Abstract
This study examines and analyzes the current state of gardening facilities for residents in 11 senior citizen housing complexes and their understandings, actual gardening behaviors and their effects. The objective is to suggest a direction for the planning of gardening and its spatial composition in senior housing complexes. The study used surveys and interviews and conducted field visits to examine actual gardening facilities. The study produced the following outcomes.
1) Elderly people had high expectations that gardening would bring them 'mental comfort and physical health'. Though they are experiencing mental comfort, direct effects on physical health were not seen.
2) The common gardening space provided by the facilities subject to the research, were small in size compared to the number of residents and it was inconvenient since it did not take into consideration the characteristics of the gardening activities.
3) Elderly people found that gardening encouraged social interactions with other residents and enriched their daily lives.
4) Residents in senior housing complexes chose places as gardening spaces that are close to their flats, in particular their living rooms and on the same level for easy horizontal access.

From the result of this research, it was clear that diverse gardening space should be provided for the residents to choose and freely express their individual characteristics. In addition, instead of providing a dedicated gardening space, a multipurpose area that could also be used for diverse hobbies was more practical.

Keywords: senior multi-unit housing; elderly people; space of gardening; gardening behavior; expanded living

1. Research Background and Objective
In the era of the super-aging society, Japan acknowledges the significance of arranging housing and facilities for elderly people. Generally, a senior housing complex provides both care service and support to improve QOL (Quality of Living) as a built-environment of living. In other words, it is an important consideration in planning senior housing to ensure the health care of the residents and to provide an environment to induce residents to actively engage in meaningful lives.

Recently, so-called "gardening welfare" or "horticultural therapy", which makes use of the soothing effect of plants, has received heightened attention as a means to improve QOL and to maintain the health of elderly people. In horticultural therapy, an emotional benefit is expected through positive stimulation, both physically and psychologically, by engaging people in gardening behavior — a series of activities centered on tending and caring for plants for growth — to come in touch with plants.

Until now, research related to the influence of plants on the human body and mind has focused on cases of people with mental, psychiatric or physical disabilities in the medical, welfare, and social horticulture fields. The main benefits of gardening have been identified as an increase in social exchanges, refreshing mood, psychological comfort, physical pleasure (Matsuo, 1994), positive attitude in daily life and improvement in perception (Yamane, 2003), and vitality (Toyota, 1998). Based on previous research, support for gardening spaces in senior housing complexes is on the rise. However, by providing a gardening space without considering its characteristics, there were many cases where this space was unattended and the initial plan to influence elderly people through plants was not carried out.
In the everyday lives of senior citizens, gardening can be a means to maintain health, to provide a private leisure activity, and to interact with other people and provide self-expression on a collective level. It is necessary to understand the effect of gardening and consider the spatial composition of gardens as part of green environments in terms of architecture and built-environment planning.

Noting this, the research examines the effect and significance of gardening behaviors in senior multi-unit housing for healthy elderly people\(^1\), and closely surveys the current state of the spatial use of gardens. As gardening behaviors are expected to become more common in the future, the study suggests ways for the spatial reorganization of gardens and a future direction in maintaining green environments.

2. Research Method

As shown in the research framework of Table 1., the study conducted surveys in three phases. The first survey involved visits to 11 senior multi-unit housing complexes\(^2\) to examine the current state of gardening behaviors and the use of gardening space (2007.5–2008.1). The second survey conducted a questionnaire of residents, with approval, on their ideas regarding gardening and engagement in gardening behaviors (2008.11–2009.1, no. of respondents: 212). For housing units that did not grant approval for surveys, the study conducted interviews only in 7 for in-depth interviews concerning gardening spaces and details of their behaviors and opinions. The session also involved picture-taking (2008.11–2009.1, no. of respondents: 65). For housing units that did not approve a visit, the study conducted questionnaires only.

3. Survey Outline

The senior multi-unit housing complexes subject to the research and the gardening space for seniors can be seen in Table 2. The subjects were 7 "Fee-charging senior homes", 2 "Ko-ju-chin" excellent senior rental housings and 2 "Ko-sen-chin" senior housing. There were a total of 11 housings, but only 6 of them had common gardening space\(^3\). The types of common gardening space provided were a farming garden, rooftop vegetable garden, and a common vegetable gardening space. On the other hand, for the residents that lived in housings without a gardening space, common empty spaces for gardening behaviors were found, such as the lounge, exhibit corner, consulting corner and terrace. In addition, residents' personal spaces, such as their veranda or living room, were used. A high interest in gardening could be predicted, since

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Table 1. Research Framework

<table>
<thead>
<tr>
<th>Surveys of the current state of gardening space in senior multi-unit housing complexes for healthy elderly people</th>
<th>Questionnaire surveys</th>
<th>Interview surveys</th>
<th>Role of gardening shown in case studies survey</th>
<th>Expansion of living shown in gardening case studies survey</th>
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</thead>
<tbody>
<tr>
<td>Survey of elderly people's consciousness concerning gardening</td>
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</tbody>
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Table 2. Introduction of the Senior Multi-unit Housing Complexes in the Surveys

<table>
<thead>
<tr>
<th>Type</th>
<th>Year of establishment</th>
<th>Location</th>
<th>No. of units</th>
<th>Indoor activity room</th>
<th>Superintendents office</th>
<th>Meeting room</th>
<th>Park playground</th>
<th>Common vegetable patch</th>
<th>Guestroom</th>
<th>Multi-use room</th>
<th>Laundry room</th>
<th>Roof-top garden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior housing</td>
<td>1998</td>
<td>Chiba-City</td>
<td>60</td>
<td>Multi-use room, living community space, space, cafeteria, front desk, health care room, walking path, pet community space</td>
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<td>Senior housing with care facility</td>
<td>2004</td>
<td>Kashima-City</td>
<td>74</td>
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<td>Excellent senior housing</td>
<td>2003</td>
<td>Nagoya-City</td>
<td>57</td>
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<tr>
<td>Senior housing</td>
<td>2004</td>
<td>Yokohama-City</td>
<td>179</td>
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<tr>
<td>Fee-charging senior home</td>
<td>1995</td>
<td>Yokohama-town</td>
<td>39</td>
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<td>Nerima-City</td>
<td>49</td>
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<tr>
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<td>2002</td>
<td>Meguro-City</td>
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<td>Fee-charging senior home</td>
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<td>Tokyo</td>
<td>30</td>
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<tr>
<td>Fee-charging senior home</td>
<td>1998</td>
<td>Suginami-City</td>
<td>90</td>
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<tr>
<td>Fee-charging senior home</td>
<td>2003</td>
<td>Koto-City</td>
<td>79</td>
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*Gardening space provided by senior multi-unit housing complexes*
more than 50% of the residents enjoyed gardening behaviors.

4. Elderly People's Consciousness Concerning Gardening Behaviors

To identify the elderly people's consciousness concerning gardening behaviors, a survey was conducted on elderly people both with and without gardening experience.

Seventy-two elderly people without gardening experience (Fig.1.) answered that they felt [psychological comfort] and 52 [physical health], showing high mental/physical expectations regarding gardening behaviors. On the other hand, 52 elderly people with gardening experience (103 persons) (Fig.2.) responded that "it gave me mental comfort", and 30 responded that they experienced [visual improvement]. However, only 11 elderly people noticed any effect on their health; a disappointment considering the high expectation of "health" from elderly people without gardening experience. This result shows that the mental effect from gardening in senior multi-unit housing complexes can be expected, although there is not enough evidence to support physical health effects.

5. The Gardening Space Used by Residents

This chapter identifies the gardening space used by the residents of senior multi-unit housing complexes with and without common gardening space. The gardening space used by the elderly people living in housing complexes with and without gardening space can be seen in Fig.3. A high 35% of senior citizens living in housing complexes with a common gardening space used it for their gardening behaviors. However, even with the common gardening space provided, 29% of the residents used the veranda, 23% used the interior space, and 13% used other common spaces used independently by the residents. On the other hand, for housing complexes without a common gardening space, 45% used the veranda and 38% used the interior space of the house for gardening behaviors. As shown in the results, the residents found appropriate spaces for gardening outside the common gardening space such as the interior space or the veranda near the living room, which is the most accessible space in the house.

6. Conditions & Evaluation of Gardening Spaces Provided by a Housing Complex

In this chapter, the actual conditions and problems of using the gardening space are identified through three particular cases among 6 of the senior multi-unit housing complexes that provide gardening space. (The first is a case where senior citizens and the general residents both use the gardening space. In the second case common and private gardening spaces are provided, and in the third case a rooftop is used for gardening space). The common gardening spaces of the three housings and the evaluation of their spaces using the residents' interview survey are as shown in Fig.4.

[Case 1] is an excellent senior rental housing complex where the seniors reside on the first and second floors while the other general residents reside on the third floor. Since the common gardening space is used by both the seniors and the general residents, the seniors have relatively less opportunity for gardening. The common gardening space appeared to be smaller compared to the actual number of residents; only six of the residential units could use this space. Also in the interview survey, respondents pointed out problems such as "the common vegetable garden could not be used as it was occupied by others at the time of moving in" (male, age 68) and "the space is smaller compared to the unit size" (male, age 70).

[Case 2] is a fee-charging senior home with care facility with a separate nursing unit and a healthy senior citizens' unit that provides a common gardening space and a private gardening space for the residents living on the first floor. Though the common vegetable gardening space was used by the residents during earlier times, it is now used by the janitors since the number of users has reduced. Also, in the interview survey, one group represented by a female, age 86 replied, "I don't want to participate in gardening in the common vegetable garden, since it is not a private space." meaning that they wanted a private gardening space and the other group represented by a female, age 81 replied, "I would like a common vegetable garden, however currently the janitors are using it." meaning that they wanted a common gardening space. The results show two different opinions, but the facility was not able to respond to any of these demands.

However, the residents living on the first floor made good use of their private garden by planting vegetables for consumption, flowers for a pleasant environment, and using it during visits from their families. Such results can be explained by the accessible location of the garden, which is right outside the living room area, and its private character, that can be personalized.

[Case 3] is a fee-charging senior home where the nursery and the senior residents occupy one building to encourage communication between generations. Though there is a common gardening space on the rooftop, it does not provide soil for gardening, but a space where residents can put their personal flowerpots and planters. The residents made complaints about the location problem, such as "It is hard to walk up to the roof for gardening. The common gardening area is not very convenient for timid people like me." (male, age 85) and "It is difficult to go up and down to the rooftop." (female, age 86). In addition, since the facility locks the gardening space and restricts the time it is difficult for the residents to use the space on a
regular basis.

As shown in these cases, it was clear that the senior housing complexes that provided gardening space did not consider the size and location of the garden according to the number of units and the convenience of the users. In addition, the facility's management policy and the poor response to the user's demand brought down the usage rate and reduced the desire.

Fig. 1. Expectation of Gardening Behaviors by Elderly People

Plural answers N=103

Psychological comfort: 52
Physical Health: 11
Visual improvement: 30
Good in environment: 7
Communication: 10
Other: 10

Fig. 2. Idea of Gardening Behaviors Experience by Elderly People

Common gardening space provided by the housing (yes): 29%
Common gardening space provided by the housing (No): 39%

Interior space: 4%
Veranda: 16%
Common gardening space provided by the housing (Yes): 39%
Common gardening space provided by the housing (No): 39%

Fig. 3. Residents' Gardening Space by Common Gardening Provided by Senior Multi-unit Housings

Evaluation of gardening space (interviews):
- The common vegetable garden couldn't be used since it was occupied by others at the time of the move (male, age 60).
- The space is smaller compared to the unit size (male, age 70).
- The vegetables are in a poor state and need more care (female, age group 91).
- The common vegetable garden is not very appealing because of other people's intervention (male, age group 70).

Fig. 4. Conditions & Evaluation of Gardening Spaces Provided by Housing Complexes
for gardening behaviors. However, a private garden close to the living room that provides personal space increased the variety as well as the rate of its usage.

7. Conditions and Evaluation of Gardening Spaces Used Independently by the Residents

The survey result indicates that residents prefer gardening spaces near their home that provide privacy. Here, cases will show the detailed location of gardening spaces used independently by the residents. These independent locations are shown in Fig.5.

[Case 4] is where the empty spaces of a hallway in a multi-unit housing are used to provide a pleasant atmosphere to a lonely space. [Case 5] is where the residents use the small multipurpose space in front of the entrance for gardening behaviors. This space is used not only for plants, but also for placing artificial flowers and paintings. [Case 6] is where the space in front of the elevator is used for gardening behaviors. This space is not permanently used by one person, but by different people taking turns to decorate it with personal flowerpots and flower arrangements that brings the delight of watching diverse beauty. [Case 7] is where the residents residing on the first floor remodeled the porch into a private garden. This space was made to enjoy gardening behaviors without concern for others. [Case 8] is where the veranda and the interior space are used. The easy accessibility makes the veranda and the interior space the most preferable space for gardening, furthermore, the sunlight in these areas is an essential factor in gardening.

However, gardening in the veranda can block the way during evacuation and since most of the complex does not have a water supply on the veranda, many residents complain of its inconvenience. In addition, those using the interior space complain that the living room is too small even to place daily necessities, so it is impossible to carry out more gardening behaviors.

As shown above, the diverse gardening behaviors of elderly people, living in senior housing complexes, was carried out according to their personal preference. Such activities were performed in empty spaces inside the facility where they can place their flowerpots, and also in personally made gardens, veranda and the interior space. These locations had accessible plans or were close to their units, showing that the residents chose locations where they could easily take care of the plants.

8. The Role of Gardening Behaviors in Senior Multi-unit Housing

In this chapter the authors examine a study that was conducted by visiting residents to identify the daily behavior influenced by gardening behaviors. The aim of this examination was to find out how the gardening activity affects the lives of multi-unit housing residents (Table 3.).

[Case 9], people participate in the Acorn Club to engage in gardening exchanges outside their homes. The participants grow acorns in a house or a foyer to give pleasure to neighbors and exchange related information with other members (long distance outing behavior, social activity behavior, and information gathering behavior).

[Case 10], a first-floor resident erected a temporary wooden wall on a veranda to secure a private garden. The owner goes for a walk every morning to nearby...
hills to pick wildflowers and plants to grow in the garden (short distance outing behavior).

[Case 11], involves a former farmer who remodeled a veranda into a greenhouse, raising foliage plants and flowers to create a pleasant living environment and to keep company. He also developed a standing relationship with the owner of a neighborhood supermarket as he frequented the shop to buy gardening materials and plants (short distance outing behavior, communication behavior with neighbors).

[Case 12], the resident raises plants indoors and in a corridor, providing a delightful view for the neighbors. The respondent said it is very encouraging when people praise how beautiful the plants are (communication between neighbors inside the multi-unit housing).

[Case 13], the resident started to grow flowers and plants to lessen her loneliness, and has now developed a close relationship with an owner of a flower shop. Also, the resident acquired extensive knowledge on flowers, which has by now become an inseparable part of her life (outing behavior, communication between neighbors, gathering information).

[Case 14], illustrates an example of transferring foliage plants and flowers from former residences to indoors in a senior housing complex. The resident also engages in gardening behaviors at a country cottage, an hour's drive from the house, which expands the scope of daily living (outing behavior in their former home).

As shown in the above cases, gardening behaviors for seniors living in multi-unit housing, physically expands their daily boundaries with outings and they personally take the role of socialization such as gathering information and communication.

9. Conclusion

In this study, a survey and an interview were conducted with residents living in a healthy senior multi-unit housing complex to identify the condition and location of gardening behaviors and examine the problems that occur. In addition, the survey aimed to understand the influence of gardening in the different sectors of their lives.

The result of the research is as follows.

1) Elderly people showed physical and psychological benefits from gardening as it provides 'mental comfort, health benefits, and a pleasant living environment.' The survey confirmed such benefits of gardening.

2) The size of the common gardening space provided by the senior multi-unit housing complexes was smaller in size considering the number of residents, and some facilities made the gardening space physically inconvenient for the seniors to access. However, relatively free gardening behaviors were performed in the first floor private gardens close to the living room area, making it easier for the residents and their visiting family to use them.

3) Aside from the common space, the residents chose accessible locations such as the porch, the interior space, and the multipurpose space. These areas were used for gardening, and for diverse gardening behaviors according to the seniors' personal tastes.

4) Residents in senior housing complexes engage in private gardening behaviors in many places other than the designated common gardening areas. Mostly, people chose a place that is close to a living room in the flat and allows easy horizontal access. In other words, the gardening space needs to be organized on an adequate scale with easy horizontal access. Care needs to be taken to enable uninhibited gardening behavior according to the users' special characteristics such as physical disabilities.

The result of this study identifies that diverse spaces should be provided for the residents to freely perform gardening activities based upon their taste and choice. In addition, facilities should not only provide a simple gardening space but a multipurpose space where diverse hobbies can be enjoyed. The following equipment will be needed when considering the space for gardening activities.

Veranda: Secure evacuation space, install a water
supply and a gardening space where people can work standing up and sitting down.

Interior Space: Sufficient space for gardening activity as well as diverse hobbies.

Hallway/In front of the Entrance: Secure empty spaces in the hallway and multipurpose space in front of the entrance.

Common Gardening Space: Size according to the number of residents, and a ground plan for the easy access of physically weak seniors.

Acknowledgment

This survey was conducted as part of a joint research project between Yokohama National University and Takenaka Corporation, "Research on Planning Model of Senior Housing Based on Resident Survey" (2007).

Notes
1) This housing aims to support the independent lives of seniors rather than nursing.
2) Senior housing in Japan divides the facility into institution type, housing type and small scale type according to the service, level, and scale provided to the seniors. Also, according to the specific seniors, it is divided into a healthy seniors' type and a nursing type. Senior housing is also divided into facilities with or without a common gardening space.
3) The gardening location indicated here is the space made exclusively to support gardening activities.

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3) Toyota (1998), The horticultural therapy that It will try to begin, Ieno Hikari Kyoukai, Tokyo, pp.19-20, 31-38.