Implementation of a Scene Expansion Mechanism Using an Event Sequence: As a Mechanism in an Automatic Narrative Generation Game

Jumpei Ono and Takashi Ogata

***Abstract*—The goal of this study is to develop a game that generates a story automatically based on the story creation process used in Table-top role playing games (TRPGs). TRPG is an analog game that employs the creativity of the game player. We have already produced a mechanism for developing a scene sequence from a mutual communication between game master (GM) and player (PL) experimentally. This mechanism generates a story constructed from a few scenes. Scenes are parts of a story that are separated by a temporal and spatial border. In this paper, we introduce a mechanism to expand scenes by using event sequence information with the goal of generating a long story. The event sequence information is obtained using a semi-automatic event sequence acquisition system that was developed in previous work.**

***Index Terms*—Automatic narrative generation game, event sequence, script, table-top role playing game.**

I. Introduction

The goal of this study is to develop a game that generates a story automatically based on a process involving the communication between a "Game Master (GM)" and "Player (PL)" in a Table-top Role Playing Game (TRPG) [1]. The TRPG, invented by Gary Gygax [2], is an analog game that employs the creativity of the game players. For example, there is a study that examined "creativity" from six viewpoints, i.e. story, acting, gaming, problem-solving, game-world [3], and stimulated creativity of the game user by processing the communication between GM and PL in the game system, which the authors suggest consciously aims at generating many kinds of stories.

As part of the trial run of the automatic story generation game, the mechanism to generate a scene sequence from the communication between GM and PL was developed [4]. This mechanism generates the story, which is constructed by a few scenes (scenes are parts of a story that are separated by a temporal and spatial border). A mechanism that expands scenes by applying the knowledge of an event sequence to the mechanism has been introduced in this paper. The purpose is to generate a longer narrative. The event sequence information is created using a semi-automatic event sequence acquisition system that was developed in previous work [5].

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II. Background

In this paper, a new mechanism that combines two experimentally developed mechanisms has been suggested. This section outlines both these mechanisms and the system that is created using these mechanisms.

A. What Game Is in the Paper

Digital games based on TRPG are announced in various mediums so far. These are the games that brought how to play in TRPG close to conventional digital games. The PL is the user and the GM is a computer in those games. The game proposed here is intended for the game system, which we modeled closely after the structure of a TRPG. The game user assumes a role unlike the GM and PL. In an extreme example, we could imagine a game in which the user has almost no participation.

In the study that examined the story creation process of a TRPG, a model [6] for devotional storytelling is suggested for use by story participants who take on the roles of one of the characters. An interviewer shares story space with a narrator and demonstrates controlling the progress of the story interactively in a TRPG. There is a study that examined the power a game participant has to shape the story in a TRPG across three varieties of games in the TRPG genre. The study includes an example [3] that examined "creativity".

B. A TRPG-Based Automatic Narrative Generation Game

The automatic narrative generation game generates a story by fleshing out a rough framework of it using various methods. We call a generated story a "scenario" here. The scenario consists of a "world setting" and a "scene sequence". The former is the set of the information necessary to flesh out the story, and it includes characters, objects, locations and times, and the set of limitations and rules to be applied to those elements. The scene sequence is a set of multiple scenes. The rough framework of the story mentioned above is a scene sequence, and the scenario that we finally flesh out is a scene sequence. The individual scenes are constructed as an action sequence of the characters in a range that is divided temporally and spatially in a scenario. Table 1 has a summary of terms related to TRPG.

Fig. 1 shows the generation mechanism; the overall processing is divided into three phases: (Step.1) preparations, (Step.2) story generation, and (Step.3) result output. The authors developed the mechanism for Step.2 via their experiments.

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TABLE I: TERMS IN THE NARRATIVE GENERATION GAME

Terms	Role	Terms in TRPG
Game master (GM)	To control the preparations for and the progression of the game. Usually alone.	GM
Player (PL)	To play characters in the game. There are multiple PLs.	PL
Scenario	Overall information that connects world setting and scene sequence.	—
World setting	Information that constitutes the setting of the game and limitation. To include characters, things, locations, time and restrictions in the game.	System
Scene sequence	Sequence of several scenes. This sequence includes the condition of the change in two scenes.	Scenario
Scene	A spatial and temporal section in a story.	Scene

By using this trial mechanism, a scene sequence is expanded when GM shows a scene sequence and PL suggests a scene. Fig. 2 illustrates the process.

However, this trial mechanism does expand a scene into plural events. Therefore, in this article, the scene development mechanism by the event sequence that uses the mechanism to speak with the next section experimentally has been used.

A scene is a spatial and temporal section in a story. Furthermore, the scene is constructed by one or more events. An event points at movement and the change with any component in the story.

C. Integrated Narrative Generation System

The Integrated narrative generation system (INGS) [7] being developed is a system that integrates the mechanism of story generation that was systematically developed by us, and it is the basis of other application systems. The automatic narrative generation game uses various mechanisms of the INGS.

The INGS aims at storing pieces of the story (the special pieces of the story are the whole structure of the story) in various particle sizes, by classifying and arranging those pieces systematically, without limiting the pieces of a story and a discourse to a particular type and genre beforehand. A knowledge base is called a story contents knowledge base for its purpose. Fig. 3 is an example of the knowledge. The displayed knowledge is a constructed element that includes conceptual dictionaries. The conceptual dictionaries are dictionaries that include noun concepts or verb concepts structurally.

D. Semi-automatic Event Sequence Acquisition System

The automatic acquisition of every possible piece of the story contents knowledge base was one of the purposes, and the trial manufacture of a semi-automatic acquisition tool of the event sequences was the primary objective [5]. An event sequence structures events systematically. The acquisition tool mentioned above acquires script knowledge in story content knowledge bases [7].

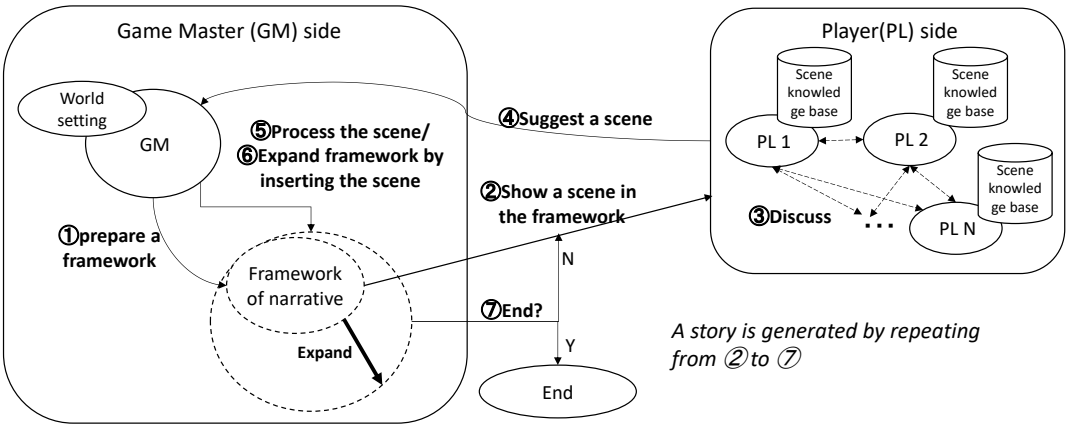

Fig. 1. A story generation model in the Table-top role playing game.

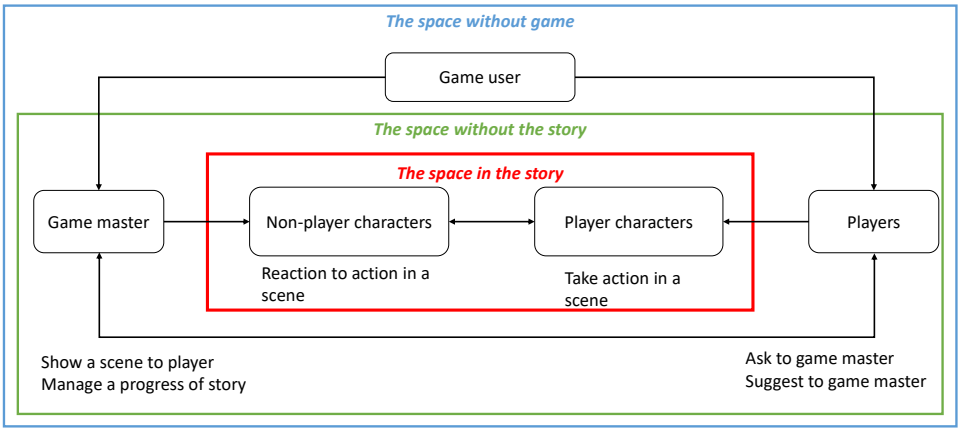

Fig. 2. The overview of an interaction between game master and player.

In the semi-automatic acquisition of script knowledge [5], the user selects a verb concept from verb concepts displayed by the tool. The user writes a script that includes two or more events to expand it concretely in natural language. The tool

converts the script into an event description form (case frame) in INGS. Finally, the converted script is stored in a story contents knowledge base. In addition, as a type of the verb concept that a system shows for a user, the tool uses the verb concept in a story contents knowledge base. For example, the verb concept "eat" is made a script due to the plural nature of the event, but it is an original verb concept "eat" that shows for a user here. The tool can make the verb concept of the event to facilitate a script-based development that details more.

```
(script0011 (負ける 4[be-defeated] (立つ 34[be-ahead] 誇る
      1[be-proud]泣く 1[be burdened] 逃げる 2[shirk]))
   ((event 負ける 4[be defeated] (agent (&v age1)) (counter-agent
      (&v age2)) (instrument (&v obj1)))
   ((1 (event 立つ 34[be-ahead] (agent (&v age2)) (counter-agent
      (&v age1)) (instrument (&v obj1))))
    (2 (event 誇る 1[be-proud] (agent (&v age2)) (object (&sc 勝利
      @勝利[win@win])))))
    (3 (event 泣く 1[be-burdened] (agent (&v age1)) (object (&sc
      悔しさ@悔い[chagrin@chagrin])))))
    (4 (event 逃げる 2[shirk] (agent (&v age1)) (from (&v
age2)))))))
```

Fig. 3. Example of a story contents knowledge (script).

Using the above-mentioned acquisition system, the scene expansion mechanism was developed. The acquisition system uses it for the construction of the knowledge base for scene expansion.

III. Implementation of a Scene Expansion Mechanism Using Event Sequence

The scene expansion method is divided into construction of event sequence knowledge and expansion of scene using event sequence knowledge (Fig. 4).

Fig. 5 is a summary of the scene sequence from which a scene was developed. In this way, the scene sequence has an event sequence for every scene. In [4], the mechanism expanded the scene sequence, but this is the expansion of the macro-part in this structure. In addition, with the scene development to be performed here, the expansion of the micro-part has been dealt with in this structure. The next section explains the method in detail.

A. Method

1) Constructing event sequence knowledge

The construction mechanism of the scene development knowledge was developed using the event sequence semi-automatic acquisition system. A specific verb concept was assumed from a scene and knowledge was built by analyzing a sentence. The knowledge so built, which is used in a story, is desirable. Therefore, the system outputs an explanation indicating the input of the sentence to the user.

1) The user chooses an object to make an event sequence.
2) The user inputs more than two sentences.
3) The system searches for a verb concept from an input sentence and makes the status structure.
4) The system stores the created knowledge in a knowledge base.

2) Expanding a scene using event sequence knowledge

Whenever a scene is shown by GM, the scene expansion processing is carried out by searching an event sequence in the knowledge base that PL has, and selecting it.

1) The user chooses one event sequence among those in the knowledge base that PL has based on a scene that was shown by GM or a scene that PL suggested for GM.
2) A chosen event sequence is an event sequence tied to the scene, which unfolds on a knowledge base.
3) GM presents a scene by an event sequence chosen at the top. In addition, GM selects whether GM stops development processing. This decision is controlled by the user.
4) When the user chooses to continue development processing again, the mechanism chooses an event sequence among those in the knowledge base that PL has. An event sequence chosen here is the event sequence that can expand the event sequence developed in the previous step.

These steps are repeated until the user stops the above-mentioned processing.

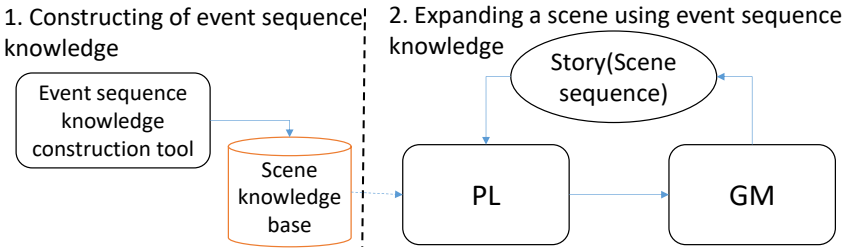

Fig. 4. The process of scene expansion mechanism.

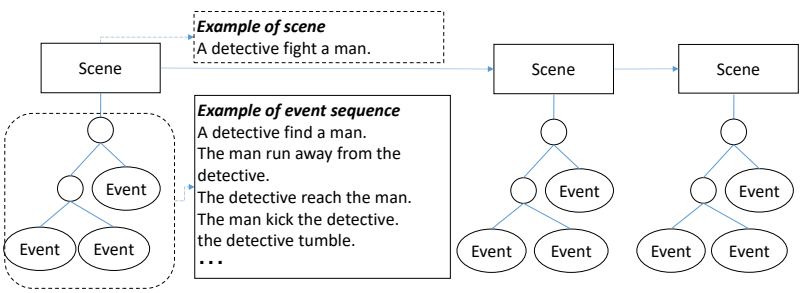

Fig. 5. Example of scene expansion.

B. Result

Using the input that was used by the trial manufacture of the scene sequence expansion mechanism [4], a story was generated using the scene expansion mechanism.

First, a user builds event sequences that link the verb concept (scene) included in a scene sequence input to scene sequence expansion mechanism and the verb concept (scene) included in the knowledge base that PL has. Next, with the expansion of the scene sequence, the mechanism develops the scene using the event sequence that the user built.

1) Constructing of event sequence knowledge

Fig. 6 shows the generation process of the event sequence, and Fig. 7 is a completed event sequence. Six event sequences ware made from verb concepts (“kidnap”, “dispute”, “be-left-intact”, “examine”, “shoot”, “fight”), which are included in the scene sequence later and the knowledge base that PL has.

2) Expanding a scene using event sequence knowledge

Fig. 8 is input, and Fig. 9 is the result of the expansion of the scene sequence and the expansion of scenes. By this result, the knowledge that has been already stored by a story contents knowledge base is used as well as the event sequence that a user built (“fight” that was inserted by suggestion of PL was expanded by using the knowledge that has already been stored in this result).

「誘拐する 1」を，二つ以上の文から成る事象連鎖に展開してください。[Please, you change “kidnap” to event sequence that conform two more sentences.]
なお、「誘拐する 1」とは「男が子供を誘拐する」という意味です。[And, “kidnap” means “A man kidnaps a child”.]
入力をどうぞ。[Please, you input sentences.]
>>**男が子供を追う。男が子供を捕らえる。男が逃げる。**[A man chases a child. The man catches the child. The man escape.]

Fig. 6. Example of scene expansion.

(script0061 (誘拐する 1[kidnap] (追う 2[chase] 捕らえる 1[catch]逃げる 1[escape]))
((event 誘拐する 1[kidnap] (agent (&v age1)) (counter-agent (&v age2)))
((1 (event 追う 2[chase] (agent (&v age1)) (counter-agent (&v age2))))
(2 (event 捕らえる 1[catch] (agent (&v age1)) (location (&v loc1)) (counter-agent (&v age2))))
(3 (event 逃げる 1[escape] (agent (&v age1)) (from (&v loc2)) (to (&v loc3)))))))

Fig. 7. Constructed event sequence.

Scene sequence	((event 誘拐する 1[kidnap] (agent age% 青年#1[young-man#1]) (counter-agent age% 女#1[woman#1])) (event 争う 2[dispute] (agent age% 男 #1[man#1]) (counter-agent age%青年#1[young-man#1])) (event 助かる1[be-saved] (agent age%女#1[woman#1])))
PC	((ID age%青年#1[young-man#1]) (instance-of 青年@男[youngman@man]) (type nil) (所持[possession] nil) (健康状態[health-condition] 100) (職業[job] 警官@警官[police@police])…)

Fig. 8. Input data for scene sequence expansion mechanism.

In this paper, we suggest the system which performs story generation by burying the blank of the framework of story. This mechanism is one of two funs that automatic narrative generation game which the authors aims for has. Another fun is to bury a blank in form to betray the ending included in the frame daringly. As a result, the story that GM does not expect is completed. The mechanism that we spoke here is mechanism to become the premise.

((誘拐する 1[kidnap]
(event 追う 2[chase] (agent age%青年#1[young-man#1]) (counter-agent age%女#1))
(event 捕らえる 1[catch] (agent age%青年#1[young-man#1]) (location loc%通り#1[street#1]) (counter-agent age%女#1))
(event 逃げる 1[escape] (agent age%青年#1[young-man#1]) (from loc%裏道#1[back-street#1]) (to loc%家#1[house#1])))
(調査する 1[examine]
(event 調べる[check] (agent age%男#1[[man#1]]) (counter-agent age%女#1[woman#1]))
(event 発見する 2[find] (agent age%男#1[man#1]) (counter-agent age%女#1[woman#1])))
(争う 2[dispute]
(event 殴る 2[strike] (agent age%青年#1[young-man#1]) (counter-agent age%男#1[man#1]))
(event 避ける 1[avoid] (agent age%男#1[man#1]) (counter-agent age%青年#1[young-man#1]))
(event 殴る 2[strike] (agent age%男#1[man#1]) (counter-agent age%青年#1[young-man#1])))
(戦う 3[fight]
(event 襲う 2[attack] (agent age%青年#1[young-man#1]) (counter-agent age%男#1[man#1]))
(event 避ける 1[avoid] (agent age%男#1[man#1]) (counter-agent age%青年#1[young-man#1]))
(event 引き抜く 2[entice] (agent age%男#1[man#1]) (object obj%剣#1[sword#1]) (from obj%鞘#1[sheath#1]))
(event 突く 2[attack] (agent age%男#1[man#1]) (counter-agent age%青年#1[young-man#1]))
(event 避ける 1[avoid] (agent age%青年#1[young-man#1]) (counter-agent age%男#1[man#1]))
(event 反撃する 1[counterattack] (agent age%青年#1[young-man#1]) (counter-agent age%男#1[man#1])))
(助かる 1[be saved]
(event 帰る 2[come-home] (agent age%女#1[woman#1]) (from loc%家#1[house#1]))
(event 喜ぶ1[be-glad] (agent age%女#1[woman#1]))))

Fig. 9. Generated scene sequence.

IV. Conclusion

In this paper, a scene development mechanism using event sequences was proposed. This is a mechanism for automatic

narrative generation that includes a generative model to represent the communication between GM and PL in a Table-top role playing game. This proposed mechanism is a part of the mechanism that has been proposed [4].

The above mechanism presents a scene as part of a scene sequence, and the mechanism outlined in this paper is comprised of the user making an event sequence and going through the scene development process.

The coherence examination between events or scenes in a story generated by questionnaire survey is planned for the future.

Furthermore, we consider acquiring knowledge from a generated story. The structure that is decomposed into the structure of the story itself or a certain size is integrated into a knowledge base, which is a trial to bring about new knowledge for structure generation of the stories by performing the resolution of a formed story or the combination of two stories [8].

REFERENCES

[1] J. Ono and T. Ogata, "Architecture of a narrative generation system based on a TRPG model: The use of an integrated narrative generation system for knowledge acquisition (preliminary version)," *Bulletin of Networking, Computing, Systems, and Software*, vol. 5, no. 1, pp. 40-48, 2016.

[2] M. Witwer, "Empire of imagination: Gary Gygax and the birth of dungeons & dragons, bloomsbury," 2016.

[3] K. Bergström, "Creativity rules. How rules impact player creativity in three tabletop role-playing games," *International Journal of Role-Playing*, vol. 3, pp. 4-17, 2012.

[4] J. Ono and T. Ogata, "A prototype system of a scene sequence expansion mechanism in an automatic narrative generation game based on TRPG method," in *Proc. the 30th Annual Conference Japanese society for Artificial Intelligence*, 2016.

[5] T. Arai, J. Ono, and T. Ogata, "Semi-automatic generation of event sequence knowledge for narrative generation: The use in an integrated narrative generation system," in *Proc. the 30th Annual Conference Japanese Society for Artificial Intelligence*, 2016.

[6] Hoshino and J. Storytelling, *Journal of Japanese Society for Artificial Intelligence*, vol. 19, no. 1, pp. 29-34, 2004.

[7] T. Ogata, "Computational and cognitive approaches to narratology from the perspective of narrative generation," *IGI Global*, pp. 1-73, 2016.

[8] J. Ono and T. Ogata, "Automatic acquisition from the web of expression elements in a narrative generation system," in *Proc. The 27th Annual Conference of the Japanese Society for Artificial Intelligence*, 2013.

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