Consideration of Mental Therapeutic Robots from Psychological and Sociological Perspectives

Tatsuya Nomura*†
* Department of Media Informatics, Ryukoku University
Otsu, Shiga 520–2194, Japan
Email: nomura@rins.ryukoku.ac.jp
† ATR Intelligent Robotics and Communication Laboratories
Keihanna Science City, Kyoto 619–0288, Japan

***Abstract*— This paper considers the possibility of robotic therapy from psychological and sociological perspectives. In particular, this paper regards therapy methods using pet–type robots and human–like conversational robots as the two poles of robotic therapy, and then discusses about what problems potentially exist in these methods.**

I. Introduction

The word "robots" itself has still not had a strict definition. In this stage, robotic therapy also cannot be defined in a strict sense. If it is defined as methods of mental therapy using autonomous artifacts that have individual bodies and behave like animals including humans, however, this type of mental therapy has been already realized to some extents (e.g., [1], [2], [3], [4], [5], [6]). This definition includes therapy methods using software agents with virtual bodies on computer displays [7].

On robotic therapy in the above sense, we have considered the possibility and danger of it by using research results in some psychological and sociological literatures [8], [9], [10], [11], [12], [13]. The previous consideration was mainly based on sociological discussions about rationalism and emotion management in the modern society, implying the possible widespread of robotic therapy and mental burden of clients. However, it did not sufficiently take into account types of robotic therapy, or specific problems of each therapy method.

Methods of mental therapy vary from therapeutic conversation between clients and therapists to interaction between clients and therapeutic animals such as dogs. When considering the perspective of interaction partners in therapy, one pole of them is animal assisted therapy (AAT). The type of robotic therapy corresponding to this therapy method may be the one using pet–type robots as substitution of animals in AAT. Therapy methods based on conversation with human therapists also vary from instruction–based methods such as cognitive-behavioral therapy to conversation–based methods such as psychiatry and narrative therapy [14]. Thus, another pole of mental therapeutic methods may be narrative therapy in which clients communicate with therapists on equal terms with them. The type of robotic therapy corresponding to this therapy method may be the one using human–like conversational robots as substitution for human therapists.

Thus, this paper regards therapy methods using pet–type robots and human–like conversational robots as the two poles of robotic therapy, and then discusses about what problems potentially exist in these methods.

II. Mental Therapy Using Pet–Type Robots

This section considers and discusses about specific problems of mental therapy using pet–type robots, that is, robots as substitution for animals in AAT. The consideration is based on original characteristics of AAT (This paper is based on [15]).

A. Characteristics of Animal Assisted Therapy

According to [15], effects of AAT have scientifically been investigated just since 1980's. There are several assumptions about therapeutic effects of animals. Moreover, there is a difficulty to investigate it due to hardness of experimental design in clinical fields. As mentioned later, this difficulty is succeeded in mental therapy using pet–type robots.

H. Yamada summarized the existing theories and research results, and then provided with a process model on effects of animals to human health (chapter 2 in [15]). His model consists of the following factors:

- A1. Interaction between animals and humans caused by both humans' and animals' behavior characteristics, such as touching and breeding.
- A2. The first level of effects to humans caused by the interaction at A1, such as evoked emotions and reduced strain.
- A3. Construction of relationships between animals and humans caused by the first level effects at A2, such as mutual dependence, mutual trust, and attachment.
- A4. The second level of effects to humans caused by the relationships with animals at A3, such as encouraged relationships with other people, self–confidence, the sense of responsibility, and reduced loneliness and anxiety.

This model finally represents that the second level effects at A4 improve humans' quality of life (QOL).

The above model by Yamada covers the whole nature of AAT, and as he mentioned [15], individual studies focus on

a part of levels in the model. For example, indices of A3–A4 levels such as empathy and social integration are focused in the study on effects of dogs in a classroom of immigrant children [16].

B. Implications to Therapy Using Pet–Type Robots

Yamada's model of AAT, mentioned the above, can be adopted on investigating therapeutic effects of pet–type robots in the following way corresponding to the above items A1–A4 respectively:

- R1. Investigation of whether humans' interaction behaviors such as touching can be evoked by pet–type robot.
- R2. Measurement of humans' physiological and psychological states such as reduced strain, to investigate whether interaction with pet–type robots give the first level of effects.
- R3. Investigation of relationships between humans and pet–type robots as a result of the first level effects.
- R4. Measurement of humans' QOL to investigate whether the relationships between humans and pet–type robots give the second level effects.

Important is that correlations between these indices should be analyzed to empirically clarify causes of improved QOL. However, this analysis may be hard in clinical fields.

In fact, many research works on mental therapy using pet–type robots focused on some or all of the above indices. On therapeutic effects of a seal–type robot to the elderly people in a nursing home, Saito, et. al., [5] and Wada, et. al., [6] used urinary tests and a questionnaire with face scale to measure reduced stress reaction (R2) and familiarity with the robot (R3), respectively. On therapeutic effects of a dog–type robot (AIBO) to the elderly people in a nursing home, Kanamori, et. al., [3] used salivary Chromongranin to measure reduced stress reaction (R2), and some questionnaires related to loneliness and health–related QOL (R4). Kimura, et. al., [4] used a face–scale questionnaire to measure mood of child inpatients in interaction with several pet–type robots in hospitals (R2). However, these studies did not clarify correlations between the indices at the different levels.

As mentioned above, it is considered that hardness of correlation analysis at the above different levels is caused by specific problems in clinical fields such as limited number of samples and difficult control of experimental conditions. In this sense, the existing research works may be just at the stage of confirming the existence of effects at each level.

C. A Possibility of Therapy Using Pet–Type Robots

A solution for the above problem is to take into account other types of research results about pet–type robots to explore cause–effect relations in therapy using pet–type robots.

For example, Friedman, et. al., [17] investigated people's relationships with robotic pets by analyzing more than 6,000 postings in online discussion forums about AIBO. Moreover, Kahn, et. al., [18] examined preschool children's reasoning about and behavioral interactions with AIBO. Their important suggestion is that people in general and children in particular, may fall prey to accepting robotic pets without the moral responsibilities that real, reciprocal companionship and cooperation involves. Their suggestion implies that the sense of responsibility at the A4 level in Yamada's model of AAT may not occur and improvement of QOL by it may not be expected in therapy using pet–type robots.

Moreover, Kato, et. al., [19] conducted action research of robot assisted activity for the elderly people in a nursing home. Their research was based on group dynamics between the elderly, the home staffs, and the researchers themselves, and is different from the other studies focusing on effects on individual subjects. Their results based on observation from video data suggested that all the participants affect construction of narratives about interpretation of AIBO's behaviors. This suggestion implies that the existence of companions may affect improvement of QOL by pet–type robots. This implication is consistent with the results on children in hospitals by Kimura, et. al. [4].

These implications from other types of research can be used for exploratory focus on effects and their causes in therapy using pet–type robots. For example, even if pet–type robots can evoke some positive emotions in R2 and R3 levels, they may not cause the sense of responsibility in R4. Thus, if clients interact with the robots alone, these emotions may not lead to improvement of QOL in R4 level. On the other hand, if there are companions inspiring interaction, these emotions may encourage construction of narratives about the robots in the community and lead to improvement of QOL. Based on this prediction, we can consider a clinical experiment with controlled design depending on the existence of companions and measurement of emotions in interaction with robots.

III. Mental Therapy Using Human–Like Conversational Robots

This section considers and discusses about specific problems of mental therapy using human–like conversational robots, that is, robots as substitution for human therapists. The consideration is based on the existing research result about relations between narrative therapy and therapeutic conversational agents [13].

A. Narratives and Conversational Artifacts

"Narrative" is one of key words in the modern society. Giddens [20] pointed out a central role of narratives of the self in some literatures on self–actualization in the late modern society. Kobayashi [21] claimed that there are increasing people trying to write life histories of themselves, and industries aiming at satisfying demand of these people like manuals for making narratives of selves, publishers, and so on, called "narrative industries," have appeared.

There is a possibility that the research field of artificial intelligence is also affected by this cultural trend. Sengers [22] argued introduction of narrative theories to architectures of artificial agents. Moreover, the bartender agent produced by Isbister and Hayes–Roth [23] can be considered to be a

successful one along the narrative approach. This agent was not strictly based on the narrative approach. However, the agent has her original background like her life history and encourages interaction with users based on the background.

B. Narrative Therapy

On the other hand, the word "narrative" has therapeutic meanings in a field of psychology.

Narrative therapy [14] is one of therapeutic positions in family therapy [24]. Family therapy is originally based on family system theory that caused from cybernetics [25], [26]. In this theoretical framework, a family is a system that consists of its family members including clients and communication between them. It has a kind of homeostasis and the existence of the clients means a result of warped homeostasis in communication. Then, family therapists aim at perturbing the family system to improve states of the system by using autonomous capacity of the system. Several therapeutic techniques for this improvement have been developed [24].

However, some family therapists have recently been criticizing meta–positions of therapists for families based on this autonomous mechanism and empiricism existing behind the mechanism. They argue that power of therapists for clients caused by this empiricism oppresses clients themselves. Narrative therapy has been developing as a therapeutic attitude proposing that therapists must stay on equal terms with clients.

Narrative therapists assume that reality surrounding persons do not objectively exist independent from them, but is produced and maintained by "narratives" that are socially constructed through linguistic interaction between the persons. These narratives give consistency and structures for situations and events in lives of persons, and selves of them. Then, narrative therapists aim at re-organizing narratives on clients' selves that are talked by the clients and produce pain of them. And they aim at producing a novel narrative through conversation with the clients on equal terms with them, while removing professional positions of the therapists. For example, a discipline in narrative therapy represents this stance by using the word "not–knowing positions". Thus, narrative therapy does not mean a concrete therapeutic technique but just an attitude that therapists should have toward clients [14].

C. Narrative Therapy by Conversational Robots

There are some sociological works relating narrative therapy to conversational robots.

Asano [27] critically considered a position of narrative therapy in the modern society while referring to some sociological works including Giddens [20] and Kobayashi [21] mentioned above. According to the perspective of narrative industries, narrative therapy is also just one of them in the field of mental therapy, that is, a commodified product satisfying demand of people trying to talk narratives of themselves. In fact, Giddens also pointed out that self–help books are commodified productions for self–actualization [20].

On the other hand, Ritzer's theory of McDonaldozation of Society argues that the principle of rationalization based on efficiency, calculability (quantification), predictability, and control by technology dominates many fields of modern society, including not only management and economy but also education [28]. According to this theory, the field of mental therapy is also affected by this principle of rationalization, and it implies introduction of computers to mental therapeutic fields since they satisfy the above conditions that the principle constitutes of.

The above sociological works have an important implication: commodification of narrative therapy and introduction of computers and robots to mental therapy by the modern rationalism lead to conversational robots as substitution of narrative therapists. In fact, humans tend to positively evaluate even simple programs repeating specific words mechanically like Eliza and find their therapeutic meanings [29], [30]. If the design theory of conversational robots is developed, it may encourage commodification of narrative therapeutic robots.

D. Principle Problems of Narrative Therapeutic Robots

On the other hand, Asano criticized narrative therapy as follows [27]. Narrative therapy functions by explicitly drawing things concealed in narratives which clients talk on themselves through conversation between therapists and them. However, the desire of people to talk narratives on themselves is also a desire to leave these concealed things concealed. If narrative theorists are not conscious for these facts, narrative therapy has a danger that it only repeats this desire of people.

The above statement can be interpreted as follows: Narrative therapy provides clients with alternative narratives about themselves instead of the dominant narrative producing pains of them. These alternative narratives are produced by explicitly drawing things concealed in narratives of clients through conversation between the clients and therapists staying on equal terms with the clients. There is no problem if clients consciously wish to produce alternative narratives about themselves with therapists. However, many people in the modern society wish to leave concealed things concealed in their narratives and maintain the existing narratives. These people may use narrative therapy as commodified productions to complement their existing narratives. Then, narrative therapy continues to help these people maintain their narratives that should be originally modified.

This interpretation implies a possibility that interaction with narrative therapeutic robots may also just repeat desire of people to talk on themselves while leaving concealed things concealed in their narratives, which should be drawn in narrative therapeutic conversation between clients and therapists. In other words, narrative therapeutic robots may be used as commodified tools to complement narratives of people desiring to talk on themselves while leaving concealed things concealed in their narratives. This also implies that therapeutic conversational robots may be spread in the manner contrary to the original therapeutic aim of researchers and developers.

If narrative therapeutic robots do not have enough interaction capacity, they may not sufficiently satisfy desire of people to complement their narratives while leaving concealed things

concealed. Then, these people may feel unpleasant for the robots. If these robots can explicitly draw things concealed in narratives which clients talk on themselves, these robots are contrary to these people's expectation. In the same way, these people may feel unpleasant for the robots.

E. A Dilemma by Narrative Therapeutic Robots

Moreover, Giddens argued that reflexive construction of the self is a struggle against commodification, and there is a dilemma that narratives of the self must be constructed in circumstances in which personal appropriation is influenced by standardization of consumption [20]. On the other hand, mental therapy is a methodology of self–actualization in the modern society. However, introduction of artifacts to mental therapy implies standardized commodification of mental therapy since implementation of therapeutic conversational robots needs standardization of therapeutic methods possible to be represented as computer programs.

If clients aiming at constructing their narratives face to narrative therapeutic robots that are standardized commodification of mental therapy, the above dilemma in construction of the self may be made more explicit. This dilemma may cause unpleasantness of the clients.

IV. Summary and Discussion

This paper considered the possibility of robotic therapy from psychological and sociological perspectives. In particular, this paper regarded therapy methods using animal–type robots and human–like conversational robots as the two poles of robotic therapy, and then discussed about what problems potentially exist in these methods.

The consideration in this paper implies that mental therapy using pet–type robots may be validated on therapeutic effects and their causes can be investigated from several perspectives. Although the existing research results are focused on the elderly people and children in hospitals, these validation and investigation may allow extension of the therapy method to several types of clients. On these validation and investigation, however, more exact measurement of humans' psychological states is needed.

For example in the field of AAT, improvement of QOL by animals is affected by the difference on attitudes toward animals between individuals, and there is a questionnaire measuring these attitudes [15]. If improvement of QOL by pet–type robots is also affected by the difference on attitudes toward robots between individuals, a questionnaire measuring attitudes toward robots should be used on investigating therapeutic effects of pet–type robots (for example, the use of the Negative Attitudes toward Robots Scale [31]).

On the other hand, the consideration in this paper implies that human–like conversational robots may be spread in the manner contrary to the original therapeutic aim of researchers and developers, and they may produce a dilemma specific in the modern society. This implication should be investigated by social research from several perspectives. In particular, spread of human–like conversational robots may depend on envision and assumption about robots, and there may be cultural difference on them [32], [33]. This social research is going to be conducted soon.

Moreover, this paper focused on some problems inherent in clients of narrative therapy, and did not sufficiently discuss whether narrative thrapy can be realized as an enginnering product (this problem was partly discussed in [12]). In fact, this realization may be hard since narrative therapy is not an integrated therapeutic technique but an attitude of therapists toward clients. Although individual researchers have reported their methodologies [14], they are very pragmatical and far from integrated procedures possible to be computerized. In addition, there may be no research showing that narrative therapists can avoid the principle problem that Asano pointed out [27]. This realization problem of narrative therapeutic robots should be discussed in future works.

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References

[1] K. Dautenhahn and A. Billard, "Games children with autism can play with robota, a humanoid robotic doll," in *Universal Access and Assitive Technology*, S. Keates, P. J. Clarkson, P. M. Langdon, and P. Robinson, Eds. Springer–Verlag, 2002, pp. 179–190.

[2] T. Hashimoto, "Emotion model in robot assited activity," in *Proc. 2001 IEEE International Symposium on Computational Intelligence in Robotics and Automation (IEEE CIRA 2001)*, 2001, pp. 184–188.

[3] M. Kanamori, M. Suzuki, H. Oshiro, and et. al., "Pilot study on improvement of quality of life among elderly using a pet–type robot," in *Proc. IEEE International Symposium on Computational Intelligence in Robotics and Automation (IEEE CIRA 2003)*, 2003, pp. 107–112.

[4] R. Kimura, N. Abe, N. Matsumura, A. Horiguchi, T. Sakaki, T. Negishi, E. Ohkubo, and M. Naganuma, "Robot assisted activity using robotics pets in children hospital," in *Proc. Joint 2nd International Symposium on Soft Computing and Intelligent Systems and 5th International Symposium on Advanced Intelligent Systems*, 2004, (CD–ROM Proceedings).

[5] T. Saito, T. Shibata, K. Wada, and K. Tanie, "Change of stress reaction of the elderly by interaction with robot seal in health services facility for the aged," in *Proc. Joint 2nd International Symposium on Soft Computing and Intelligent Systems and 5th International Symposium on Advanced Intelligent Systems*, 2004, (CD–ROM Proceedings).

[6] K. Wada, T. Shibata, T. Saito, and K. Tanie, "Psychological effects and change of familiarity with robots in long–term experiment of robot assisted activity," in *Proc. Joint 2nd International Symposium on Soft Computing and Intelligent Systems and 5th International Symposium on Advanced Intelligent Systems*, 2004, (CD–ROM Proceedings).

[7] S. C. Marsella, "Pedagogical soap: Socially intelligent agents for interactive dramm," in *Socially Intelligent Agents: Creating Relationships with Computers and Robots*, K. Dautenhahn, A. H. Bond, L. Cañamero, and B. Edmonds, Eds. Kluwer Academic Publishers, 2002, ch. 17, pp. 141–148.

[8] T. Nomura and N. Tejima, "Critical consideration of applications of affective robots to mental therapy from psychological and sociological perspectives," in *Proc. 11th IEEE International Workshop on Robot and Human Interactive Communication (ROMAN 2002)*, 2002, pp. 99–104.

[9] T. Nomura, "Problems of artificial emotions in mental therapy," in *Proc. IEEE International Symposium on Computational Intelligence in Robotics and Automation (IEEE CIRA 2003)*, 2003, pp. 567–570.

[10] ——, "Double bind situations in man–machine interaction under contexts of mental therapy," in *Intelligent Virtual Agents: 4th International Workshop, IVA 2003*, T. Rist, et. al., Ed., 2003, pp. 67–71.

[11] ——, "Problems of artificial emotions in mental therapy using computers and robots: On its possibility and danger," *Studies in Simulation and Gaming*, vol. 13, no. 2, pp. 188–197, 2003, (in Japanese).
[12] T. Nomura, T. Takaishi, and T. Hashido, "Consideration of machine consciousness in the context of mental therapy from psychological and sociological perspectives," in *Proc. the Symposium on Next Generation Approaches to Machine Consciousness (SSAISB 2005 Convention)*, 2005, pp. 67–74.
[13] T. Nomura, "Narratives and therapeutic conversational agents: Their principle problems," in *Proc. INTERACT 2005 Workshop on Abuse*, 2005, pp. 58–61.
[14] S. McNamee and K. J. Gergen, *Therapy as Social Construction*. Sage, 1992, (Japanese translation: Y. Noguchi and N. Nomura. Kongo–Shuppan, 1997.).
[15] T. Iwamoto and I. Fukui, Eds., *Theories and Practices of Animal Therapy*. Baifukan, 2001, (in Japanese).
[16] A. Hergovich, B. Monshi, G. Semmler, and V. Zieglmayer, "The effects of the presence of a dog in the classsroom," *Antrozoös*, vol. 15, no. 1, pp. 37–50, 2002.
[17] B. Friedman, P. H. Kahn, and J. Hagman, "Hardware companions? – what online AIBO discussion forums reveal about the human–robotic relationship," in *Proc. CHI 2003*, 2003, pp. 273–280.
[18] P. H. Kahn, B. Friedman, D. R. Perez-Granados, and N. G. Freier, "Robotic pets in the lives of preschool children," in *Extended Abstracts of CHI 2004*, 2004, pp. 1449–1452.
[19] K. Kato, T. Atsumi, and K. Yamori, "Generating process of stories in robot assisted activity: A case study of robot assisted activity with pet–type robot at a for–profit nursing home," *The Japanese Journal of Experimental Social Psychology*, vol. 43, no. 2, pp. 155–173, 2004, (in Japanese).
[20] A. Giddens, *Modernity and Self–Identity: Self and Society in the Late Modern Age*. Polity Press, 1991.
[21] T. Kobayashi, *Talked "Self"*. Gakuyu Shobo, 1997.
[22] P. Sengers, "Narrative intelligence," in *Human Cognition and Social Agent Technology*, K. Dautenhahn, Ed. John Benjamins, 1999, ch. 1, pp. 1–26.
[23] K. Isbister and B. Hayse-Roth, "Social implications of using synthetic characters: An examination of a role–specific intelligent agent," Knowledge Systems Laboratory, Department of Computer Science, Stanford University, Tech. Rep. KSL 98–01, 1998.
[24] V. D. Foley, *An Introduction to Family Therapy*. Allyn & Bacon, 1986, (Japanese translation: A. Fujinawa, et al. Sogensha, 1993.).
[25] G. Bateson, *Steps to an Ecology of Mind*. Harper & Row, 1972, (Japanese translation: Y. Sato. Shisaku–Sha, 1990.).
[26] P. Watzlawick, J. B. Bavelas, and D. D. Jackson, *Pragmatics of Human Communication*. W. W. Norton & Company, 1967, (Japanese translation: K. Yamamoto and J. Ogawa. Niheisha, 1998.).
[27] T. Asano, *Narrative–Theoretic Approach to Selves*. Keiso–Shobo, 2001, (in Japanese).
[28] G. Ritzer, *The McDonaldozation of Society*. Pine Forge Press, 1996, (Japanese Edition: K. Masaoka (1999). Waseda University Press).
[29] J. W. O'Dell and J. Dickson, "Eliza as a therapeutic tool," *Journal of Clinical Psychology*, vol. 40, pp. 942–945, 1984.
[30] S. Turkle, *Life on the Screen: Identity in the Age of the Internet*. Simon & Schuster, 1995, (Japanese translation: M. Higurashi. Hayakawa–Shobo, 1998.).
[31] T. Nomura, T. Kanda, and T. Suzuki, "Experimental investigation into influence of negative attitudes toward robots on human–robot interaction," *AI & Society*, vol. 20, no. 2, pp. 138–150, 2006.
[32] T. Nomura, T. Kanda, T. Suzuki, and K. Kato, "People's assumptions about robots: Investigation of their relationships with attitudes and emotions toward robots," in *Proc. the 14th IEEE International Workshop on Robots and Human Interactive Communication (RO–MAN 2005)*, 2005, pp. 125–130.
[33] T. Nomura, T. Suzuki, T. Kanda, and K. Kato, "Altered attitudes of people toward robots: Investigation through the Negative Attitudes toward Robots Scale," in *Proc. AAAI–06 Workshop on Human Implications of Human–Robot Interaction*, 2006, (to appear).