SPACE ADJACENCY BEHAVIOR IN SPACE PLANNING

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Abstract. Digitally supported space-planning techniques have been researched and developed for decades. By processing space adjacency data with existing space-planning techniques, an objective space relationship diagram or schematic layout can be produced. These results represent the functional aspect of each project, which can be used as a reference for further design development. With these results, designers can enhance plan layouts with the preferences established by their client or themselves, as well as design styles. In this research, the author proposes a new method of applying personal preference to modify the objective layout, which imitates human interacting behavior as space organizing categories, Space Character.

1. Introduction

Digitally supported space-planning techniques have been researched and proposed to help architects visualize the space relationship in a two-dimensional space diagram based on space adjacency data collected during the architectural programming process. The space diagrams that are produced by these programs represent an objective space layout based on functional issues. The author researched many of the space-planning programs and discovered that most of the space-planning programs focus on optimizing the space-layout by gathering and calculating different types of datum that related to human activities and values (Hsu, 2003). This research and the results demonstrate valuable documentaries for architect’s references and allow the architect to proceed in further design; with possible improvement that combine subjective design modification can be developed. The following section shows the method that the author merges a personal alternative option into a space-planning program.
2. Integrating Personal Preferences

With the objective results produced by a space-planning program, designers can enhance plan layouts with the preferences established by their client or themselves, as well as, design styles. During this process, minor or even major alterations of the space layout by the designer may occur based on the preferences of certain space adjacencies or a particular architectural concept.

During the phase of altering the layout, designers can express their ideas based on different observations of the project. By combining the preference with the basic space-planning techniques, three common considerations may be addressed:

1. Personal preference: This includes preferences that vary from client-to-client, which can be a very subjective opinion on the space arrangement. Once this parameter is considered, the spaces will be given an additional character, which is integrated with the original space adjacency values to enable the space-planning program to fine-tune the layout. For example, in hospital design, architect might suggest that hospital management department should be located on the top floor with other departments according to objective data or architect’s experience. However, with a different management strategy or expansion consideration, the client may prefer to relocate hospital management department to other building. This decision is probably not an optimal option in architecture sense, but it will benefit the client in management issue or other client’s concerns.

2. Designer preference: With different styles and goals of design in a project, a designer’s preferences plays a very important role in architectural design. This part contains the input that is capable of introducing different styles of space layout that represent designer’s preferences. Because of the great differences of concepts, these new parameters will control the space arrangement and reorganize the space layout. In other word, designer can ask to relocate space A and B to a certain position or put A and B together, the program will automatically rearrange the other spaces that related to A or B and produce a new layout. For example, exhibition rooms can be arranged differently for a museum depends on designer’s style, or different concepts base on different theme. Sometime the exhibition rooms can group together for a big exhibition area, or they can be located in different floors for showing variety of exhibition topic. With these situations, other spaces, such as storage space and reception area, that related to the exhibition room will be adjusted to fit the new arrangement.

3. Environmental conditions: By recognizing the site, the plan is built with the consideration of environmental conditions and concepts introduced by the designer. These environmental issues and concepts offer the program a different level of space arrangement rules and able to make the program
produce layouts that represent these concerns. For example, considering the natural condition of the site, different concepts can be applied to the site planning. If the site is along a coastal area and client or designer may want to build a project along the coastline; or client and designer may prefer to arrange spaces in a certain shape according to management issue or esthetic opinion. The designer can give the spaces a new parameter that relates to the special shape of the site environment and generate a new space layout that follows that shape.

With these different approaches to the concept of preferences, designers may rearrange the spaces according to certain ideas or rules. By these rules, the spaces are gathered, divided, or placed at a certain location because of certain functional, environmental or form issues (Figure 1.) (White, 1986). Although the design aspects and styles vary, certain rearranging behaviors can be found in these modification activities of spaces. By observing these behaviors, it can be categorized by intimating humans interacting behaviors, as proposed to be a “Spatial Character”.

Figure 1. Two examples of grouping spaces in sketch space diagram
3. Spatial Character

Every human being has a different personality that consists of one or more characteristics. Their personality reacts differently in different environments or with different people. Consider a space as a person. Every space has its own personality with several spatial characters that differ by project. These characters cause the space to interact with other spaces in certain manner. These characteristics can be categorized as seven expressions of human behaviors, which divided to two sub-categories of inner space interactions and environmental conditions.

3.1. INNER SPACE INTERACTIONS

In this category, the space characters show different behaviors that interact with other spaces, which includes Leading / Following, Grouping, Loner, and Servant.

1. Leading / Following: A person with leader quality attracts people to follow. As the term, the space with a “Leading” character gathers spaces that relate to it (following) and forms a group. The “Following” space only follows the space with “Leading” character; there is no relationship between following spaces. (Figure 2a.) As in an architectural firm, for example, the relationship between principle’s office and design studio could be leading-following relationship (Table 1.). Design studios are responsible for different projects follow their own principle or manager. However, the principle’s office or manager’s office does not always play the leading role, this depends on different projects or different designer’s concept. As in a bank, a waiting area could play a leading character that is followed by ATM area, tellers, and a personal banking area.

![Leading and following](image1)

![Grouping](image2)

Figure 2. Spatial character diagram of Leading, Following and Grouping

2. Grouping: People gather for a certain purpose, same objective, interest or goal. By imitating this characteristic, the spaces that carry the same “Grouping” character gather as a group. (Figure 2b.) These spaces are
related to each other. Using the previous example, the architectural firm, design studios prefer to be together for project discussion, as well as, with the staff conference room. (Table 1.)

3. Loner: This character affects the space distance from groups for a person who prefers more privacy and avoids social conversations and stays away from a crowd. (Figure 3a.) In a residential project, some clients prefer more privacy for their master bedroom. In this case, the Loner can be a proper character to keep a distance away from certain spaces; the living room, dining room, or even other bedrooms. (Table 1.)

![3a. Loner](image1)

![3b. Servant](image2)

3.2. ENVIRONMENTAL CONDITIONS

In addition to space relationships, environmental conditions have a major impact on an architect’s decision during the decision-making process of design. Different environmental conditions provide numerous requirements, as do a variety of different concepts that designer wishes to investigate. The space characters Watcher, Outreaching and Worker can help a designer to emphasize the relationship of individual spaces and environment.

1. Watcher: This character causes a space to locate beside the boundary of the project for attractions in the environments. It is based on the human nature that people like to watch or close to certain incidents. The attractions can be different type of environmental conditions, like views, parks, lakes, or parking. (Figure 4a.) This character is useful for many different spaces in design projects, for example, the principle’s office, a waiting space, a dining space or a café. (Table 1)
2. Outreaching: The space with this character locates near the entrance or corridor for meeting or activities that relate to outreaching. This type of space represents an outgoing or sociable behavior like human that can represent a welcome space or a gathering space for a building. (Figure 4b.) For example, a living room for residential unit, a lobby for office building, or a waiting area for a bank. (Table 1.)

3. Worker: A space that offers supplies to other spaces. It is not necessary for the space with this character to be adjacent to other spaces, but it needs to be near to a second entrance or service entrance. The concept imitates the rule of separate entrance and activity area for workers and customers. (Figure 5.) The difference between Servant and Worker is that the Servant does not need to adjacent to any entrance. A service area usually has a Worker character in several building type, as a loading dock area, a mechanical room, or a janitor room. (Table 1.)

Generally, each designer has a different set of idea for each project, or the same project but different goals. For this variety, spatial characters can be very different even for the same space type. The following concerns can be a reference that how to address the spatial character to spaces. (White, 1986)

1) Similarity of general role: Leading / Following, Grouping
2) Relatedness to department, goal and system: Leading / Following
(3) Required environment: Outreaching, Watcher, Worker
(4) Effect produced: Servant, Worker
(5) Frequency of activity occurrence: Grouping
(6) Duration of activities: Grouping
(7) Privacy: Loner

These references help architects understand more about the behavior of each space character; moreover, Table 1 shows the possible space selection according to behaviors of each spatial character. Based on different design issues, functional considerations and a designer’s style, different characters could be applied to every space. The suggestion list in Table 1 tends to give designer better understanding of how spatial character works.

Table 1. Possible spatial character suggestions for different building type

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Architectural Firm</th>
<th>Bank</th>
<th>Theater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading</td>
<td>living room</td>
<td>principle’s office</td>
<td>waiting space</td>
<td>lobby, theater space</td>
</tr>
<tr>
<td>Following</td>
<td>dining room</td>
<td>design studio, secretary office</td>
<td>tellers, ATM, personal banking</td>
<td>vestibule, coat closet, café, restroom,</td>
</tr>
<tr>
<td>Grouping</td>
<td>bedroom</td>
<td>design studio, computer room, staff conference room</td>
<td>teller’s office personal banking</td>
<td>galleries</td>
</tr>
<tr>
<td>Loner</td>
<td>master bedroom</td>
<td>storage room, files room</td>
<td>manager’s office, vault</td>
<td></td>
</tr>
<tr>
<td>Watcher</td>
<td>living room, bedroom, master bedroom</td>
<td>principle’s office</td>
<td>waiting space, manager’s office, lunch room</td>
<td>café</td>
</tr>
<tr>
<td>Outreaching</td>
<td>living room</td>
<td>lobby, client conference room</td>
<td>waiting space, ATM, community room</td>
<td>ticket vestibule, lobby</td>
</tr>
<tr>
<td>Servant</td>
<td>bathroom</td>
<td>restroom, lounge, material/sample room, print/work room, library</td>
<td>restroom, training room, conference room, lunch room,</td>
<td>restroom, coat closet, backstage, dressing room</td>
</tr>
<tr>
<td>Worker</td>
<td>kitchen</td>
<td>mechanical room, garage, service area</td>
<td>storage, janitorial, data / telecom room</td>
<td>supply storage, mechanical room, loading</td>
</tr>
</tbody>
</table>
Figure 6 displays a complete space diagram that includes the selections of spatial characters in an architectural firm. In the diagram, the two principles’ offices are followed by different design studios and a secretary office. Also, spaces with different Grouping character clustered into different groups, which shows Group 1 (Gr1) as design studio, staff conference room, and computer room; Group 2 (Gr2) as material and sample room, storage room, and service area. The diagram demonstrates that each character can carry different symbol (or number) to separate from the space with same character but gather spaces with same symbol (or number).

4. Engagement between Spatial Characters and Space-Planning Techniques

In the space-planning technique that is used by the author, three sets of information, space identities, site region, and space relationships determine the basic input to the program. The program computes the proper locations for the spaces by including the space relationships, and in the order of the space identities list in the input data.

By extending the space-planning technique, spatial characters inherit the same computational structure and add several elements to the original input data. With additional spatial character identifications and relationship values, the new refined program structure can alter the input order of spaces, and
calculate new space relationship values base on the effect of the spatial characters.

Three techniques are employed to integrate the space-planning technique with the spatial character:

1. Character identification: With various character identities that have been given by designer, the program adjusts the location of spaces by identity matching or applying rules. Except for matching, character identity also offer certain input order for space planning program. In order to compose the space arrangement properly with the spatial character, a certain input order will be issued based on the group interaction behaviors and environmental interactions between spaces. The following input order is proposed for this method:

   Leading → Following → Grouping → Watcher → Outreaching → Worker → Servant → Loner

   This order forms the following set of rules:
   (1) Leading character locates first for the spaces with Following character to cluster.
   (2) The space with Grouping character gathers spaces with same character for further locating process (Servant and Loner).
   (3) The space with Watcher character occupies the boundary of the site before Outreaching and Worker.
   (4) The space with Servant character attracts to the space or group of spaces that located in the site.
   (5) The space with Loner character stays away from the space or group of spaces that located in the site.

2. Environmental conditions: In addition to the inner space interactions, environmental elements is added to reorient related spaces; which are defined as Watcher, Outreaching, and Worker character. With these components, the space layout will be more precisely associated with site conditions.

3. Level adjusting technique: The ability of changing identity-matching level allows the program to adjust space location in “fuzzy“ way. A designer can micro-control the levels and observe how the spatial characters impact the result, which show as follow:

   In the original space-planning program used by the author, the basic structure of the calculation is:

   \[ \text{Score} = \sum (D_{ij} \times SA_{ij}) \]  (1)

   Where \( D_{ij} \) represents distance between space \( i \) and \( j \)
After attaching the spatial characters, the total space relationship value will be changed based on different levels of adjustments (Low 10%, Medium 50%, or High 90%). The refined equation is

\[
Score = \sum \left[ D_{ij} \times (SA_{ij} + SC_{aij} + SC_{bij} + SC_{cij} + \ldots) \right]
\]

(2)

Where \( SC_{nij} \) \((n = a, b, c, \ldots)\) represents different spatial character values.

A designer can also adjust the level (Low 20%, Medium 50%, or High 80%) for each adjacency value and spatial character (space to space or space to environment). With this adjustment, a designer can decide either the original space relationship or the refined relationship has more control in this computation. The equation shows as follow:

\[
Score = \sum \left[ D_{ij} \times \{ (SA_{ij} \times Level) + ((SC_{aij} + SC_{bij} + \ldots) \times (1-\text{Level})) \} \right]
\]

(3)

By adding these additional parameters to the spaces, a designer not only will be able to witness the changes of the space relationship, more design possibility can be produced during this observing process; in addition, spaces interacting with environment as well. By changing the control level of spatial character, designer will witness the different degrees of personal influence on the project from the result.

3. The Potential of Spatial Character

Based on this methodology, the improvement to the space-planning program will be implemented and case studies will be produced. In addition, based on the author’s research process (Figure 7.)(Hsu, 2002), the spatial character not only can help the designer with advanced space layout, but also can be developed to another level, architecture form generation.
By giving different form elements or formation rules to certain spatial characters, the refined space-planning program can produce an architectural massing that based on these characters and rules. The possible form generating methods are:

1. Individual form generation: By giving individual form elements to each space character, spaces change their forms according to their space characters.
2. Clustering form generation: In this technique, certain group of spaces union and generate the form together by applying their form elements that reflect their space character.

With this potential, the spatial character can produce possible architecture massing for a designer to study, and ideally, help the designer during the process of architecture form development.

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References

