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# Identification Of Spatial Relationship As The Basis For Zoning In Dual-Function Building Designs

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**ABSTRACT**

Programming in building design process included space analysis. Spaces are defined based on user activity before the design process starts. After that, these spaces are grouped based on their similarity. The most common grouping is based on the freedom to use the room, private or public. This grouping is essential, especially in buildings that facilitate more than one function. This study aims to identify spatial relationships as the basis for zoning in dual-function buildings. The research method is descriptive qualitative, which describes the design process starting from activity studies, spaces analysis, spatial relationship analysis, and interpretation of spatial relationships in dual-function buildings. The study cases are dual-function buildings that function as houses and reading corners. The data is obtained from the architectural student design studio. The spatial relationship is interpreted based on activities which are divided into 3, namely the relationship between residential space, the relationship between the reading corner space, and the relationship between the housing space and the reading corner. Zoning in dual-function buildings is not only divided into public, private, and semi-public. For public and private levels in dual-function buildings, in-depth exploration is needed, especially house and reading corners.



Keywords: dual-function building design, space relationship, zoning.

## 1. Introduction

Building design involves several stages of the planning and designing process. Every architect or designer has his design steps, just like students. This is what underlies the different design results from each designer, even though the type of building is the same [3]. The building design process is divided into stages of planning, design, construction, use, and evaluation [1][2][3][4].

According to Ching and Eckler [1] and White [4], the design planning stage involves several aspects, including:

1. problem description
2. design goals
3. description of user requirements and space requirements
4. urban analysis, building analysis, and space analysis
5. concept formulation

These stages are referred to as programming [1][2][3]. Space analysis is one of the crucial stages in programming. Before conducting a space analysis, architects need to classify spaces carefully with the help of literature data, precedents, and information from clients or building users [2]. The spatial analysis will produce relationships between spaces which are usually depicted by diagrams [1][2][4].

Some important points resulting from the grouping of spaces, according to Ching and Eckler [1] include:

1. Determination of which spaces are adjacent and separate. This determination can be to distinguish the nature of public or private space.
2. Determine the principle of spatial order that explains the logic of the distribution of space and the spatial character of the building.

White [4], in his book Concept sourcebook: a vocabulary of architectural forms, describes the basics of grouping spaces and zoning in detail. Space grouping and zoning can be done based on the following considerations:

1. the need for proximity between spaces by building, space, or activity

2. The similarity of the general function of the spaces
3. linkage of purpose and space system
4. spce flow
5. the prerequisites or needs of each space
6. effects the room produces, such as radiation, heat, smell, vibration, etc.
7. position to land
8. spatial relationship with the main activity
9. the character of the person involved or the user of the room
10. room user volume
11. level of involvement of machines or people in the room
12. the level of emergency or critical situation in each room
13. The average speed of activity in each room
14. the intensity or frequency of activity in each room
15. duration of activity
16. anticipation of expansion or change of space or building.

Based on this explanation, the proximity of space is the primary consideration in classifying spaces. Ching and Eckler [1] further divided the nature of space, namely public and private or zoning.

The terms public and private in architecture were introduced on a city scale [1][2]. This term is used to divide the areas in the city that are safe because they cannot be accessed by just anyone and areas that are less secure because access is free [2]. A private area is an area that is only accessed by a handful of people, while a public area is an area that can be accessed by anyone [1][2]. The grouping of space properties can be made more detailed by adding a set of semi-public and semi-private areas. The grouping of private and public areas makes it easy to distinguish between users of the area who are entitled to enter and those who are not. In semi-public or semi-private areas, the distinction is not so clear [2]. Semi-public or semi-private areas can be defined as areas that certain people can use at certain times [2]. Semi-public areas, of course, have more open access than semi-private areas. The division of these areas is usually adapted to building design, especially at the planning or programming stage.

A dual-function building is a building with multiple functions. The two functions that are facilitated in facilities can be very different. For example, the first function is private, but the second function is public. This difference significantly impacts the relationship of spaces within the building. As explained earlier, functions have an important role in determining the grouping of spaces [1][2]. For this reason, this study will analyze the public-private zoning in the spaces of the dual-function building and identify the relationship between the spaces.

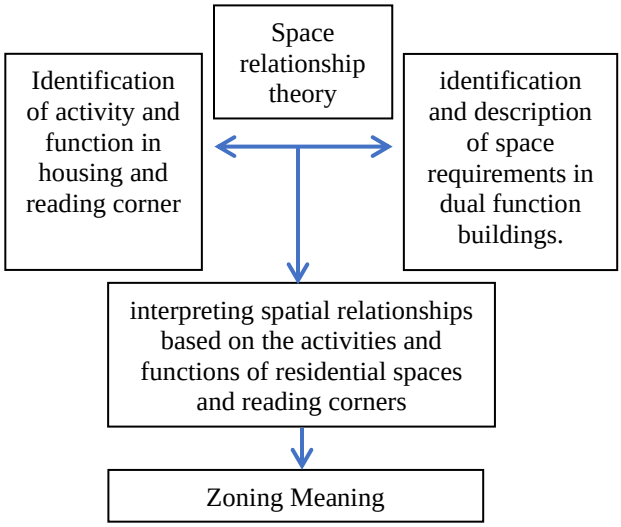
The object of this research study is a dual-function building with opposite public and private properties. The object of study is a house building that also facilitates public functions, namely the reading room. Since this research aims to identify spatial relationships to determine zoning, the study material is the work of architecture students from the planning stage to the final design for the aforementioned study objects.

## 2. Material and Methods

This study uses a qualitative descriptive method to identify, describe, and interpret spatial relationships as a zoning determination in the design of a dual-function building. This research is a research in the field of architecture, the results of which can be directly applied to the design The research material includes the relationship between space and zoning, which is obtained through several stages of analysis. The research phase includes data collection and analysis, followed by interpretation. Data were collected in this study using interviews and field observations. Interviews and field observations were used to obtain data on activities and space requirements in dual-function buildings.

The first stage of analysis is identifying the activities and functions of space in a dual-purpose building. This identification is carried out on the activities and functions of the dwelling, the activities, and functions of the space in the reading corner, and also the activities and functions of the shared space in the dwelling and the reading corner. One of the problems faced in planning and designing bi-functional buildings is linking or connecting two functions in one building. The second stage of analysis is the identification and description of space requirements in a dual-function building. The third stage is to identify, describe, and interpret spatial relationships in the planned spaces based on the activities and functions of the residential and reading corner spaces. The fourth stage is the meaning of zoning based on spatial relationships interpreted in the third analysis stage. Data collection and research in the first and second stages used the theory of spatial relations proposed by Ching and Eckler [1].

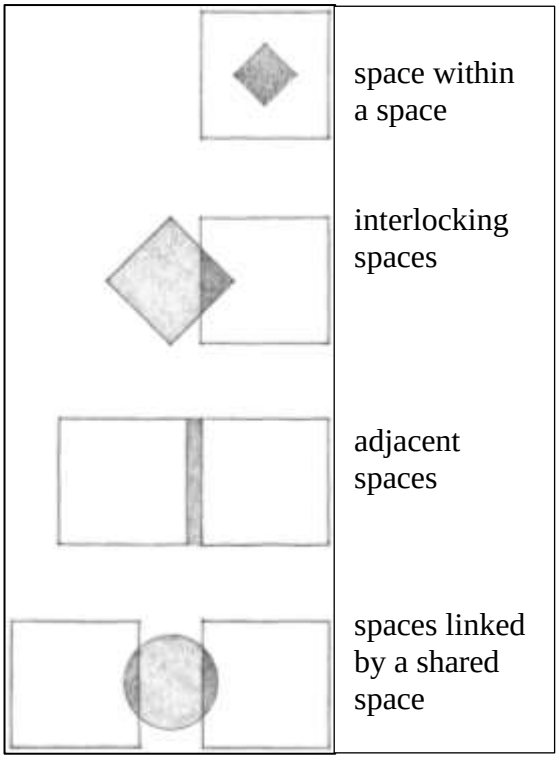
The qualitative analysis process uses MDAP (Manual Data Analysis Procedure), namely manual data analysis. Qualitative analysis uses humans as the main instrument because humans can capture phenomena encountered in the field. According to Bungin & Irwanti [6] MDAP can be carried out by each researcher according to the character of the qualitative method used. The tradition of manual data analysis follows the phenomenological tradition and the grounded theory tradition developed by Glaser & Strauss, Strauss & Corbin, Charmaz, and Saldana by prioritizing researchers as the main tool of data analysis.




Source: (Author, 2022)
Figure 1: Analysis process

The theory of spatial relations used as a tool in identification is the theory of Ching and Eckler. Ching and Eckler [1] describe how to connect spaces using four methods, namely:

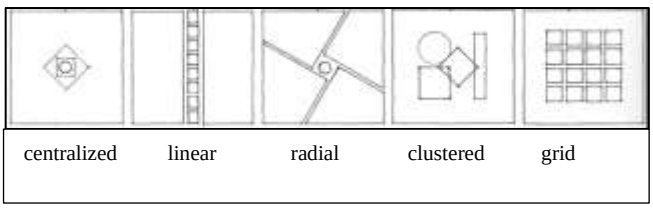
1. Space within a space. This method connects two rooms by placing the smaller space within the larger one
2. Interlocking spaces. The two rooms are related dimensionally but still maintain the identity and definition of space. The overlapping areas are seen as shared spaces.
3. Adjacent spaces. Rooms placed next to each other are the most common form of spatial relationship. Each space is clearly defined and able to fulfill both functional and symbolic needs
4. Spaces linked by common space. Connecting rooms can use an intermediate area as a liaison.




Source: (Ching & Eckler, 2012)
Figure 2: Illustration of method of connecting space

As for the space configuration, Ching and Eckler [1] describe five types of configuration, which include:

1. Centralized. This type is dominated by one main room with a secondary room that surrounds it.
2. Linear. Similar spaces are lined up linearly.
3. Radials. This type is characterized by 1 area as the center of the linear configuration expanding radially.
4. Clustered. Spaces are grouped by proximity or visual resemblance or relationship.
5. Grids. The spaces are arranged in a structural or 3-dimensional grid.




Source: (Ching & Eckler, 2012)
Figure 3: Illustration of spatial organization

## 3. Result and Discussion

*3.1. Identification of space activities and functions in a dual-function building.*

In programming or space analysis, the initial identification is related to the user. Programming must identify building users, user capacities, activities carried out, activity flows, and required spaces. In a dual-purpose residential building and reading corner, user identification is carried out on residential and reading corner users. The same is true for the identification of user activities. For example, one of the residential users is the mother. All maternal activities must be identified and described in the planned space. Mothers have activities including cooking, receiving guests, resting, doing worship, relaxing with family, and managing the reading corner. So the space provided must accommodate these activities. Before determining the name of the space, the important thing to do is to assess the function of the space from activities translated into specific functions. Cooking activities require space with functions to mix, prepare, cook, and serve food. Resting activities require space with function as a place to sleep, a place to relax, etc. This identification process is carried out until all users needs get a container in the form of space.

In the reading corner, the exact identification is also made. Users can be divided into two, namely managers and visitors. Both have different activities, so the space required is different. Because this analysis is carried out in a dual-function building, user activities are identified in the residential and reading corner area. An example of an activity study is depicted in Figure 4.

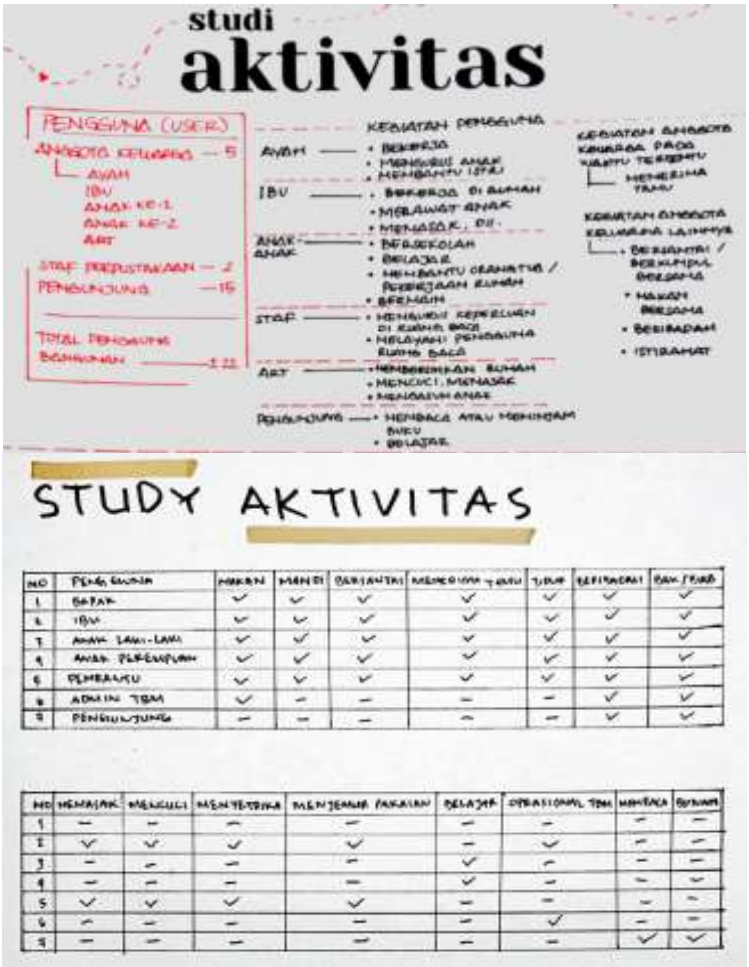



Figure 4: Activity Analysis
Source : (Author, 2022)

*3.2. Identification and description of space requirements in dual-function buildings.*

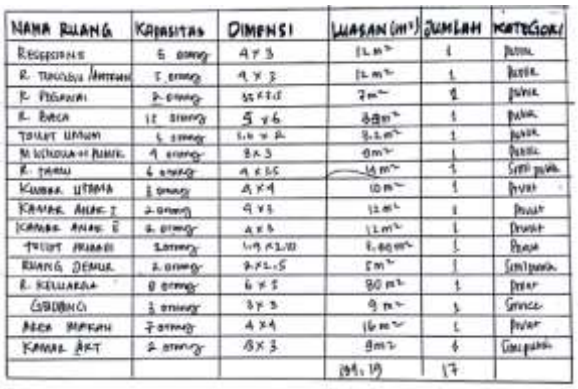
After identifying the users and their activities, the next step is to identify and describe the space requirements to accommodate these activities and functions. There are several user activities that are accommodated by the shared space. All residential users carry out the activity of receiving guests, so the space provided is only 1 room and is shared. The room used to accommodate these activities is the living room. All residential users carry out rest activities, but because these resting activities are private in the dwelling, rest requires space for each user. The same steps are carried out for all activities. This analysis phase includes activities in housing and reading corners. At this stage, overall zoning categorization can be carried out in each space. In general, zoning is divided into two, namely public and private, based on the nature of the space and access to the space.

Public zoning is generally found in the reading corner because the reading corner can be accessed easily from the outside. Meanwhile, private zoning is usually found in residential areas because access is limited. Residential areas can be further divided into semi-private areas, namely in spaces with limited access but still accessible to outsiders, namely the living room. There is also a division of zoning between public-private-service. Service is a service area that supports activities of a public-private nature. The table below is an example of space identification and description based on occupancy activity.

Table 1: Space analysis based on activity

| **Activity** | **Space/room required** |
|---|---|
| Receive guest | Terrace<br>Sitting room |
| Rest | Main bedroom<br>Kid's bedroom |
| Eat and Cook | Kitchen<br>Dining room |
| Relax | Living room<br>Garden |
| Work/Study | Workspace<br>Study room |
| Worship | Musholla |
| Shower, toilet | Bathroom |
| Washing, Drying, Ironing | Laundry room, drying room, ironing room |
| Storing Goods | Storage |

Source: (Author, 2022)



| NAMA RUANG | KAPASITAS | DIMENSI | LUASAN (m²) | JUMLAH | KATEGORI |
|---|---|---|---|---|---|
| RESEPSIONIS | 6 orang | 4 x 3 | 12 m² | 1 | PUBLIK |
| R. TAMUNYA [illegible] | 5 orang | 4 x 3 | 12 m² | 1 | PUBLIK |
| R. PENGAWAS | 2 orang | 5,5 x 3,5 | 7 m² | 2 | PUBLIK |
| R. BACA | 12 orang | 5 x 6 | 30 m² | 1 | PUBLIK |
| TOILET UMUM | 6 orang | 1,5 x 2 | 3 m² | 1 | PUBLIK |
| M. MUSHOLLA + PUBLIK | 9 orang | 3 x 3 | 9 m² | 1 | PUBLIK |
| R. TAMU | 6 orang | 4 x 3,5 | 14 m² | 1 | SEMI PUBLIK |
| KAMAR UTAMA | 2 orang | 4 x 4 | 16 m² | 1 | PRIVAT |
| KAMAR ANAK 1 | 2 orang | 4 x 3 | 12 m² | 1 | PRIVAT |
| KAMAR ANAK 2 | 2 orang | 4 x 3 | 12 m² | 1 | PRIVAT |
| TOILET PRIVASI | 1 orang | 1,4 x 1,2 | 1,68 m² | 1 | PRIVAT |
| RUANG DEMUR | 2 orang | 2 x 1,5 | 3 m² | 1 | SEMI PUBLIK |
| R. KELUARGA | 8 orang | 6 x 5 | 30 m² | 1 | PUBLIK |
| GUDANG | 1 orang | 3 x 3 | 9 m² | 1 | SERVICE |
| AREA MENGAJI | 7 orang | 4 x 4 | 16 m² | 1 | PUBLIK |
| KAMAR ART | 2 orang | 3 x 3 | 9 m² | 1 | SEMI PUBLIK |
| | | | 199,19 | 17 | |

Source : (Author, 2022)
Figure 5: Table of Space Requirements and Dimensions

*3.3. Interpretation of Spatial Relations based on the activities and functions of residential spaces and reading corners.*

A matrix diagram shows the relationship of spaces in the building. In the matrix diagram, the relationship between spaces can be grouped into 3, namely: (1) directly related; (2) indirectly related; (3) unrelated. Directly related spaces are spaces whose activities are interconnected—for example, the dining room and kitchen in the residence. The basis of analysis to determine the spatial relationship is the activity and function of space in the building.

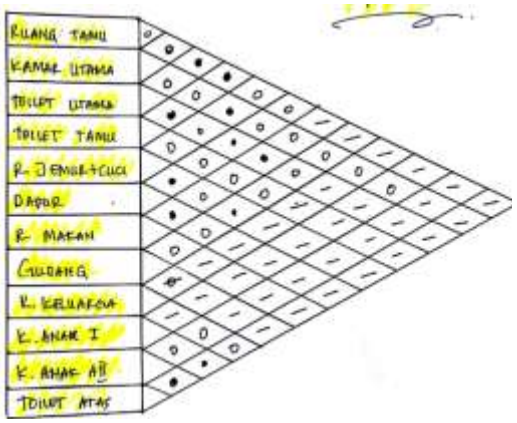
In buildings with two different functions, namely residential and social, both have spatial relationships in their respective functions. The spatial relationship in the dwelling will be different from the spatial relationship in the reading corner. But there is a space that is a link between the two. This is in accordance with Ching and Eckler's theory of interlocking spaces and spaces linked by common space. In interlocking space, two rooms are related to each other in dimensions but still maintain the identity and definition of space. The overlapping areas are seen as shared spaces. A shared space is a space that is neutral in nature and is easily accessible from both the residence and the reading corner. In the analysis, defining what space will be used as shared space is necessary. For example, a book gallery is located between the living room and the reading room. This book gallery is a space that can be shared by residential users and reading corners.

Whereas in spaces linked by shared space, related spaces can use an intermediary area as a liaison. For example, an outdoor reading room which also doubles as circulation, can be used

as a liaison between the residence and the reading corner. The two theories of spatial relations are then translated to define the connecting space between the dwelling and the reading corner. Interpretation or translation of these spatial relationships can vary, but the point is that the connecting space or shared space is an area that is neutral and easily accessible from 2 sides.

While the other spatial relations are contiguous spaces and spaces linked by common space. Suppose it is associated with the spatial relationship matrix. In that case, adjacent spaces include directly and indirectly related spaces and the space relations spaces linked by common space. In the residential room, the relationship between the children's room and the study room can be connected to the family room. Another open interpretation is the study room, an adjoining room.

The definition of adjacent spaces, that is, each room, is clearly defined and able to fulfill functional needs. The two images below exemplify a matrix of residential space relationships with three categories and examples of residential images and reading corners based on spatial relationships, according to Ching and Eckler.




Source : (Author, 2022)
Figure 6: Space relationship matrix based on three categories


Source : (Author, 2022)
Figure 7: Space relationship between Housing and Reading Corner

*3.4. The meaning of zoning based on spatial relations*

Based on the analysis, it can be concluded that the spatial relationship can be reviewed through 2 models. In the matrix model, spatial relationships can be divided into three categories, namely: (1) directly related, (2) indirectly related, and (3) unrelated. Meanwhile, the spatial relationship based on Ching and Eckler's theory is divided into 4, namely: (1) space within a space; (2) interlocking spaces; (3) adjacent spaces; and (4) spaces linked by common space.

In the single function building spatial relationship matrix model, this spatial relationship is easy to identify by interpreting the activities between spaces. However, in buildings with dual or dual functions, it is necessary to identify each function first, then interpret the relationship between the two functions. In a dual-function building, spatial relations can be determined based on: (1) the relationship between activities in it; and (2)

activities carried out between 2 users with the same intensity and level of involvement.

The spatial relationship model based on Ching and Eckler's theory has four kinds of spatial relationships. In single-function buildings, most spatial relations based on this theory are adjacent spaces, i.e., spaces placed next to each other. However, the other three kinds of spatial relations can be found in small numbers. For example, a space in a room, or a small space in an ample space. The relationship between the two activities is very close because small spaces can only be accessed through large spaces. An example is a bathroom in the main room. This bathroom can only be accessed through the main bedroom door. So, this space relationship becomes the primary basis for determining zoning.

The family room in residence can also be an interlocking space because it has its own definition of activity but can be used as a liaison for other spaces. This space is a shared space for the spaces located around it. In the reading corner, the space relationship found is space within a space in the service room, the display room, or the reading room. This spatial relationship is directly related to its activities.
The finding of zoning in bi-functional buildings is built based on themes in spatial relations, which are a reflection of the analysis that has been done previously. Zoning theory on buildings is generally divided into two, namely public and private. In comparison, the activities between can enter the semi-public and semi-private.

Zoning in a dual-function building can be interpreted as a zone division which is described by considering several things, namely:

1. User activities and functions in each room
2. The relationship between spaces in the main function (residential), additional functions (reading corner)
3. Identify the common space and the spatial relationship between the two functions
4. Intensity and level of user involvement in the space

So that it can also be explained that, in general, in dual-function buildings, residential spaces are private zones, and reading corner rooms are public zones. At the same time, the shared space is a semi-public space. In residential areas, not all spaces have the same privacy level, and in the reading corner, not all spaces have the same public level. The activities of building users influence this private level.


Source : (Author, 2022)
Figure 8: Space zoning on Housing and Reading Corner

## 4. Conclusion

This study aims to identify, describe, and interpret spatial relationships as a zoning determination in the design of a dual-function building. The conclusions obtained are:

- The process of identifying and describing user activities is the most important thing in finding spatial relationships. User activity is described as a container named space that can functionally fulfill the needs of user activity.
- Space relations are interpreted based on user activity in each space. In a dual-function building, the interpretation of this spatial relationship goes through 3 stages, namely the relationship between the residential space, the relationship between the reading corner room, and the relationship between the residential space and the reading corner.

- The meaning of zoning in a dual-function building is built based on the spatial relationship that has been interpreted previously. The main thing that needs to be considered in zoning is the intensity and level of involvement in space so that what is found in zoning cannot be applied in general, public, private, or semi-public only. However, it needs an in-depth exploration of the public and private levels of housing and reading corners.

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