SEMANTIC ANALYSIS OF MACHIYA INHABITATION CONTEXT
Culturally friendly design method based on Machiya system of Kyoto (Part 1)

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In this paper, the architectural space of Machiya will be described using semantic dimensions instead of syntactic dimensions of conventional tridimensional space. Semantic dimensions (formality, privacy, brightness and naturalness) are collected for different activities using a questionnaire and arranged in a data base. With such data it is possible to differentiate Machiya from other typologies and to find similarities between the typical layout of Machiya and its semantic description. But as well we found a discrepancy between the semantic space of existing Machiya and the type of dwelling preferred by those who say that they would like to live in Machiya, showing that even if inhabitants can recognize semantic space of Machiya they might not necessarily be aware of the implications of it. Therefore new ways of continuation of Machiya in the contemporary context are being explored.

** Keywords: Machiya, Architecture, Context, Interpretation, Semantic dimensions, Inhabitation
町家の居住コンテクストに関する意味論的分析
京都の町家システムに基づく文化親和型の設計方法（その1）

1. Introduction: semantic dimensions and space of Machiya

The objective of this paper is to describe the architectural space of Machiya using semantic dimensions gathered from inhabitants instead of conventional tridimensional space.

In this case we will focus on internal inhabitation as the context of Machiya as other research had been done previously regarding external (physical) context of Machiya1). Architecture concerns the inhabitation of space2), focusing on the relation in between the actual space and the meaning of such space in terms of its inhabitation or the activities realized in such space. Therefore when analyzing architectural space we do not always need to use the conventional three dimensions, as the matter of the research is focused on how the space relates to its inhabitation, and inhabitation is based on an understanding of the meaning of space (interpretation), thus we will use the parameters corresponding to how the space is related to its meaning by the inhabitant (semantics). Such parameters will be used as spatial dimensions, which do not need to be three, and will be called “semantic dimensions”.

2. Semiotic approach

2.1 The sign as semiosis

In order to analyze semiotic objects, it is necessary to choose an eloquent semiotic theory; in this case we will base the paper mainly on semiotic theories of Charles Sanders Peirce.

C. S. Peirce explains the relation of the parts of the sign as semiosis (Fig. 1):

“A sign, or representamen, is something which stands to somebody, that is, creates in the mind of that person an equivalent sign or perhaps a more developed sign. That sign which it creates I call the interpretant of the first sign. The sign stands for something, its object.” (C.P. 2.228)3)

Fig. 1 Diagram of the sign defined by C. S. Peirce

O: Object
S: Sign
I: Interpretant
S stands for O
S creates I

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This system was chosen because of its suitability for evolving systems such as Machiya making use of the interpretant to connect new signs as in a sequence. It is also considered that each Machiya is constructed according to an existing cultural background, therefore such cultural concepts are considered to be the "object", the built space corresponding to Machiya system is considered to be a "sign" of such cultural concepts, and the "interpretant" is considered to be the sense made by the Machiya, as well as creating a new "sign" or new space. Therefore the real experience of inhabitation/interpretation will mark the only boundary between theory and reality. Hence a community, which is the one to experience architecture, or in other words makes it real by inhabitation, should play a more important role in design processes and decision making, and the acknowledgement of architects should better focus more on such community instead of focusing on other architects.

2.2 Infinite Semiosis

Within the context of Peircian semiosis, it is considered that the Interpretant can be as well a Sign of the same or another Object. In other words, an interpretant can be a further sign, as well as the sign can be seen as a preceding interpretant. This means that the semiotic process can go on ad infinitum called "Infinite Semiosis" or in some cases "Unlimited Semiosis". Moreover, we can call such process as "Semiotic stream"; as such process is continuously ongoing, keeping our interpretations constantly subject to change.

Considering this idea we consider that the design process is as well a semiotic stream. Let's consider for instance that the objects "O" are the concepts or ideas of architecture, such as the idea of a house, theater, office building, or any design concepts, design ideals, etc; such ideas or concepts which are then represented by a sign "S" standing for "O", which will correspond to the actual "work of architecture", such as houses, buildings, plazas, etc; generating an interpretant "I", which would be the sense made by the sign "S", and can create as well a new sign at the same time, another "work of architecture" standing or another the same object "O".

The vernacular design process of traditional Japanese dwellings (Fig. 2) is described straightforward using the same type of scheme, in this case referring to an object "O" corresponding to "Japanese dwelling inhabitation idea", standing for such idea is build a sign "S", which corresponds to "some Japanese house", as the vernacular process is a collective process with shared ideas about what a "Japanese dwelling" is, it can be said that the sense made by "S", can generate "another Japanese house", "I/S", which can be an improvement of "S" as interpretant (I) and also stand for "O" being a sign (S). The same continues as in the case of "I/S", "I/S" and so on in an infinite semiotic stream as shown in the scheme (Fig. 2).

Fig. 2 Semiotic stream corresponding to the vernacular process of design explained as continuous interpretations

An important consideration is that any work of architecture can be interpreted also as something else, for example as a sculpture. To avoid such situation we have to be sure that the ideas corresponding to the object are related to inhabitation

Machiya as well has been developed in a way as in Fig. 2. But also if we consider that each activity done in one Machiya or other type of building has its own semiotic stream, as in Fig. 3, then O gathers the ideas about inhabitation of Machiya or dwelling concepts of Machiya, and S1a to S1x corresponds to the spaces for activities in Machiya 1 for each activity, S2a to S2x corresponds to the spaces for activities in Machiya 2 generated by interpreting S1a to S1x and so on. But we have to consider that this (Fig. 3) is a simplified model in order to illustrate the process, because in reality each Machiya was not designed as a consequence of one single preceding Machiya, therefore the preceding signs interpreted in order to generate the spaces of one Machiya could have involved several different preceding buildings, and even include ideas not included in the dwelling concepts of Machiya (O in Fig. 3).

The present situation of Machiya is especially chaotic in such a way, as many ideas from different dwelling types are being mixed (Fig. 4), as for example modern bathrooms included in old Machiya, with western kitchens but maintaining a Japanese style tatami room with view to a Japanese garden designed according to ideas of Sukiya style and so on. But even if such mixtures may appear chaotic we can analyze such situation if we understand the semantic relation in between the ideas (O) and spaces (S) given by the context of the ideas (O): the modern elements can be understood according to their coherence to modern context obeying to modern ideals such as functionality, while in the case of traditional elements of Machiya semantic parameters will correspond to traditional aesthetic such as hare ( maxWidth), ke ( maxlen), oku ( maxlen) and so on.
In the case of this research the absolutist point of view is considered useless, as it might be potentially destructive, as for example if we consider light and bright spaces as an ideal, we can eventually destroy the emerging beauty described by Tanizaki10, 11, by instead of allowing a relative graduation of light it would be imposed only one value over the rest. Therefore the semantic parameters selected for this research will be considered as context-relative values without one positive or negative side, and separated for each activity, instead of general values for each building. In the particular case of Machiya, we have selected four semantic dimensions: formality, privacy, brightness and naturalness.

Formality is an adaption to the concepts used in the traditional space of Machiya to distinguish ordinary activities represented in space mainly by the doma, and extraordinary activities, represented mainly by tatami rooms. Elements such as doma or tatami, have a meaning according to how formal the activity realized in such space might be, and will be disposed in a formal order in Machiya, resulting as well in symbolic elements such as for example the daikokubashira5.

Privacy is an adaptation of the traditional meanings of uchi and soto, which in the case of Machiya as well had an special spatial hierarchy, where we can distinguish different degrees from the street towards the back of the Machiya, having a spatial meaning for the activities realized in the front or the back of the house11.

Brightness is related to the internal order of bright and dark inside of Machiya, and has also an important meaning for orientation, as for example in dark spaces from which inhabitants can appreciate the light received by the garden. Also it is an important topic in Japanese esthetics10.

Naturalness is related to the characteristic sense of nature present in Machiya7, 8 represented mainly by gardens, which as well have an important meaning for the activities realized in the spaces connected to the gardens, such as the zashiki.

The layout of Machiya has the particularity that it shows the main semantic parameters (formality and privacy) in an orthogonal way as in Fig. 6, where private side is towards the back, the public in the front, the informal side towards the left and the formal side towards the right, the center of such division.

2.3 Semantic Dimensions

We realize then that the dwelling concepts taken in consideration by inhabitants vary in time and context, and can be classified in two different types: the absolutist type, which is intended as ideal for everything and always, as for example the functionalism in modern architecture where nonfunctional spaces or elements such as ornaments where considered not appropriated in any case and for all activities; the other type is the context-relative type, as for example "hare" and "ke" type of gardens in traditional Japanese architecture8, 9, where the preferred type is related to the activities corresponding to each context. Note that modernists who tend to be absolutists, when coming to Japan tended to prefer only one of each pair of relative dwelling concepts, as for example the case of Bruno Taut who described the Katsura Imperial Villa as positive and the Nikko Toshogu as negative8, 10, 9, instead of interpreting them as a residence and a temple: as a related duality according to their purpose (context) (Fig. 5), where the dwelling space is to be considered restrained while the space for ceremony can be exuberant.

In Fig. 3 we can see how the dedicated concepts of Machiya splitting in two different types: the absolutist type, which is related to the activities corresponding to each context and the context-relative type, as for example the "hare" and "ke" type of gardens in traditional Japanese architecture8, 9, where the preferred type is related to the activities corresponding to each context.

In Fig. 4 we can see how the relative concepts of Machiya splitting in two different types: the absolutist type, which is related to the internal order of bright and dark inside of Machiya, and has also an important meaning for orientation, as for example in dark spaces from which inhabitants can appreciate the light received by the garden. Also it is an important topic in Japanese esthetics10.

In Fig. 5 we can see how the dwelling concepts of Machiya are classified in two different types: the absolutist type, which is related to the characteristic sense of nature present in Machiya7, 8 represented mainly by gardens, which as well have an important meaning for the activities realized in the spaces connected to the gardens, such as the zashiki.

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is symbolically represented by the Daikokubashira. Though, we added brightness and naturalness to get finer results. Note that the space inside a house such as Machiya might be considered at times completely private and completely informal. Still we can see even more evidently in Machiya the duality of semantic parameters of Japanese traditional space as Machiya can be transformed according to the occasion for different festivals, so that it becomes more exuberantly decorated during festivals.

3. Research aim

Summarizing the previous section, the traditional architecture of Machiya can be understood as composed of several activities, and the corresponding space is expressed according to semantic parameters related to each activity creating a semantic order for the activities, such as shown in Fig. 6. But Machiya in contemporary context has to deal with new semantic parameters, where different values are being considered as “correct” or “incorrect” and influence of other inhabitation ideas (Fig. 4). Therefore it is important to answer several questions such as:

1. Can contemporary inhabitants recognize the semantic order of Machiya?
2. Would contemporary people really like to live in Machiya?
3. How can we extend Machiya in contemporary context?

The aim of this research is to deal with such questions. The preliminary hypothesis suggests that to certain degree the answer of question 1 might be true, but as for question 2 the expectation might be different, therefore even if Machiya are currently popular the answer to this question is less optimistic, but it might be possible to find answers to question 3 using an approach based on inhabitation with the current semiotic framework, because using it we should be able to find a link with Machiya recognized by contemporary inhabitants, leaving open possibilities to include contemporary values. As well this approach does not depend on formalistic imitations, such as the ones that can be seen in some modern buildings in Kyoto, with “fake” Machiya styles, and on the other hand might not depend on the material expenses associated to formal imitations.

4. Research method

The data collection is done with a written questionnaire in paper and online format sent to random inhabitants mainly in Kyoto, we received 215 answer sheets (134 in paper, 81 online) with less than 10% of missing data for each question; however, in the case of missing data we did not include them in the analysis. The distribution of the answers according to gender is as follows: 113 male, 100 female, 2 did not specify. According to age the distribution is the following: from 0-29: 72; from 30 to 39: 49; from 40 to 49: 16; from 50 to 59: 15; from 60 to 69: 36; 70 and over: 24; and 3 did not specify age. According to nationality 172 are Japanese, 40 non Japanese and 3 did not specify.

The questionnaire has 13 questions:

1- Which type of dwelling the person lives in (Machiya, other type of house or row house, apartment building or others), if the person is owner or is borrowing/renting the dwelling, and what dwelling he would prefer to live in.
2- The number and type of rooms in the dwelling and the preference among them.
3- Indicate if the laundry space is inside the dwelling, in a common area of the building or outside of the building.
4- Indicate the existing and preferred views from the dwelling.
5- Indicate the preference among pairs of items (futon or bed, tatami or flooring, unit bath or separated toilet and bath, balcony or garden).
6- To rate Machiya elements according to its importance for the urban context.
7- Personal information such as gender, age, type of occupation, type of family constitution, number of people living in the same household, nationality and location of the dwelling (Fig. 4).
8- Indicate the use or intention to use of the dwelling in activities such as Gion festival, Hina Matsuri, Byobu Matsuri, or others.
9- Indicate the presence or intention to use in the dwelling elements such as tokonoma, butsudan, ojisan, or other.
10- To rate 13 activities (entering, breakfast, lunch, dinner, cooking, sleeping, washing (shower), bathing, clothes washing, clothes drying, leisure, informal-private, formal-private, formal-public, informal-public).
12-study/reading and 13-work): for each activity it is rated its *formality, privacy, brightness, naturalness*, and additionally the suitability of the space for such activity using a scale of 5 different levels according to their existing dwelling.

11- To rate the same activities as in question 10 again for *formality, privacy, brightness and naturalness* but this time according to their preference, and additionally mentioning other activities they would like to do in their dwellings.

12- Indicate the existing views from each of the 13 activities selecting garden, other than garden or no view outside.

13- Indicate the preferred view for each activity as well selecting from garden, other than garden or no view outside.

The data used for the current paper focuses mainly on questions 1, 10 and 11. *Formality, privacy, brightness and naturalness* are the semantic parameters used in the research collected in questions 10 (current situation) and 11 (expected preference), while question 1 links the data from question 10 and 11 to the dwelling typologies including Machiya. The data analysis is done using a database where all received answers are collected sorted and processed. Additionally it is used data mining software KNIME[^10] in order to make graphs and clustering analysis.

5. Semantic order of Machiya

Can contemporary inhabitants recognize the semantic order of Machiya?

As the interpretation of architecture can be complex, and may mix many tendencies as in Fig. 4, and as well some people might not necessarily agree if certain building is or not a Machiya, it is used the data gathered from the inhabitation questionnaire where each inhabitant answers according to his own believe, and is grouped into the following building types used hereinafter:

1. **Machiya**: Machiya including Nagaya.
2. **“House”**: houses and row houses which are not Machiya.
3. **“Other (buildings)”:** including other building types mainly apartment buildings and collective dwellings.

The results are then plotted in graphs representing semantic space where the four semantic dimensions are represented in the following way: Axis X (horizontal) indicates average *formality*, axis Y (vertical) indicates average *privacy*, and the shade of the bubbles indicates average *brightness* (dark = dark, light = bright) and the size of the bubbles indicates average *naturalness* (bigger = more *naturalness*). The data scale is from 1 to 5 as in the questionnaire, which avoids distortion from scattered data when averages are used[^10]. Semantic graph is for referential comparison: more accurate depiction of values shown in other graphs as in Fig. 11-13.

We can then divide the graphs of Fig. 7 into 4 quarters, corresponding to “formal-private”, “informal-private”, “formal-public” and “informal-public” (Fig. 8[^10]).

![Fig. 7](image7.png)

**Fig. 7** Axis X (horizontal) indicates average for *formality*, axis Y (vertical) average *privacy*, the shade of the bubbles indicates average *brightness* (dark = dark, light = bright) and the size of the bubbles indicates average *naturalness* (bigger = more *naturalness*).

![Fig. 8](image8.png)

**Fig. 8** Graph corresponding to Machiya (same as in Fig. 7) divided into semantic quarters as the Machiya layout in Fig. 6.
We can notice in Fig. 8 that the informal-public quarter is empty, but the closest activities in the adjacent quarters are cooking and entering. Also we can notice that entering is the most informal of the public activities (on the left of work): bathing and shower are in the back towards the informal-private; also within the same informal-private quarter we can find sleeping, clothes washing, clothes drying and cooking; in the formal-private quarter we can find study/reading, dinner, lunch, breakfast and leisure towards the public side: and in the public-formal quarter we find work and entering. This is consistent with a Machiya layout, as we can see if we compare it with Fig. 6 (sleeping would be in the second floor and entering is next to the informal public quarter). Note that the tooriniwa is one of the most relevant elements in Machiya layout, since Machiya is the only typology where cooking is located clearly on the left side of eating activities (breakfast, lunch and dinner) in the semantic graphs (Fig. 7), while in “Houses” breakfast has almost the same formality as cooking, and “Other buildings” have eating activities on the right side of cooking.

Another important point we see in Machiya is that work is much closer to the rest of the activities in the semantic graphs (Fig. 7), and is closest to entering.

In the case of Machiya, the central point will correspond symbolically to the daikokubashira, in this case it is symbolically marked a division into the four semantic quarters in Fig. 8 as in Fig. 6, in order to make a comparison of both and in such way we could approximately map a Machiya layout over the graph in Fig. 8 using such symbolic division as reference. But as this correspondence (between Fig. 6 and Fig. 8) appeared by plotting the data from those who answered the questionnaire we conclude that inhabitants could recognize the semantic order of Machiya and differentiate it from the other typologies (even if the inhabitants who answered were not necessarily aware of doing so).

6. Machiya compared with contemporary expectations

Would contemporary people really like to live in Machiya?

In order to answer this question the results of question 11 will be used, combined with the answers of question 1 (see section 4 “research method”). If we look at Fig. 9 we can see that only a small percent of the inhabitants live in Machiya\(^{13, 12}\) and the percentage is even lower for younger inhabitants, but still almost a 40% of the any age group answered to be willing to live in Machiya, nevertheless “Houses” (other than Machiya) is still first preference. But if we gather the data of all those who answered that they would like to live in Machiya, and make a semantic graph with the information they answered in question 11 about their preferences of semantic dimensions, so we make the semantic graph of their expectations (Fig. 10), with data of what we call “Machiya as expected”.

We notice several differences between the real Machiya (Fig. 7 or 8) and the “Machiya as expected” (Fig. 10). Looking at the results from people who answered that they want to live in Machiya (Fig. 10), it is apparent that they are not aware of the semantic order of Machiya or simply they do not really want to live in Machiya.

We see that the formality of the Machiya as expected is more similar to “Houses” and “Other buildings” than Machiya (Fig. 7 and 10), as the eating activities (breakfast, lunch, dinner) are on the left of the washing, and cooking activities (which in Machiya (Fig. 7 or 8) are on the left of eating activities, in the tooriniwa). On the other hand the expectation for naturalness is relatively high and when compared to other dwelling types Machiya indeed tend to be perceived as more “natural”.

To explain better such incongruence we consider the formality graph (Fig. 11). We can notice that each dwelling type has certain influence in the expectation of the inhabitants of each dwelling type. This means that for example in the case of bathing in Fig. 11, inhabitants of “Houses” perceive a low formality for such activity, and keep the expected formality as well low, while inhabitants in Machiya perceive bathing as more formal and as well expect a higher level of formality for bathing, but neither inhabitants of “Houses” nor Machiya inhabitants consider bathing as formal as inhabitants of “Other buildings”, which as
well expect that the formality for bathing will be among the most formal activities. This means that in part the great difference in formality expected by many of the inhabitants who chose Machiya as their preference and the formality perceived by inhabitants really living in Machiya is because many of those who choose Machiya are currently living in other dwelling types and are unaware on how much their current dwelling is affecting their choice of semantic dimensions.

We can see as well reflected this incongruence of inhabitants preferring Machiya and having semantic preferences different from Machiya as we include data of age. Older inhabitants live more in natural Machiya and also consistently expect more naturalness (Fig. 12), while younger people mainly living in less natural apartment buildings, expect less naturalness, especially for washing (shower), bathing and clothes washing, which are activities radically modernized in modern buildings if compared to Machiya.

The data explained in the previous two paragraphs indicates that the current context of the people answering the questionnaire has a strong influence, as it is a semiotic stream (Fig. 3 and 4) in which a certain design (building) is situated, affected by a past experience and as well can affect future expectations as described in section 2.2.

If we include the data corresponding to the evaluation each inhabitant did about the suitability of their living space for each activity, (Fig. 13) we notice that Machiya still tend to be considered quite suitable, but less when compared to “Houses” in some points. Indicating that even if expectations of inhabitants choosing Machiya are different from real Machiya, their suitability tend to be good, and therefore Machiya might be successful in contemporary context but with some changes.

Finally answering the question if contemporary people would like to live in Machiya, we could say that even considering that an important percentage of inhabitants choose Machiya as their preference, the current context of the people who choose is more relevant, and they may in fact prefer something different as what a real Machiya is being perceived. Therefore those who answered Machiya might only successfully live in Machiya if they are willing to adapt to something different than expected or the Machiya is modified according to their expectations as in Fig. 10.

7. Machiya in contemporary context
How to extend Machiya in contemporary context?
Considering the expectation of inhabitants, the first point we would mention regarding the high levels of naturalness are the gardens. The 96% of inhabitants answer that they prefer a garden or view to a garden from their dwelling, also from the 205 people who answered question 5 about preference among balconies and gardens, 140 people preferred gardens, only 18 preferred balconies and 47 answered to like equally gardens or balconies. As for the views (questions 12 and 13), in Fig. 14 we see that the existing views are dominated by “other view than garden”, while the preferences are dominated by gardens. This shows a great opportunity for designing houses and as well apartment buildings or others with more gardens instead of balconies.

In the case of Machiya the gardens are particularly important under these circumstances, and as well can be reflected in the high level of naturalness (as can be told from data of question 10 of the questionnaire, especially for breakfast, lunch, dinner, study/reading or sleeping when compared to other dwelling types (wider bubbles in Machiya than other types in Fig. 7)). Gardens
and naturalness are a big opportunity for Machiya, even more considering nowadays environmental concerns. Moreover only 1% of those who preferred more naturalness than they had in their existing dwelling did not prefer a garden or garden view.

A more complicated issue happens with the layout of Machiya. Even if we notice that there is a correspondence of the semantic space recognized by inhabitants of existing Machiya and the layout of traditional Machiya (Fig. 8 and 6), we also notice that the structure of an informal tooriniwa (towards the left of the semantic graph in Fig. 8) where activities such as cooking, washing, bathing and clothes washing are located is the opposite of the expected Machiya (Fig. 10), and as well opposite as in other typologies (Fig. 7). Thus we find an expected and a perceived pattern and we can focus on both in order to develop new designs.

Fig. 15 Dendrograms, corresponding to cluster analysis of building types applied to the semantic dimensions data. Scales on the left indicate distance (Manhattan distance function).

If we compare the “Machiya as expected” and “Machiya” using this analysis, we find new patterns as well as the following similarities and differences (Fig. 15):

We notice for example about the activities breakfast, lunch and dinner that in “Machiya” they are grouped next to leisure and next to leisure is clothes drying. In the case of “Machiya as expected” breakfast, lunch and dinner is next to clothes drying as in “Other”, while leisure is grouped with entering. Also in both, “Machiya as expected” and “Other” such activities are on the informal side, showing certain influence of the “Other” type in the expectation of inhabitants who chose Machiya.

On the other hand we found some similarities between “Machiya” and “Machiya as expected” as both have a similar cluster composed of washing (shower), bathing, clothes washing, cooking and study/reading. But even if such grouping does not appear in the dendrograms of the other typologies, and such cluster contains mainly activities related to the tooriniwa, in the case of “Machiya as expected” this cluster would be private formal (Fig. 8), while in “Machiya” it would be a private cluster, less formal and also with a lack of naturalness (Fig. 8). If similar clusters appear but with a difference in semantic definition, we recognize a semantic shift of such activities, which means that the space(s) for such activities is changing its meaning.

According to these findings, if we would try to transform an existing Machiya into the expected type we would need to re-structure part of the central area of Machiya, mainly affecting the semantic relation of the tooriniwa and the eating room.
Using semantic dimensions we can approach the design problem of new types of Machiya very freely. We can focus on Machiya according to new expectations or focus on how actual Machiya are being perceived: in fact, we could eventually design new types of “Other buildings” based on the gathered data by integrating new garden systems instead of conventional balconies and changing the internal semantic order of such buildings. On the other hand, we could transform existing Machiya and organize the internal space as described before.

Apart from cluster analysis we can use many more methods to find new spatial organization. As for the number of semantic units, we can consider fewer semantic units (less clusters) for tighter spaces or more semantic units (more clusters) for larger dwellings. Also we can complement the process with other technologies and even incorporate different design methods into this framework.

As for the exterior of Machiya and the relation with the streetscapes, we have done previous research focused on such issue also verifying the importance of inhabitation systems and not emphasizing formal expression.

8. Conclusions

We could recognize underlying structures in the arrangement of the activities in different dwelling typologies. In this case using only four semantic dimensions: “formality”, “privacy”, “brightness” and “naturalness” we distinguished Machiya from other typologies.

Contemporary inhabitants can recognize the semantic structure of Machiya, but are not necessarily aware of such situation, as the expectation of those who say that they would like to live in Machiya is quite different as the existing Machiya. Moreover we could find that there is a recognizable influence of the existing context in the preferences of the inhabitants. The semiotic stream in which a certain design (building) is situated is affected by a past experience and as well can change future expectations: therefore it is important to consider such semiotic stream as part of the design process, in a way as it was related to the vernacular design process as well (see section 2.2). *14, 15.

The semantic dimensions can be recognized in existing buildings as well as projected into expected buildings. Additionally it is possible to track down influences of existing contexts and the expected ones, therefore the semantic dimensions are able to construct a bridge between changing contexts: we can analyze and compare present spaces with future expectations and past using the same semantic dimensions.

We can find opportunities for Machiya in the contemporary context mainly focusing on its naturalness.

On the other hand we might need to establish a new order of formality for new expected Machiya types. Considering such aspects one of the most affected elements of Machiya will be the tooriniwa and the activities done in such space, so we can find new ways for designing such spaces.*17, 18.

As the semantic dimensions are underlying structures of the space of the activities done in the different dwelling typologies, the data obtained from such analysis is very versatile as underlying structures do not depend on superficial details.

Considering design problems that can be seen in Kyoto, such as Machiya reformed as conventional modern houses, or buildings imitating Machiya, the semantic dimensions offer new alternatives which can be used for creating internal layouts of new Machiya adapting them to new contexts without need to use conventional designs, and on the other hand can be used to change internally new buildings in order to adapt to Machiya context.

In further research it should be considered to focus on specific case studies, in order to appreciate the effect and influences of semantic dimensions more in detail. Also more detailed study should cover the relation among different inhabitants as well as guests and residing inhabitants.

Acknowledgements

We would to thank to all who answered the questionnaire. Also we would like to thank to those who helped voluntarily to distribute the questionnaire, Ms. A. Nishii, Ms. M. Kimura, Mr. H. Konishi Mr. R. Kinoshita, Mr. D. Ilnazov, Mr. A. Nahmias and Mr. M. Mora.

This research is supported by Grant-in-Aid for scientific research (B): “Semiotic Study on Townscape Design based on Community Governance” (Leader: Teruyuki Monnai), by Japan Society for the Promotion of Science (JSPS).

Notes

*1) Inhabitation would be in this case essence of architecture, as such in the case of “wohnen”(dwelling) related to “bauen” (building) by Heidegger, but in the case of this research in the context of Peircean semiosis.

*2) According to 日本の民家 (今 和次郎, 1989) it is possible to recognize elements such as earthen floors and raised floors in different Japanese building types. As well it is explained that such elements got introduced in townhouses. Such process is based on the idea that underlying ideas could be passed over from buildings to buildings.

*3) In the case of Study on Japanese Traditional Living Space and Landscaping several examples of “hare”, “ke” and “suki” type of gardens are being analyzed in Machiya case studies. “Ke” is associated with domestic purpose, “hare” with ceremonial purpose or formal gardens, while “suki” is being related to aesthetical designed gardens related to sukiya style.
*4) Bruno Taut in his text *Fundamentals of Japanese Architecture*, describes modern architecture in Japan as “quality” influenced by Katsura Imperial Villa and “kitsch” influenced by Nikko Toshogu. His conception is highly biased by his own theory, so that he considers one as good (Katsura), and the other rather negative (Nikko). According to Ponciroli, Taut did indeed recognize certain dependence of context in Katsura Imperial Villa as “a refined life style that transcended the mere principle of utility” (Ponciroli, 2005, page 319). He indeed describes a dimensional dimension, but rather as spiritual instead of exuberant, somehow his theoretical frame was closed to accept anything outside restrained and simple architecture devoid of exuberant ornament. Moreover Walter Gropius, after Taut, also saw Katsura and Nikko as positive and negative, and he, even more framed than Taut, considered that some of the ornament in Katsura that Taut accepted as functional was in effect formal weakness (Ponciroli, 2005, page 328). As we can see in such case, the tendency to become absolutists of the modern architects played an unfavorable role in the interpretation of Architecture as positions can become more and more limited. But still everyone has its own limited frames.

*5) In the essay *In Praise of Shadows*, it is described how the darkness inside traditional Japanese dwellings is used esthetically, but in such case it does not consist in an argument for establishing a determined value for light, but rather to appreciate the subtle shades that can be found in the Japanese dwellings, as result of the shade built for the hot summers. The context of the shadows and the relation with the elements and people present in such shaded places is an important issue in such essay.

*6) The Daikokubashira is a column present in Machiya and other traditional Japanese dwellings. It is considered the most important and large column and is located usually in between the earthen floor doma and the raised living rooms. It has symbolic meaning and in fact, during the research it was common that the inhabitants of visited Machiya showed such column to us.

*7) See 京町家まちづくり調査, answers to question 8.

*8) Missing data in the case of correlations is treated with listwise deletion. In such case the missing data still affect less than 10% (e.g., the graph of Fig. 9). However in the case of independent variables pairwise deletion is used to keep the maximum sample number.

*9) This research is focused on the semantic dimensions to compare dwelling typologies in the current context; therefore general activities of the contemporary context are used. The list of activities is based on 国民生活時間 1990, with some changes, focusing more on spaces within a dwelling.

*10) KNIME is an open-source platform for data mining, initially developed at the University of Konstanz, Germany.

*11) The data in semantic graphs is shown using x axis, y axis, bubble size and grayscale shades for visually comparing data at a glance, for more accurate representations of values, other representations are used.

*12) We experimented with average values and plotting individual data, as we use discreet data, averages showed to effectively represent the general tendency for each activity.

*13) Machiya, according to the framework of this research (see sections 1 and 2 of this paper) is defined by the interpretation of the inhabitant: therefore the numbers of Machiya will correspond to the numbers identified by those who answer the questionnaire. It will depend on the answers of the inhabitants to define what a Machiya is and how many Machiya exist. By consulting results of other research where the researchers used their own definition of Machiya in order to determine the number of Machiya, as for example 京町家まちづくり調査, we may notice that only a reduced number of inhabitants do recognize their own house as Machiya, but there are many more houses that some researchers consider as Machiya.

*14) Manhattan distance is used because all dimensions are considered as independent, thus absolute difference is being calculated.

*15) In the conclusion of *Architecture in context*, it is suggested that the architect’s ego is one of the obstacles in designing visual continuous architecture (referring to visual context in such case, while this research focuses on inhabitation context), pointing out that it is a modern tendency to think that creativity of architects has to stand out from the rest and that similarity is something negative, but it is not necessarily the case. Once again, considering architecture as semiotic stream we can understand that architecture deals more with collaboration in between systems than with personal reaffirmation. Moreover architecture is a collective creation as the context always belongs in part to each work of architecture and vice versa, and as explained by Ford we are never in the beginning of the semiotic stream.

*16) If applied to Christopher Alexander’s unselfconscious and selfconscious design processes, the semiotic streams would help to link the unselfconscious vernacular process with the contemporary context.

17) The renovation of the tooriniwa is a common issue in Machiya, for examples we can see cases in 「京町家の改修」～住み続けるために～.

References

2) Shepard, Paul: *What is architecture?: an essay on landscapes, buildings, and machines*, 1994
4) Merrel, Floyd: *Semiosis in the Postmodern Age*, Purdue University Press, 1995
6) 今 和次郎: 日本の民家, 岩波書店, 1989
9) Ponciroli, Virginia (eds.): *Katsura Imperial Villa*, Electa Architecture, 2005
11) Löfgren, Karin: *Machiya, architecture and history of the Kyoto townhouse*, doctor dissertation of KTH Royal Institute of Technology, 2005
12) 京都市: 京町家まちづくり調査 (平成20-21年度), 2011
13) NHK 世論調査部: 国民日本人生活時間 1990, 日本放送出版協会, 1992
16) 京都市景観・まちづくりセンター編: なるほど！「京町家の改修」～住み続けるために～, 京都市景観・まちづくりセンター, 2003

Image sources

Fig.1, 2, 3, and 4 by author.
Fig. 5 left picture by Ishimoto Yasuhiro http://www.kunstpedia.com/blogs/katsura-imperial-villa---photographs-by-‘ishimotoyo-yasuhiro.html
Fig. 5 right picture from http://jim.jic.or.jp/en/travel/heritage/nikko/nikkotoshugou_1_m.jpg (original image is in color)
Fig. 6 from Reference number 11, (il. 237).
Fig. 7, 8 and 10 by author using KNIME. Fig. 9, 11, 12 and 13 by author using Microsoft Excel. Table 1, by author using Microsoft Excel.
和文要約

本論文の目的は、3次元空間の構文論的次元の代わりに、居住者的生活行動から得られる意味論的次元を用いて、町家の建築空間を記述することである。すなわち、現実の空間内での居住者に注目することによって、空間と意味との関係を解明することを目指す。居住者は空間の意味を理解すること（解釈）に基づいているがゆえに、空間が意味に関連づけられる意味論的次元に対応する指標を使用することができるからである。

意味論的分析のために、我々はまず表一の観点、ハーキー、内一外という伝統的概念から導き出された意味論的指標を用いて町家を記述する。そこでは「形式性」（formality）と「プライバシー」（privacy）という2つの重要な意味論的次元が導き出される。次いで、「明白さ」と「自然性」という2つの意味論的次元が導入される。これらの次元は、町家における奥庭や坪庭、及び光と影という美学的含意に応ずる。

そこで我々は、これらの4つの意味論的次元を踏まえて、13の生活行動（1-玄関）から、2-朝食をとる、3-洗面をとる、4-洗濯をとる、5-調理をする、6-睡眠をとる、7-身体を洗う（シャワーをする）、8-入浴、9-衣類を洗濯する、10-衣類を取る、11-食事をする、12-勉強する／読書する、13-仕事をする）について居住者に質問し、回答を得た。このとき、意味論的次元に関する現状だけでなく、好みとともに、望ましい居住条件についても尋ねた。

データの集計においては、町家、町家以外の戸建てで低層住宅、高層集合住宅といった居住条件を考慮し、居住者を受けた。各生活行動について意味論的次元の平均値を算出した。その結果、居住条件別に13の生活行動をプロットしたグラフを得た。X軸（水平軸）は「形式性」を、Y軸（垂直軸）は「プライバシー」を示す。各生活行動を示す円の色は「明るさ」（暗い円=暗さ、明るい円=明るさ）、円のサイズは「自然性」を示す（大きいほど自然性が高い）。これらのグラフを比較することによって、それぞれの居住条件を意味論的に比較することができる。

我々は次の問題に焦点を結ぶ。

1）現代の居住者は、町家の意味論的秩序を認識しているか？
2）現代人は町家の居住することを本当に好んでいるか？
3）町家は現代のコンテクストにおいてどのように振る舞えるか

第1の問題に答えるためには、現代の居住者の生活行動パターンが町家の空間的秩序に対応しているかどうかを調べる必要がある。主要な意味論的秩序（「形式性」と「プライバシー」）を把握するために、奥側のプライベートな部分、通路側のパブリックな部分、通路側のイマージュな部分、座敷側のフォーマルな部分からなる町家レイアウト化の特性を利用する。このレイアウトにかかって、生活行動がフォーマルかイマージュか、プライベートかパブリックか評価することができる。

第2の質問については、我々は町家に住みたいと言って居住者の好みに関する意味論的データを集めており、そのデータに基づいてもう一つの意味論的グラフを作成している。

町家に住みたい人々の数が多いとしても、居住者の好みを示す意味論的グラフは町家とは全く異なることにあると考えるべきである。居住条件に見ると、好みが既存の条件と類似する傾向があることがわかる。既存の条件が好みに影響を及ぼしているのである。

現代人が町家に住みたいかどうかという質問に回答すると、多くの人々が好みとして町家を選ぶとしても、彼らの現在のコンテクストが影響している以上、本当に町家に住みたいかどうかは必ずしもよく分からない点がある。

第3の質問に答えるためには、町家の中にある付加的な質問の結果を導入し、居住者条件別に意味論的データのクラスター分析を行う。我々は町家における重要な役割を果たしており、自然性と高い関係を有していることを発見できる。「自然性」は町家の意味論的記述と町家に住みたいと言われる人々の好みの中の共通要因の一つである。町家は新しいタイプの町家をデザインする機会となる。クラスター分析から興味深い生活行動の意味論的グループを発見でき、それは新しいデザインの可能性を指し示している。

結論

異なる居住条件における生活行動の組合せの中に、潜在的な構造を認識することができる。本研究では、「形式性」「プライバシー」「明るさ」「自然性」という4つの意味論的次元をとることによって、町家とその他の居住条件を区別することができた。

現代の居住者、町家の意味論的構造を認識できるが、彼らが必ずしもそのような状況に気づくことは限らない。居住者の好みにおいて、既存のコンテクストが大きな影響を及ぼすことも明らかにすることがある。特定のデザイン（建物）の解釈は、過去の経験の影響を受けており、同時に未来の期待を変えることもできる。それゆえ、デザインプロセスにおいて、こうした意味論的な流れを考慮することが重要である。これはファクティカルな建築のデザインプロセスとも関連している。

意味論的次元は既存の建物だけでなく、期待される未来の建物にも反映される。それゆえ、意味論的次元は変化するコンテクストを架橋する機械となる。既存のコンテクストと期待されるコンテクストの間の関係を理解することが重要である。我々は意味論的次元を用いて、現在を未来や過去と比較し分析することができます。

我々は、「自然性」を焦点に結ぶことによって、現代のコンテクストにおける町家の可能性を発見する機会を得る。他方、期待される町家条件の「形式性」の新しい秩序を確立する必要がある。

こうした側面を考え入れると、町家の影響を最も受ける要素は通りと庭のように行われる生活行動であろう。我々はそこから新たな空間をデザインする方法を発見することができるはずである。

現代住宅としてリフォームされた町家、あるいは町家を模倣した建物、京都に見られる様々なデザインを検討するとみ、伝統的デザインを使用する必要のない新たなコンテクストに対して意味論的次元を適用することによって、新しい町家のレイアウトを含む代替案を導き出すことができるし、他方で、町家コンテクストに適応するように、建物内部を変更することも可能である。

以上のことから、本論文は現代のコンテクストにおける町家の新しいデザインの可能性を探究したものである。

(2012年6月8日受稿受理、2012年12月3日採用決定)