $M = 2.85, SD = 0.87$ ). Other main effects and interactions were not significant [author:  $F(4, 239) = 1.26, \eta_p^2 = 0.02$ ; presentation order:  $F(1, 239) = 0.37, \eta_p^2 = 0.00$ , author  $\times$  presentation order:  $F(4, 239) = 0.75, \eta_p^2 = 0.01$ ; author  $\times$  presentation order  $\times$  method:  $F(4, 239) = 0.25, \eta_p^2 = 0.00$ ].

Table 4: Means and SDs of Immersion as a function of author and method.

Author	N	SFP		non-SFP	
		Mean	SD	Mean	SD
1	52	3.26	0.77	2.67	0.90
2	51	2.74	0.81	3.12	0.76
3	49	2.84	0.84	2.51	0.88
4	53	2.93	0.93	2.72	0.88
5	44	2.95	0.85	2.91	0.79

Table 5: Means and SDs of Speculation as a function of author and method.

Author	N	SFP		non-SFP	
		Mean	SD	Mean	SD
1	52	3.62	0.67	3.08	0.74
2	51	3.49	0.58	3.30	0.65
3	49	3.51	0.69	2.83	1.00
4	53	3.30	0.68	3.47	0.60
5	44	3.28	0.80	3.34	0.75

For Speculation, the method had a significant main effect [ $F(1, 239) = 28.20, \eta_p^2 = 0.11$ ], indicating that the SFP texts had higher scores ( $M = 3.44, SD = 0.69$ ) than non-SFP texts ( $M =$

3.20,  $SD = 0.78$ ). The interaction between author and method was also significant [ $F(4, 239) = 13.75$ ,  $\eta_p^2 = 0.19$ ]. Pairwise comparisons using paired  $t$ -tests with a Bonferroni adjustment showed that the scores were significantly higher for SFP texts than for non-SFP texts for Authors 1, 2, and 3 but not for Authors 4 and 5 (See Table 5). The interaction between presentation order and method was also significant [ $F(1, 239) = 27.54$ ,  $\eta_p^2 = 0.10$ ]. Pairwise comparisons using paired  $t$ -tests with a Bonferroni adjustment showed that SFP texts received higher scores when they were presented before non-SFP texts (SFP:  $M = 3.52$ ,  $SD = 0.61$ ; non-SFP:  $M = 3.05$ ,  $SD = 0.83$ ) but not when they were presented second (SFP:  $M = 3.37$ ,  $SD = 0.76$ ; non-SFP:  $M = 3.37$ ,  $SD = 0.70$ ). Other main effects and interactions were not significant [author:  $F(4, 239) = 1.06$ ,  $\eta_p^2 = 0.02$ ; presentation order:  $F(1, 239) = 1.21$ ,  $\eta_p^2 = 0.01$ , author  $\times$  presentation order:  $F(4, 239) = 1.07$ ,  $\eta_p^2 = 0.02$ ; author  $\times$  presentation order  $\times$  method:  $F(4, 239) = 0.59$ ,  $\eta_p^2 = 0.01$ ].

## 4 Discussion

This study explored whether SFP enhances the quality of Sci-Fi texts using the Narrative Experience Scale of Science Fiction. The results showed that all scores were higher for the SFP texts than for the non-SFP texts, although a significant interaction was also found with author and presentation order. Despite some limitations, we conclude that the use of SFP might improve the quality of Sci-Fi, as evaluated by the narrative experience of readers.

The effects of using SFP differed depending on the authors, although the main effects were observed in all the subscale scores. Specifically, one author for Comprehension, two for Immersion, and two for Speculation showed no difference between SFP and non-SFP texts. In addition, SFP disrupted Comprehension for two authors and Immersion for one author. The results imply that the SFP could facilitate all three aspects of the narrative experience, but individual differences may exist. Further studies are required to identify the factors influencing whether the SFP has facilitative effects. These factors could include the authors' beliefs, the types of Sci-Fi they prefer, and their strategies for creating Sci-Fi stories. The authors' preference for collaboration could also influence the effects of SFP because SFP involves collaborative efforts.

As the method (SFP/non-SFP) was a within-participant factor, each participant read two Sci-Fi texts. Therefore, we added presentation order as a factor to examine the main effect and interaction concerning the presentation order. The results showed no interaction between method and presentation order for Comprehension, but this effect was observed for Immersion and Speculation. Specifically, when an SFP text was presented first, it received a higher score than its non-SFP counterpart. However, this effect was not observed when SFP texts were presented later. Thus, the facilitative effects of the SFP on Immersion and Speculation may be limited to instances when participants are not exposed to another text.

Despite some limitations, we can conclude that the SFP contributes to creating higher-quality Sci-Fi. Consequently, it is necessary to identify why the facilitative effects of the SFP have emerged. There were several differences between the SFP and non-SFP texts. First, the SFP texts were created by groups, whereas the non-SFP texts were created by the authors alone. Previous studies on idea generation have shown that more diverse ideas are generated in a group than in an individual. The results of this study can be interpreted as an effect of group work. Second, unlike non-SFP texts, the creation of SFP texts involved the engagement of experts with different backgrounds or values engaged in SFP. These factors may contribute to the production of creative Sci-Fi. Third, the structured tasks involved in SFP could have helped authors generate creative scenarios. However, there were other differences, such as the subject matter of the Sci-Fi and the number of letters. Thus, the role of group work in SFP should be examined by controlling for

other confounding factors.

While scholars have examined the effectiveness of SFP in business, less attention has been paid to the quality of SFP texts as literary works. The present study demonstrated that SFP enhances the quality of Sci-Fi. Therefore, SFP can also be an effective tool for creative writing.

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