

## Research Article

# A literature review of psychological narratology in the clinical domain: Artificial intelligence and robots to assist individuals with disabilities

Kai Seino<sup>1</sup>, Shun Ishizaki<sup>2</sup><sup>1</sup>Department of Social Rehabilitation of Research Institute, National Rehabilitation Center for Persons with Disabilities, 1, Namiki 4, Tokorozawa City, Saitama Prefecture, 359-8555, Japan<sup>2</sup>SFC Forum (General Incorporated Foundation) and Emeritus professor, Keio University, 5322, Endo, Fujisawa, Kanagawa, 252-8520, Japan

## ARTICLE INFO

## Article History

Received 25 November 2020

Accepted 18 October 2021

## Keywords

Narratology

Computational narratology

Counseling

Clinical psychology

Disability

Psychiatry

## ABSTRACT

This study aimed to examine the psychological approach from a narrative viewpoint and discuss the expanding collaboration with artificial intelligence and robots. The methodology adopted was literature review followed by theoretical examination. It was ascertained that psychological narratology has expanded beyond the so-called narrative therapy. Additionally, artificial intelligence and robot applications were identified in the clinical domain. This proves to be an implication of the extension of psychological narratology.

© 2022 The Author. Published by Sugisaka Masanori at ALife Robotics Corporation Ltd.

This is an open access article distributed under the CC BY-NC 4.0 license

[\(http://creativecommons.org/licenses/by-nc/4.0/\)](http://creativecommons.org/licenses/by-nc/4.0/).

## 1. Introduction

The potential of combining narratology as a problem-solving method with techniques such as artificial intelligence (AI) and robots, and their applicability in clinical areas were explored in this study. The term “narrative” is described as the “act of discussing and being discussed using language (spoken and written language)” [1]. Narratology can also be defined narrowly as in “narratology,” which refers to the reproduction of real or fictional events, accompanied by time constraints [2].

Bruner [3] suggested that the narrative provides individuals with a method for understanding and thinking about their everyday lives and interactions with others. The narrative may be thought as an evidence base containing conventional, objective data. In recent years, the narrative approach has been utilized in clinical domains such as medicine, nursing, and psychology. For

example, representation is a narrative therapy in psychotherapy.

The conceptualization of a narrative is not just limited to the narrative approach; a broader approach to the narrative, termed as “narrative generative system,” was advocated by Ogata [4], [5]. The narrative generative system not only considers the structure or form of a story but also incorporates the process by which the story is constituted and received. Moreover, “computational narratology,” one of the underlying theories of the narrative generative system, is a concept resulting from the fusion of computational technology and story. Authors have divided narratology into literary narratology and psychological narratology from the viewpoint of a narrative generation system [6]. While literary narratology considers the content and form of a story, psychological narratology deals with the story treatment in the clinical domain and is a narrative approach.

Corresponding author's E-mail: [seino-kai@rehab.go.jp](mailto:seino-kai@rehab.go.jp), [ishizaki@sfc.keio.ac.jp](mailto:ishizaki@sfc.keio.ac.jp) URL: [www.rehab.go.jp/english/index.html](http://www.rehab.go.jp/english/index.html)

Against the backdrop of Ogata's theory, Seino et al. [6], [7] proposed a new technique for data mining designed to provide support for individuals with disabilities. This technique provides a method for the analysis and generation of a story by combining text-mining technology and literary narratology. The results demonstrated that a theory could be established based on a narrative generative system. However, to investigate the practical implications of the system for the theory and method of psychological narratology, a discussion of technology (e.g., computer, software, and coding) has been omitted.

Thus, this study aimed to present a psychological approach of the narrative's perspective and to identify practices and research related to psychological narratology to examine the possibility of using narrative research for the use of AI and robotics in clinical settings, mainly to help individuals with disabilities. Psychological approach refers to the medical treatment and support for any illness that exists in the clinical domain. In this study, the possibility of extending this approach by collaborating with AI or robots has been examined. Specifically, we review the research and practice of psychology, psychiatry, and a proximity domain in recent years and their use of narrative. Our discussion is broadly focused on the approach and practices relevant not only to narrative therapy but also to a narrative or to narratology. We examine the potential of AI and robots using psychological narratology and robotics applications to research diseases and lend support to individuals with disabilities.

## 2. Definition and theory of a narrative

### 2.1. Definition of a narrative

A narrative has been defined in multiple ways—there are also many theoretical positions on the topic [8]. One definition of narrative is that it is an explanation of the experience of a continuous story or people. A narrative may also be communicated using several methods [9]. Narratology, which is the theory of a narrative, is defined in the narrowest sense in the theory of “literary narratology.” Moreover, a narrative may be used outside of the field of literature, as in a clinical domain such as psychology, medicine, nursing, and social work that provides services to support people. The combination of narratology and the use of a narrative in the clinical domain is called “psychological narratology.”

### 2.2. Literary narratology and “computational narratology”

The study of the nature, form, and function of a narrative is called literary narratology [2]. Ogata [10] organized narratology into five categories that establish its theoretical underpinnings: (1) “The Poetics” of Aristotle; (2) Structuralism developed based on the ideas of Saussure; (3) The literary art movement of Russian Formalism; (4) British and American literary theory; and (5) The literary theory of structuralism.

Narrative comprises both “story” and “discourse.” According to narratology [2], the story is the content of the narrative, while the discourse is concerned with its expression. Narratology employs an analysis of both story and discourse. Propp [11] described narratology through the fundamental components of the Russian folktale. In particular, he defined the narratological notions of “function” and “roles.” “Function” is a character's act defined based on its significance in the story. Furthermore, Genette [12] divided discourse into three categories: (1) “tense,” which is the temporal relation between discourse and story; (2) “mood,” which is the reproduction of the story through the discourse; and (3) “voice,” which is the relationship between the narrator and the narrated and the relationship between the narrator and text.

In applied studies of narratology, some researchers have analyzed and generated stories based on the theories constructed by Propp and Genette [13], [4]. Based on these, Ogata [14] suggested a study framework called “computational narratology.” It offered a literary study frame that fused an understanding of narratology with the generation of narrative through the use of AI and cognitive science, thereby broadening the concept of computational narratology.

### 2.3. Interdisciplinary narrative generative system

Previous studies have explored the concept of story generation in the domains of cognitive science and AI. Ogata and Kanai [10] have completed advanced research on the interdisciplinary approach for the narrative generative system, which introduced narratology and literary theory. In addition, Ogata [4] proposed the concept for the narrative generative system, which continues to be developed at two levels: at a broad level, the narrative generative system constitutes a method for symbolically understanding a human being and society in aggregate and at a narrow level, the narrative generative system consists of a computer program. Research based on Ogata's concepts has been progressing in the clinical domain—specifically, on disease and disability. The results will be used for clinical support [15], [6], [7].

### 2.4. The research framework of a narrative

Several studies have suggested how to treat a narrative. In a macroscopic position, the framework of a narrative includes all life activities. In a microscopic position, a narrative (story) expresses the causalities of an event [16]. In addition, the narrative approach is defined as “the method of making the concept of a narrative key and presenting a certain phenomenon” [17].

Numerous disciplines have studied narratives. Ogata [5] classified the research on the entire discipline with the narrative into three more categories (Table 1).

Table 1. The division between a discipline and narrative

Classification	The contained discipline
1 Symbol level [Literature, art, and entertainments domain]	Narratology, poetics, rhetoric, literary criticism, linguistics, folklore, folktale study, and an old tale, entertainment research, Noh play theory, kabuki theory etc., cultural anthropology and folklore, philosophy and thought, movie theory, and cinematic review
2 A brain, a nerve, and a psychological level [Psychiatry and a psychological domain]	Psychology, psychiatry and psychopathology, psychoanalysis, tale treatment, neuro-psychoanalysis, and brain science (The author added a postscript.)
3 Social level [Social domain]	Sociology, history, business administration, economics, jurisprudence, marketing theory, and advertising theory

### 3. The narrative in clinical/psychological approach

In this section, we present the psychological narratology from the viewpoint of a narrative and discuss its extension and application to other areas of research. The conventional clinical domain gives objective importance to evidence. The concept of an evidence-based approach originated from evidence-based medicine (EBM) in the 1990s [18], [19]. Sackett et al. [19] defined EBM as the “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of the individual patient.” Conversely, “evidence-based” approach has been criticized [20]. Based on the limits of objective facts, social constructivism that provide the relativist conception of reality, has been recognized [21]. Against the backdrop of social constructivism, a trend that allows a reconsideration of EBM from the perspective of

the narrative is called narrative-based medicine (NBM) [22]. Since the 1990s, the narrative approach has attracted greater attention in interpersonal help domains, such as medical care, nursing, and psychology. The epistemological and methodological development that attach importance to the narrative is known as the “narrative turn” [23].

In twentieth-century narrative studies, narratology provided a way to study the structure of narratives but was limited to the study of texts [24]. However, narrative methods are currently focused on expanding to other areas, such as medicine and education, rather than further developing the theory.

Ogata [25] also proposed a cognitive and computational approach to interdisciplinary narratology. He called such “computational and cognitive narratology” as “post-narratology.” He also discussed the narratology of narrative generation in particular. Specifically, there are creative AI techniques for literature, art, and narrative generation. In this context, there has been a movement toward the practical use of the developed systems and contents in distribution mechanisms such as companies and social systems. Furthermore, Hoshmand [26] discussed psychology from the perspective of narratology wherein he elaborated the narrative paradigm in research including narratology, narrative theory, and cultural psychology. He pointed out that the various qualitative research paradigms have something in common and they have a social constructionist background. Narrative research, which focuses on the meaning and narrative of what clients say about themselves and their lives in counseling practice, was considered to be useful in conducting research on identity development and the experience of counseling and life transitions. Woods [27] discussed the role and importance of narratives in health care. He critically examined how humanities and social sciences have used narratives to understand the experience of health and illness. He also pointed out that the use of narratives is required not only in the clinical fields but also in medical humanities, medical sociology, and anthropology. He added that narratives provide privileged access to the subjective experience of illness and are promoted as a primary means for ill people to express their changing sense of self and identity, explore new social roles, and become members of new communities.

## 4. Review of psychological narratology

In this section, the system of psychological narratology is proposed, and it shows that the clinical/psychological approach is extensible through post-narratology. Post-narratology is a narrative generative system that includes story generation by AI. To actuate story generation, a literature review is performed through clinical approach, considering that the extension to post-narratology is possible. The system then constructs the story through AI, and authors argue about the feasibility of a bridge and whether a clinical contribution is possible by re-extending the clinical/mental approaches through story generation. These approaches are concretely aimed at research and practice in clinical domains such as psychology. A psychological narratology is the theory of the clinical/psychological approach that is relevant to the narrative in the broadest sense that the author has proposed.

### 4.1. Narrative therapy

#### 4.1.1. Narrative approach in counseling

In the counseling field, a narrative has come to be associated with narrative therapy since the 1980s. In a narrow sense, psychological narratology refers to the narrative therapy used in psychotherapy and family therapy. Narrative therapy was advocated by White and Epston<sup>28</sup> and developed in the context of family therapy in the 1980s. White and Epston [28] applied Foucault's [29] classification to narrative therapy, aiming to excavate the new "alternative story" from the "dominant story" that restricts life. This excavation is conducted by "externalizing" and seeking a "unique resolution" for the problem. In addition, Spence [30] described the scenario in which a narrator is in treatment, and a listener listens to what the narrator narrates as a tale. In analytic psychology, the role of a "tale," like the myth, is touched upon by Kawai [31], who presupposes that the process of psychotherapy is a tale. In addition, in Gestalt therapy, Polster [32] suggested that dialog is necessary to restore mental harmony and proposed a method of dialog wherein the patient is seated in an "empty chair" or an "imaginary chair."

#### 4.1.2. Consideration of a proposal

Narrative therapy involves creating a narrative that provides the client with a tool for problem solving. A typical narrative approach heads toward the solution to a

question as the client completes a tale. We propose the following possibility from the viewpoint of post narratology: what is treated is the discovery or description of a "dominant story" and an "alternative story," and the technique of externalization. There are two implications for this suggestion. First, the "dominant story" and "alternative story" may be identified to construct the theory of a narrative generative system. Second, computational technology may be able to realize the two stories.

### 4.2. Self-help group

#### 4.2.1. The group for mutual aid

A self-help group comprises those who suffer from the same illness and offers support through peer relations. For example, self-help groups may be formed for individuals addicted to alcohol, drugs/psychotropic substances, or gambling, or individuals dealing with the same life obstacle or chronic malady. In recent years, self-help groups have come to be viewed as a narrative approach [17]. The first self-help group, Alcoholics Anonymous (AA), was formed in the United States in 1935 to facilitate the recovery from alcohol addiction. AA proved to be effective in treating alcohol addiction, and over time, many other groups adopted the same method to deal not only with addiction or dependence but also other problems. Katz & Bender [33] defined self-help group as a small group of companions (peers) who provide mutual aid for the achievement of a specific purpose. AA meetings are regularly scheduled and the members who gather at each meeting talk in turn about various topics. The talk may consist of experiences from one's past and even the utterance of a single word may constitute a speaking turn [17]. Another study notes that a self-help group does not have a technical definition [34].

#### 4.2.2. Consideration of a proposal

The first-line specialty of support of a self-help group is "experiential knowledge." It is the knowledge based on a member's experience and serves as a source of support for a self-help group. The knowledge of members is more practical and comprehensive than that of professionals [35]. Each member's "experiential knowledge" is discussed, and the collective knowledge of the group is accumulated and utilized as knowledge from a group. We can interpret knowledge sharing as the process of creating one big narrative from two or more members' narratives. The process may be adopted into theory as narrative generation and may be realized as a system. For example,

previous studies have accounted the collection of several texts that were spoken, generating the tale based on some typical elements. Ito [34] examined a self-help group from the perspective of an individual tale. The results of the study indicated that the tale should have been regarded as an object with the effect of showing not the collective knowledge of a group, but that of a participant's self. To determine the degree of change for each participant, it was presupposed that it was important to establish the standard by which a participant made a tale "the good talk." In other words, it was important for a tale or suggestion to achieve a set basis for valuation. An evaluation of the tale could be conducted based on how the group absorbed the tale and how it affected the production and consumption of future tales.

### **4.3. Open dialog**

#### *4.3.1. Philosophy of discussion*

Open Dialog (OD) is another psychological approach that has gathered attention in Japanese psychiatry. Originated in Finland in the 1980s, OD is a method of therapeutic intervention for an acute-term mental disease. In OD, two or more staff conduct a crisis intervention within 24 hours of request. Patients and families practice OD every day by sitting in a circle. It seldom uses a drug but treats a patient's critical condition [36]. All matters are discussed and determined during the OD at the members' meeting place. In addition, an expert team discusses a patient and his/her family's exchange in their presence, as they reflect on what is being shared with them.

#### *4.3.2. Consideration of a proposal*

OD is considered to be a narrative approach, and dialog is the key medical treatment. It is a narrative therapy that is reflective and has an ideological background. OD constitutes 12 key elements, which focus on tale generation and its effect; consequently, the process is thought provoking. A dialog is performed by two or more members in various positions. In addition, open-ended questions are used as an interlocutory trigger. OD may be realized as an automatic dialog system or a narrative system by speech recognition. By raising two or more viewpoints and observing relationships, an automatic dialog system may be able to utilize an extraction method to return an element as the narrative is being generated.

### **4.4. Tohjisha-Kenkyu (self-directed studies)**

#### *4.4.1. Empowerment approach by oneself and a companion*

In recent years, the "Tohjisha-Kenkyu" approach that originated in Japan has attracted international attention. It was introduced as an open dialog in Japan (Saito 2016) and is commonly used in patients with schizophrenia. It has also been developed as a treatment for individuals with developmental disabilities. Tohjisha-Kenkyu is an empowerment approach wherein an impaired individual becomes the researcher of their own problem and collaborates with others to analyze it further [37].

#### *4.4.2. Consideration of a proposal*

Tohjisha-Kenkyu provides suggestions to examine a narrative generative system and how to connect narrative generation to problem solving. In Tohjisha-Kenkyu, it is assumed that the concerned individual will themselves emerge as a hero of their difficulties. In addition, Noguchi<sup>17</sup> reported that Tohjisha-Kenkyu is "a community of narration" that makes it "the community of the tale." Many audiences are in a "narrative community," and new narration becomes more ascertained with an existing audience. A narrative community is a space where new narration is shared and established. In addition, the aspects of changing attitudes and how to identify and position attitudes are also commonly addressed in narrative therapy. Moreover, the conceptualization of one's own experience and that of a friend is similar to the notion of "experiential knowledge" in a self-help group. In addition, when considering tale generation, an improvisational, unique understanding or an idea is important; it demonstrates how to utilize the result, which creates a "relation" as a "behavior" in a scene received by the narrative generative system.

### **5. AI and robot applications and psychological narratology**

In this section, we mainly review the use of AI and robots in helping individuals with disabilities and discuss it from the perspective of psychological narrative theory.

Owing to the cross-disciplinary nature of this topic, there is a dearth of related literature. Therefore, this section focuses broadly on relevant narratological approaches and how they are practiced as therapy amongst various human populations. The results of this study have relevance to various subdisciplines of medicine, psychology, and

possibly biology. As there is no clear research area in narratology and AI/robotics, the literature spans a variety of fields and applications.

### **5.1. Disability support and narratives**

The use of narratives in disability support practice and research has been reviewed below. Narrative theory and narrative were used from a research perspective and as a method of data analysis.

Peters et al. [38] conducted a narrative analysis based on clinical reasoning. There are two approaches to physicians using narrative rhetoric methods. According to the dual-process model of reasoning, physicians use two mental systems to make diagnostic decisions. They are System 1, which is quick, unconscious, and intuitive, and System 2, which is slow, rational, and analytical. Here, we conducted a qualitative study on clinical reasoning for System 1. We asked the physicians to describe episodes wherein they used intuitive reasoning while treating patients, and by combining the grounded and narrative approaches, we analyzed their descriptions of the clinical reasoning process. We were then able to look for narrative features (words, phrases, and linguistic structures).

Koay et al. [39] reported on the robotic research using narratives. In this study, narratives were created as part of the narrative-based methodology to enhance the participants' immersion in a prototype study of a companion robot for home use. The goal was to make human interaction consistent and meaningful. The participants interacted with the robot in the context of a larger narrative flow. The narratives were used to elicit meaningful information and feedback from potential users of a new technology.

Syrdal et al. [40] accounted the prototyping of human-robot interaction using narratives. Participants took part in a long-term study in which they had to interact with a robot. The prototyping method, using narrative framing techniques, allowed the participants to engage in episodic interactions with the robot. The goal was to investigate how the participants responded to the scenarios and the robot as well as the specific behaviors of the robot. The results of the evaluation showed that the prototyping method helped the participants understand how to use the robot and accept its use within the scenario.

Perrier et al. [41] conducted a narrative analysis of interviews on the athletic identity of individuals with acquired physical disabilities. Then, they examined how the narrative types affect the promotion of sports among

individuals with acquired physical disabilities. The analysis revealed three types of narratives: (1) The non-athlete narrative, wherein the physical changes were explained as a reason for diminished identity as an athlete, (2) The future self-narrative, wherein the focus was on current sport behaviors and performance goals with behavioral changes diminishing athletic identity, and (3) the current self-narrative, wherein the focus was on the aspects of current sport participation, such as feedback from other athletes and skill development, which supported athletic identity.

Allan et al. [42] stated that narratives that challenge or expand on dominant discourses may increase the quantity and quality of participants. Their study used a life course analysis to explore the meaning of participation in para sports for athletes with physical disabilities. The results provided a unique understanding of the developmental process of para-sport athletes and the meaning of participation for these athletes. This narrative can help form strategies and programs to optimize participation and increase participation rates.

Richardson et al. [43] utilized a narrative regarding gym use by individuals with physical disabilities. Here, narrative is a way to understand individuals' life within the society by examining how they use stories to understand their experiences. For example, a participant's belief that exercise improves physical health may be related to the narrative "exercise is medicine."

Anthony et al. [44] employed narratives in a health survey to identify the types of narratives about physical activity used by individuals with spinal cord injury. Specifically, interviews collected as part of a lifestyle study of individuals with disabilities were analyzed using structural narrative analysis. Consequently, three types of narratives used by them were identified: (1) Exercise is recovery, (2) Exercise is medicine, and (3) Exercise is progressive atonement. It was concluded that the types of narratives identified may not only reflect but also constitute the experience of physical activity; therefore, they are useful tools to base physical activity promotion initiatives.

### **5.2. AI in supporting individuals with disabilities**

There is a debate regarding the use of AI to help individuals with disabilities. Trewin [45] discussed how the increasing use of AI, particularly machine learning methods, affects the fair treatment of individuals with disabilities in the society. He argued that fairness for individuals with disabilities is different from fairness for

other attributes, such as age, gender, and race. One major difference is that disability manifests itself in various ways and individuals adapt to it. Moreover, the information about disability is sensitive and not always shared precisely because of the possibility for discrimination. With these differences in mind, they explored the definition of fairness and discussed how it might work for individuals with disabilities. Finally, they suggested ways to approach fairness for individuals with disabilities with regard to AI applications. Trewin et al. [46] also argued that AI systems should be considered for their potential impact on users in a wider range of usage situations. They should also provide opportunities for errors to be corrected and for affected users to raise concerns about fairness. To build a more inclusive and robust system, individuals with disabilities should be included when procuring data to build models and during testing. In short, in many existing situations, solutions that do not use AI are already discriminatory, and introducing AI risks simply perpetuating or replicating these deficiencies.

Furthermore, Joamets et al. [47] analyzed reliable AI practices to protect individuals with disabilities in the application of economic and social rights. The rapid development of AI has taken legal and ethical debates to a new level. This article specifically examines how the interplay of law and ethics applies in situations where individuals with disabilities need some assistive technology to participate in society as equal members. It examined whether “the EU Guidelines for Trustworthy AI,” as a milestone in ethics regarding technology, have the power to change current practices of how social and economic rights are applied. Although there is no doubt that AI can have a positive impact on society, some questions arise when considering how the legality and ethics of reliable AI can be applied in situations where individuals with disabilities need assistive technology to participate in society as equal members.

Thus, the discussion on AI was mainly about how fairness and ethics can be ensured rather than how it can be used to support individuals with disabilities. It is possible to use qualitative analysis with psychological narrative theory to provide basic data for these discussions and for verification.

### **5.3. Disability support and robots**

Robots are being considered, developed, and tested to assist individuals with disabilities. Hoffman [48] reported on the design of robots for individuals with disabilities.

The design process for robotic assistive devices greatly differs from that of autonomous robots. The human-centered design process for assistive device design was reviewed, including the importance of the user interface and the division of functions between the user and the robot.

Drolshagen et al. [49] reported the use of industrial robotic arms to enable workers with disabilities to perform their jobs. This is also relevant to the use of robots in manufacturing. In this study, the reaction and habituation to the robotic arm was investigated. Later, the participants’ reactions to the robot arm during collaborative work were observed. The results showed that although it took about 20 minutes for the participants to get familiarized with the situation, the robot was very well accepted and did not cause any fear or discomfort.

Kildal et al. accounted the use of a robot to perform assembly tasks for workers with cognitive disabilities. They conducted a qualitative pilot user study, in which assembly workers with cognitive disabilities and multidisciplinary experts encountered a collaborative robot in their daily assembly tasks, to derive design requirements for such workers and compare them with design requirements for normal workers.

Gomez-Donoso et al. [51] developed a multi-sensor system for the rehabilitation of and interaction between individuals with motor and cognitive disabilities. The system had multiple interaction modes (head and body poses, hand gestures, voice, touch, and eye gaze) to provide different treatments depending on the type and degree of disability. The system could also be customized through training to define the patient’s unique gestures for each sensor. The system incorporated a variety of applications for rehabilitation and provided a flexible and modular framework for the development of new applications aimed at new rehabilitation therapies.

The study by Muhammad Umair et al. [52] demonstrated the application of a robot for individuals with disabilities. The research focus was to expand the technologies that have been developed and need further refinement. It is evident that there are not enough human resources to assist older adults and individuals with disabilities. Therefore, information and communication technology is expected to play a role here. Although several assistive robots, such as walking assistive robots, communication robots, and wheelchair robots, have been developed, only a few are being used owing to the risk of cost-effectiveness.

Yamauchi [53] presented a case study on the use of robots for individuals with disabilities. The biggest difficulty in introducing robots and other advanced technologies into the field of welfare equipment is the high cost involved. Even when a product is launched, it is not immediately adopted into the medical reimbursement system, and it takes some time before public funds are invested. Furthermore, orphan products cannot be mass-produced to reduce costs, which is an obstacle to the introduction of innovative products.

Although the use of robots may be effective in supporting individuals with disabilities, problems related to the high cost and cost-effectiveness have been pointed out by several studies. To address these concerns, governmental assistance through institutionalization is imperative, and psychological narrative theory may be utilized as part of qualitative research to investigate and verify the effectiveness of such assistance. Additionally, like with AI, there is a possibility that narrative theory and narrative perspectives would prove to be effective in the development and adaptation of robot families.

## 6. Psychological approach for application of AI

In this section, two studies of the clinical/psychological approach and the possibility of narrative generation by AI are discussed.

### 6.1. Narrative generation for employment support of individuals with disabilities

In this section, the authors' research has been presented. We extracted the text elements and employed a system of story generation using AI. Specifically, we analyzed a disabled person's free descriptive answer to an interview question using the method of "informatics tale analysis" to extract the elements of the story. This method combines the technology of text mining and some theories of a literary narratology. Text mining involves the quantitative analysis of text data based on natural language processing or data mining. After extracting the story element from the individual's text response, the system proposed to create a collective story.

An example of the narrative is shown below. To protect respondents' privacy, some answers have been altered, but the basic meaning remains unchanged. In the authors' study, both the wider and narrow senses of narrative were used depending on the particular contexts of the analysis.

[Concerning work description] In response to the question: Describe your job in detail.

Example 1: Since my legs were injured, I have been assigned paperwork. I am now engaged in computer work. (Physical disability)

[Concerning care and support at the workplace] In response to the question: Specify the care and support provided in your workplace as a means of assisting your career.

Example 2: At my workplace, employees often get acquainted with coworkers at informal meetings, such as parties with drinks. I did not attend these parties because of my condition, so I had no opportunity to get to know them. The other day, I took the opportunity of participating in one and it worked much more effectively than I had expected. (Mental disorder)

Example 3: I first wanted to work without mentioning my condition. The other day, the relative of a person who had supported me asked me to work in their office. When I began working there, I soon found that this relative did not care about my condition, and it was a disastrous year. From this experience, I realized that I should conceal my disease because people consider me to be inferior to healthy people. (Intractable disease)

The authors' study analyzed the descriptive texts that reflected the personal stories of individuals with disabilities, and clarified social stories of disability based on the results of multivariate analysis involving text mining.

This is an example from our research, "Employment Support and Story Generation for Students with Developmental Disabilities." The results indicated that story generation tends to materialize by combining existing elements with those from previous research<sup>7</sup>. Figure 1 below shows a story generative system.

The job description analysis results were used to create the image. For cases in which this system was created, it was important to consider how elements were combined. The probability of a story being generated is attained by calculating the probability that it may happen and the strength of the relationship between the text elements. To utilize the result of the support generation simulation, it is important to understand the kind of elements collected. For example, the elements of support needs may be collected based on responses to a specific problem, and it may be possible to examine what kind of problem and support needs occur at what time, thus enabling the preparation of appropriate support.



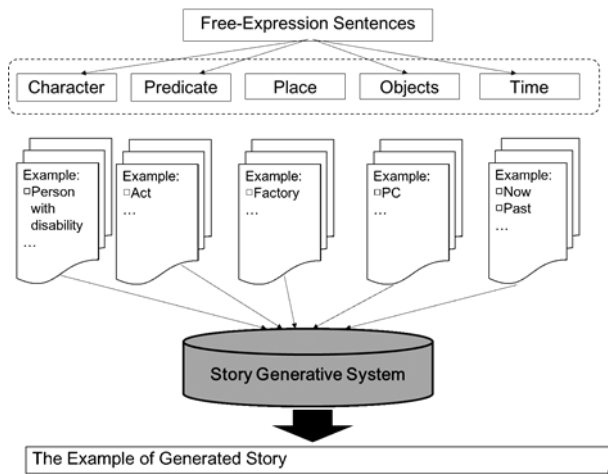


Fig. 1. The image of the story generative system

## 6.2. Narrative generation for paper creation support of a student with a developmental disease tendency

Ogata [5] and Aoki et al. proposed students' paper creation support and narrative generative system based on the cognitive tendencies and action patterns of individuals with autism spectrum disorder (ASD). They suggested that a paper creation might address the problem of a student with ASD. They further explained why the problem occurs based on the cognitive tendencies and the action patterns of individuals with ASD, who may be sensitive to "a surprise and a gap" in the "discontinuous nature" of a story. Therefore, a story (paper creation), after making it continuous, deters the reaction of a student with ASD. The evaluation mechanism was set up and support was proposed for advancing a story by issuing directions on a macro and micro levels.

## 7. AI and robot for interpersonal support and clinical practice

In this section, we review some practical applications of AI and robots in assisting patients and individuals with disabilities as a reference for considering AI and robotics applications in narratology.

### 7.1. AI applications in psychiatric research

Ikeda [54] reviewed the use of AI in the psychiatric field. In this study, 393 articles were extracted from the article search database Pubmed using keywords related to psychiatry and AI. In the 382 abstracts obtained, the most frequently occurring psychiatric diagnoses were

depression, schizophrenia, and Alzheimer's disease. The research objectives of these articles were mainly the following: (1) To improve the accuracy of medical treatment (e.g., diagnostic support, prediction of treatment effects, and side effects), (2) To elucidate the etiology and pathogenesis of diseases (e.g., genome analysis and image analysis), (3) To develop new treatment methods (e.g., drugs and medical devices), and (4) To reconstruct diagnostic concepts and systems. The AI-related terms in those papers are, in descending order of frequency, support\_vector\_machine, random\_forest, logistic\_regression, deep\_learning, natural\_language\_processing, decision\_tree, convolutional\_decision\_tree, convolutional\_neural\_network, and naive\_bayes. The following is an overview of the specific studies.

### 7.2. Use of machine learning in AI

AI is being used in research to predict disease and identify contributing factors. Rahman et al. [55] developed a method for predicting autism in newborns by machine learning the parents' age, socioeconomic status, and medication history from their medical records.

This algorithm revealed that the parental use of caffeine and certain antidepressants are associated with the development of autism in children. The results may also help identify factors that may induce autism.

AI has also been used in research to differentiate between diseases and disease subtypes. Stevens et al. [56] analyzed behavioral data in autism and found two comprehensive behavioral profiles. Each profile had its own subgroups based on the severity of different traits.

Chand et al. [57] used machine learning to analyze brain scans of schizophrenia and clinical information such as age of onset and medication use. Consequently, they identified two subgroups of schizophrenia based on different patterns of brain structure. One subtype showed brain volume increasing almost normally in two regions, rejecting previous ideas that schizophrenia is associated with reduced brain volume.

Koike and his research group developed a machine learner that determines schizophrenia and developmental disorders through image analysis of magnetic resonance imaging scans of brain structure [58].

Thus, machine learning research is expected to be applied to differential diagnosis and treatment prediction in clinical practice. It may also be useful in discovering

subtypes of the same disease and understanding the reasons for differences in nature and severity.

### **7.3. Robots for supporting children with ASD**

Hirokawa et al. [59], [60] have proposed a robot intervention activity for children with ASD, a developmental disability, to improve their social skills and promote their communication abilities. They have developed a robot manipulation interface that can be used by supporters as well as a method for quantitatively measuring face-to-face behavior and facial expressions during intervention activities, and have verified its effectiveness.

Jain et al. [61] developed a machine learning algorithm to determine when children with ASD need help from the robot, that is, encouragement from the robot as a therapeutic intervention when the child sustains attention toward things. Robots are used in these proposals because humanoid robots, with mechanical features highly compatible with children with ASD and physical and social characteristics similar to those of humans, are expected to play an important role in interventions for such children.

## **8. Discussion**

### **8.1. Extension and possibility of a psychological narratology**

In this paper, the psychological narratology was divided into several concepts and reviewed. The author demonstrated that narrative approach in the clinical domain, defined as psychological narratology, extended beyond narrative therapy in psychotherapy and expanded to various experiments and research. Three features exist among the psychological narratologies reviewed in this paper. First, many practices not only involve simple technology and method but also have a stance and a certain way of thinking. As narrative approach is situated against the background of social constructionism, fixation is avoided and relativized. Second, it is a collaborative story generation system. Third, all the tales are built through a dialog. They were not monologs and were constructed through colloquial expressions.

Based on these points, the narrative generative system is considered in both narrow and broad senses. The following possibilities exist regarding the automatic tale generation machine realized as a narrative generative system in a narrow sense, that is, like a computer program: (1) It is the

construction of a fluid system. For example, a random element is accepted. This system carries out narrative generation by combining elements. (2) The system that generate a tale communally involves two or more individuals. (3) It is a tale generation system through simple dialog and not an input.

Psychological narratology is not merely a methodology but is also a mechanism for the conversion of a relative sense of values. It is given significance with conversion (or improvement) of the worth of the tale of the party concerned and the party concerned. The following specific suggestions are based on such a system:

- (1) Consider that the community itself can generate a tale and utilize it to be a system, thus being constructive and practical.
- (2) Realize that a tale generation system places more value on the process rather than the contents of tale generation.
- (3) Obtain participation and collaboration of the concerned parties toward the realization and practical use of a system.

### **8.2. Potential applications of psychological narratology to AI or robots**

Previous studies have explored the use of AI and robots for clinical support, and it is confirmed that algorithms had already been developed or were being implemented. These studies had the following objectives<sup>54</sup>: (1) Improvement of medical treatment system, (2) Elucidation of etiology and pathogenesis, (3) Development of new treatment methods, and (4) Reconstruction of diagnostic concepts and systems. Through machine learning of existing data, AI has enabled the prediction and identification of diseases, discovery of subtypes, and identification of factors in the development of diseases [55], [56], [57], [58]. Similarly, with regard to psychological narratology, AI can enable the applications to detect subtypes and predict and identify tasks through the machine learning of speech, dialog, and written text data.

The use of robots for clinical support has been studied to improve the convenience and effectiveness of robots for supporting children with ASD [59], [60], [61]. With regard to psychological narratology, incorporating narrative elements into robots is a feasible option to assist children with ASD. It is also imperative to examine the effectiveness of robot support for non-autism spectrum disorders.

## 9. Conclusion

This research defines the narrative approach of a clinical domain, psychological narratology, and examines its extension and possibility of application to AI or robots. This review has established that psychological narratology has indeed expanded beyond the so-called narrative therapy, a form of psychotherapy. The results obtained from these practices were thought provoking and highlight the use of narrative generative system in both narrow and broad senses for actual problem-solving. Moreover, the significance of AI or robot research in the clinical domain was identified, which provides suggestions for the extension of psychological narratology. It is meaningful to consider the practice of a clinical domain from a narrative viewpoint as well as with respect to clinical reduction. We expect that the expansion of new discoveries and practices will be performed as a supporter and a researcher in connection with a theme, and researchers of related domains, such as A.I., computing science, or cognitive science, may debate and collaborate in the future.

## References

1. Y. Yamada, "Method of Qualitative Psychology: Listening to Narrative", Shinyousha, 2007. (In Japanese)
2. G. Prince, "A Dictionary of Narratology (Revised ed.)", University of Nebraska Press, 2003.
3. J. Bruner, "Actual Minds, Possible Worlds", Harvard University Press, 1986.
4. T. Ogata, "Narrative Generation System as the Practice of "Informatics of Narratology", Journal of Japan Society for Fuzzy Theory and Intelligent Informatics, Vol. 23, No. 5, pp. 676-685, 2011.
5. T. Ogata, "Narratology of Narrative Generation or Post-narratology", Cognitive Studies, Vol. 25, No. 2, pp. 200-217, 2018. (In Japanese)
6. K. Seino, K.Y. Haruna, S. Ishizaki, "Employment Status and Support Needs of Persons with Disabilities in Japan: An Analysis of Narrative Using Narratology and Text Mining on a National Survey", in T. Ogata, T. Akimoto (eds.), Computational and cognitive approaches to narratology, Information Science Reference, IGI Global, pp. 245-275, 2016.
7. K. Seino, Y. Enomoto, S. Miyazawa, "Narrative Analysis of Employment Support for Students with Developmental Disabilities: Using an Objective Analysis Of Free-Expression Answers", in T. Ogata, S. Asakawa (eds.), Content generation through narrative communication and simulation, Information Science Reference, IGI Global, pp. 341-357, 2018.
8. C. D. Riessman, "Beyond Reductionism: Narrative Genres in Divorce Accounts", Journal of Narrative and Life History, Vol. 1, No. 1, pp. 41-68, 1991.
9. D. Clandinin, D. (ed.), "Handbook of Narrative Inquiry: Mapping a Methodology", Sage Publications, 2007.
10. T. Ogata, "Backgrounds of the "Narrative Generation System" and Relations between Narrative and Literature", in T. Ogata, A. Kanai (eds.), An introduction to the informatics of narratology: about the thought and technologies of narrative generation, Tokyo, Japan: Gakubunsha, pp. 186-258, 2010. (In Japanese)
11. qV. Y. Propp, "Morphology of the Folktale", University of Texas Press, 1968.
12. G. Genette, "Narrative Discourse: An Essay in Method", Cornell University Press, 1980.
13. T. Akimoto, T. Ogata, "Towards a Discourse Mechanism in Narrative Generation System: Proposal of a System Introducing Narrative Discourse Theory and Reception Theory", Cognitive Studies, Vol. 20, No. 4, pp.396-420, 2013. (In Japanese)
14. T. Ogata, "Proposal of Computational Narratology", Proceedings of IPSJ SIG Computers and the Humanities, pp. 53-60, 1999.
15. S. Aoki, T. Ogata, J. Ono, "Narrative Generation Related to Cognitive Patterns Seen in ASD-From the Perspective of "Surprise", Proceedings of the 35th Annual Meeting of the Japanese Cognitive Science Society, pp. 652-660, 2018. (In Japanese)
16. C. K. Riessman, "Narrative Analysis", Newbury Park, CA: Sage, 1993.
17. Y. Noguchi (ed.), "Clinical Sociology of Narrative", Tokyo, Japan: Keiso shobo, 2005.(In Japanese)
18. G. H. Guyatt, "Evidence-based Medicine", American College of Physicians Journal Club, Vol. 114, No. A-16, 1991.
19. D. L. Sackett, W. S. Richardson, W. Rosenberg, R. B. Haynes, "Evidence-based Medicine: How to Practice and Teach EBM", New York, NY: Churchill Livingstone, 1996.
20. K. J. Gergen, "Toward Transformation in Social Knowledge", Sage Publications, 1994.
21. K. J. Gergen, "An Invitation to Social Construction", Sage Publications, 1999.
22. T. Greenhalgh, B. Hurwitz (eds.), "Narrative Based Medicine", BMJ Books, 1998.
23. N. K. Denzin, Y. S. Lincoln (eds.), "Handbook of Qualitative Research", Sage Publications, 2000.
24. R. Stock, "The Successes and Failure of Narratology", Narrative Inquiry, Vol. 23, No. 2, pp. 371-387, 2013.
25. T. Ogata, "Toward a Post-Narratology or the Narratology of Narrative Generation". In T. Ogata, T. Akimoto (Eds.), Post-Narratology Through Computational and Cognitive Approaches, IGI Global, pp. 85-142, 2019.
26. L. T. Hoshmand, "Narratology, Cultural Psychology, and Counseling Research", Journal of Counseling Psychology, Vol. 52, No. 2, pp. 178-186, 2005.
27. A. Woods, "The Limits of Narrative: Provocations for the Medical Humanities", Medical Humanities, Vol. 37, pp. 73-78, 2011.

28. M. White, D. Epston, "Narrative Means to Therapeutic Ends", Transformative Learning Conference, New York: Norton, pp. 23-25, Oct, 1990.
29. M. Foucault, "Power/knowledge", In C. Gordon (Ed), Pantheon Books, New York, 1980.
30. C. D. Spence, "Narrative Persuasion", *Psychoanalysis and Contemporary Thought*, Vol. 6, pp. 457-468, 1983.
31. H. Kawai, "Significance of the "Narrative" in Psychotherapy", *Japanese Journal of Psychotherapy*, Vol. 27, pp. 3-7, 2001. (In Japanese)
32. E. Polster, "Every Person's Life is Worth a Novel", W. E. Norton & Company Inc, 1987.
33. A. H. Katz, E. I. Bender (eds.), "The Strength in Us: Self-Help Groups in the Modern World", New York: New Viewpoints, 1976.
34. I. Tomoki, "Self-help Groups and Personal Stories", *Japanese Sociological Review*, Vol. 51, No.1, pp. 88-103, 2000. (In Japanese)
35. T. Borkman, "Experiential Knowledge: A New Concept for the Analysis of Self-Help Groups", *Social Service Review*, Vol. 50, No. 3, pp.445-456, 1976.
36. T. Saio, "Open Dialogue Approach to Acute Psychosis: Is its Effectiveness Well-established?", *Clinical Evaluation*, Vol. 42, No. 2, pp. 531-537, 2014. (In Japanese)
37. I. Mukaiyachi, T. Tojisha-kenkyu, "What is a Tojisha-Kenkyu? The Concept and Structure of a Tojisha-Kenkyu", *Tojisyu-Kenkyu*. (In Japanese)
38. A. Peters, M. Vanstone, S. Monteiro, G. Norman, J. Sherbino, M. Sibbald, "Examining the Influence of Context and Professional Culture on Clinical Reasoning Through Rhetorical-Narrative Analysis", *Qualitative health research*, Vol. 27, No. 6, pp. 866-876, May, 2017.
39. K. Koay, D. S. Syrdal, K. Dautenhahn, M. Walters, "A Narrative Approach to Human-Robot Interaction Prototyping for Companion Robots", *Paladyn: Journal of Behavioural Robotics*, Vol. 11, No. 1, pp. 66-85, 2020.
40. D. S. Syrdal, K. Dautenhahn, K. L. Koay, W. C. Ho, "Views from Within a Narrative: Evaluating Long-Term Human-Robot Interaction in a Naturalistic Environment Using Open-Ended Scenarios", *Cognitive Computation*, Vol. 6, pp. 741-759, 2014.
41. M. J. Perrier, B. Smith, S. M. Strachan, A. E. Latimer, "Narratives of Athletic Identity After Acquiring a Permanent Physical Disability", *Adapted physical activity quarterly*, Vol. 31, No. 2, pp. 106-24, Apr, 2014.
42. V. Allan, B. Smith, J. Côté, K. A. M. Ginis, A. E. Latimer-Cheung, "Narratives of Participation Among Individuals with Physical Disabilities: A Life - Course Analysis of Athletes' Experiences and Development in Parasport", *Psychology of Sport and Exercise*, Vol. 37, pp. 170-178, 2017.
43. E. V. Richardson, B. Smith, A. Papatomas, "Disability and the Gym: Experiences, Barriers and Facilitators of Gym Use for Individuals with Physical Disabilities", *Disability and Rehabilitation*, Vol. 39, No. 19, pp. 1950-1957, Sep, 2017.
44. A. Papatomas, T. L. Williams, B. Smith, "Understanding Physical Activity Participation in spinal Cord Injured Populations: Three Narrative Types for Consideration", *International Journal of Qualitative Studies on Health and Well-being*, Vol. 10, No. 27295, 2015.
45. S. Trewin, "AI Fairness for People with Disabilities: Point of View", arXiv e-prints, Nov, 2018.
46. S. Trewin, S. Basson, M. Muller, S. Branham, J. Treviranus, D. Gruen, D. Hebert, N. Lyckowski, E. Manser, "Considerations for AI Fairness for People with Disabilities", *AI Matters*, Vol. 5, No. 3, pp. 40-63, 2019.
47. K. Joamets, A. Chochia, "Access to Artificial Intelligence for Persons with Disabilities: Legal and Ethical Questions Concerning the Application of Trustworthy AI", *Acta Baltica Historiae Et Philosophiae Scientiarum*, Vol. 9, No. 1, pp. 51-66, 2021.
48. A. H. Hoffman, "Design of Robotic Devices to Assist Persons with Disabilities", *IEEE International Conference on Technologies for Practical Robot Applications*, pp. 1-4, 2009.
49. S. Drolshagen, M. Pflingsthor, P. Gliesche, A. Hein, "Acceptance of Industrial Collaborative Robots by People With Disabilities in Sheltered Workshops", *Frontiers in robotics and AI*, Vol. 7, No. 541741, 2021.
50. J. Kildal, M. Martin, I. Ipiña, I. Maurtua, "Empowering Assembly Workers with Cognitive Disabilities by Working with Collaborative Robots: A Study to Capture Design Requirements", *Procedia CIRP*, Vol. 81, pp. 797-802, 2019.
51. F. Gomez-Donoso, S. Orts, Sergio- Escolana, A. Garcia-Garcia, J. Garcia-Rodríguez, J. A. Castro-Vargas, S. Ovidiu-Oprea, M. Cazorla, "A Robotic Platform for Customized and Interactive Rehabilitation of Persons with Disabilities", *Pattern Recognition Letters*, Vol. 99. No. 1. pp. 105-113, 2017.
52. M. U. Hassan, N. Mumtaz, "AI in Assisting ehe Elderly and People with Disabilities", *International Journal of Research and Engineering*, Vol. 3, pp. 35-39, 2016.
53. S. Yamauchi, "Advanced Interdisciplinary Human Research in Assistive Technology for Elderly Persons and Persons with Disabilities", *Advanced Robotics*, Vol. 23, No. 11, pp. 1455-1458, 2009.
54. S. Ikeda, "Current Trends, Issues and Potentiality of AI Technology in Psychiatry", *The 33rd Annual Conference of the Japanese Society for Artificial Intelligence*, 2N5-J-13-03, pp. 1-4, 2019. (In Japanese)
55. R. Rahman, A. Kodesh, S. Z. Levine, S. Sandin, A. Reichenberg and A. Schlessinger, "Identification of Newborns At Risk for Autism using Electronic Medical Records and Machine Learning", *European Psychiatry*, Vol. 63. No. 1, pp. e22, 1-7, 2020.
56. E. Stevens, D. R. Dixon, M. N. Novack, D. Granpeesheh, T. Smith and E. Linstead, "Identification And Analysis of Behavioral Phenotypes in Autism Spectrum Disorder via Unsupervised Machine Learning", *International Journal of Medical Informatics*, Vol. 129, pp. 29-36, 2019.
57. G. B. Chand, D. B. Dwyer, G. Erus, A. Sotiras, E. Varol D. Srinivasan, J. Doshi et al., "Two Distinct Neuroanatomical Subtypes of Schizophrenia Revealed using Machine Learning", *Brain*, Vol. 143, No. 3, pp. 1027-1038, 2020.

58. W. Yassin, H. Nakatani, Y. Zhu, M. Kojima, K. Owada, H. Kuwabara et al., “Machine Learning Classification using Neuroimaging Data in Schizophrenia, Autism Ultra-High Risk and First-Episode Psychosis”, *Translational Psychiatry*, Vol. 10, No. 278, 2020.
59. M. Hirokawa, A. Funahashi, and K. Suzuki, “A Doll-type Interface for Real-Time Humanoid Teleoperation in Robot-Assisted Activity: A Case Study”, *Proc. ACM/IEEE Intl. Conf. on Human-Robot Interaction*, pp. 174-175, 2014.
60. M. Hirokawa, A. Funahashi, Y. Itoh, K. Suzuki, “Design of Affective Robot-Assisted Activity for Children with Autism Spectrum Disorders”, *Proc. of The 23rd IEEE International Symposium on Robot and Human Interactive Communication*, pp. 365-370, 2014.
61. S. Jain, B. Thiagarajan, A. Shi, C. Clabaughand, M.J. Matorić, “Modeling Engagement in Long-Term, In-Home Socially Assistive Robot Interventions for Children with Autism Spectrum Disorders”, *Science Robotics*, Vol. 5, No. 39, 2020.

---



---

### Authors Introduction

Dr. Kai Seino



She is a Section Chief of Research Institute of National Rehabilitation Center for Persons with Disabilities in Japan. She received hers Ph.D. in from Graduate School of Media and Governance Keio University in 2009. Hers research interest is Rehabilitation for Persons with Disabilities.

Dr. Shun Ishizaki



He is an Associate Professor of Faculty of Engineering at Tokyo Polytechnic University in Japan. He graduated from the Department of Mechanical Engineering, Fukui University, in 2000. He received his D. Eng. degree in System Design Engineering from Fukui University in 2005. His research interest is

Robotics.

---



---