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## **Spatial Analysis in Human Behavior in The Environment to Predict its Movement And Comfort**

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### **Abstract**

People movement in their environment is very important to predict. This is in order to avoid the danger of its density especially in their circulations. This prediction is obtained from users spatial analysis in their environment in order to meet the needs of socialization. The movement illustrates how the usage pattern in the physical environment can occur with a fixed pattern. The spatial analysis will then be able to indicate the information density and frequency by user in the environment. Such information should be presented with an adequate system that can describe the results of the spatial analysis. Spatial analysis results in the form of information density and frequency of such use will further require data from an area of the environment and the maximum number of users on environment. Such information can then be shown with a predicted maximum density and usage patterns.

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### **1. The Significance of Spatial Analysis Environment for The Safety of Users**

Analysis of user safety while in an environment is very important to be implemented. Safety is meant here is as avoid distress that can result in injuries and even fatalities. The maximal number of users or irregular movement direction will allow accidents. It can be called as the chaos in the movement and activities.

Chaos in carrying out activities in an environment is because users are not able to control its activity as opposed to the activities of other users. Such activities should be avoided. Efforts to avoid is to harmonize the various activities among users. This alignment will further form a pattern during their activity. This activity pattern will also show form patterns in the movement. This is what underlies the importance of spatial analysis to predict the use of space by users.

## **2. Creating an Environment User Convenience Through Avoidance of Movement Chaos**

Use of the environment will depend on the needs of its users and the condition of the physical environment. This statement is in accordance with the source of Laurens (2005) stating that there is a mutual relationship between humans and the environment to adjust. From these relationships can be predicted that the environment and its users must be compatible to support comfort during activity. Conformity or convenience during the activity is interesting to be studied more deeply than the factors that influence it. Relationships between the environment and its users have a reciprocal relationship on an ongoing basis. Furthermore, the relationships between them are the environment will be changed to adjust its activities and users also adapts to environmental conditions especially when the environment has its limitations. An environment that has its limitations will force users to better adapt to the environmental conditions.

The convenience forming factors of users in the environment is determined by the carrying capacity of the environment and its users. This statement is based on the results of research that held by Wardhana (2012), which resulted in the conclusion that the capacity variable of the room is to determine the comfort of the use of space or room. Environmental carrying capacity is in the form of completeness of facilities and infrastructure, the broad of the place, and the position of the other places. Users of the environment will analyze from the number of users, patterns of activity that occurred and the frequency of place usage. All these factors simultaneously affect a user's convenience environment. If convenience or comfort is achieved, then the activity that occurs will have a long time and a maximum number usage according to their needs.

Another thing that is important and should be considered in achieving comfort is the use of an environmental movement and densities. That is, there are other important factors such as movements in the form of direction and relationships between places to move and distress during activities. Crowding meant here is the number of an environment users as well as the number of users during a move from one place to another according to their needs. The movement of the user will be largely determined by the extent of existing circulation. Nevertheless, there are still important issues that affect the circulation beyond the extent of comfort during the movement with regard to the direction of movement. The direction of movement will be re-determined by the movement patterns required users.

## **3. Tools to Predict The People Movement in The Environment**

Recently, tools to analyze and predict movements and human density have been developed. The analysis tool is done Izuyama (2010), Percival (2002), Judith (1986) and Adib (2010), Tversky (2003), Minam and Tanaka (1995) and Sepe (2009). All of these analyze based on the number of users of the room or place to the direction of movement. Each user will be mapped their position on an environment and then mapped their movements in an environment. The basis of the spatial analysis of various studies above is from the direction of motion use of space, amount of space used on the space that available, the number of users of each space, the room types, the amount and frequency of space usage.

From various studies above, looks research by Sepe (2009) is the most comprehensive and easy to implement. Research by Wardhana (2012) have been completed include some basic analysis of the various factors mentioned above. The base is then fitted with a variety of new findings in the form of patterns in socializing by Wardhana in 2014 and 2015. Completed analysis of these studies is the prediction of sudden activity that can occur in an environment and prediction circulation path may be used as a place of activity (in particular activities occurs spontaneously).

Relating to the completeness of important additional form of analysis or prediction of spontaneous activity that occurs suddenly in the path of circulation, Wardhana (2012) have added a circulation pattern analysis and socialization activities in the circulation path. The spatial analysis has an advantage by

revealing more thorough activity in various neighbourhood corners. General circulation path that planned only for circulation have turned out in a socialization use which also requires a long time usage. The time to socialize will affect the densities and user comfort during their activities in environment. Overview of spatial analysis conducted by Wardhana (2012) shown in the picture below.

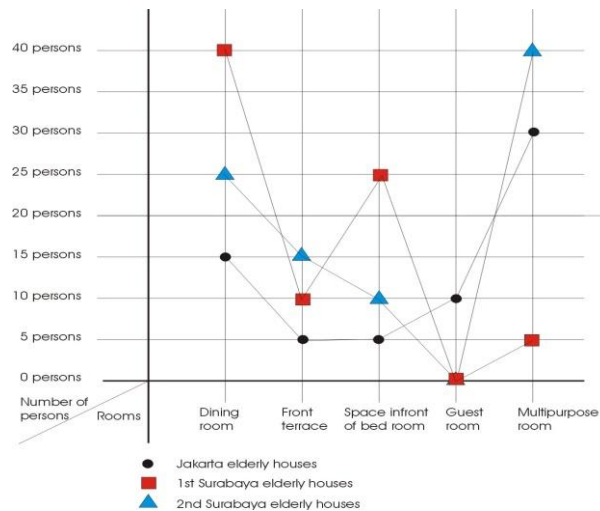


Fig. 1. Socialization patterns in Surabaya and Jakarta Elderly House, Source image: Wardhana (2012)

The above study contains important information on public facilities. For the fact, in many observations, the circulation path should be prepared also a place to socialize. Thus the completeness for social infrastructure must also be contained in this circulation path. Social activity distress and disruption could be avoided with infrastructure adequate to socialize in the circulation path.

#### 4. The Behavior of Human Socialization in The Public Sphere and The ESVA Excellence method of analyzing the use of space

Social behavior in the public environment can be inferred from some of the latest research results from Wardhana in 2014 and 2015. His research result is the circulation paths become a favorite place to socialize and presence of a variety of social activities. This activity spontaneously occurs. The study found an idea that the use of public facilities by the community is very diverse according to the needs of each socialize group. This is because a socialization group that occurs is in small numbers, but with large numbers. Overviews of the use of public facilities are as shown below.

ESVA be the best analytical tool in analyzing the spatial conditions because it has several advantages such as:

- 1) Considering the state of the dissemination activities and users an environment
- 2) Consider cultural factors and human behavior to adapt to its environment
- 3) Emphasizing observations on parts of the overall environment in analyzing the spatial conditions of an environment
- 4) Can be used to predict the ability of the environment to provide satisfaction to its users



Fig. 2. Figure. Use of circulation in public facilities for spontaneous socializing, Source image: Wardhana (2014 and 2015)

Social behavior in the circulation as a favorite place to socialize can be occur. This is because the circulation path was very efficient to shorten the journey to the place of other activities. With activity in the circulation path, then user become ease in reaching various environmental and activities position. The benefit above cause users could chose to be in the circulation pathway and also maintain a socialization group in the pathway. If not designed properly, then the circulation can be obstructed, dense and crowded. Such interference will be greater when the socialization activity in the circulation path occurs in a long time.

## 5. The Development of Spatial Analysis Tools Through The Environmental Public Value

Analysis of the use environment as described above must be fitted in every variable analysis. The unification of several usage variables analyzers of environmental research is available on the Environment Socialization Value Analysis (ESVA). Optimization with various findings on the Environment Socialization Value Analysis is the variable follow-up activities that occur spontaneously in the circulation path and environment.

Additional variables were analyzed with observational research methods periodically above must be carried out with a constant time. All activities both patterned and no patterned in an environment must be counted in the Environment Socialization Value Analysis (ESVA). Thus, the every corner of the place is important to observe because it has the opportunity to be used for socializing in any time. This variable will be included in the calculation of the TS Value and JS Circulation. Both attempts to enter this value in the TS and JS Circulation is due to two factors focus on the calculation of a circulation.

$$NSL = \frac{\sum Rg \text{ Sos}}{\sum Rg \text{ Tot} \times \text{Jml Fakt NSL}} + \frac{\sum \text{Sirkulasi Sos}}{\sum \text{Sirkl Tot} \times \text{Jml Fakt NSL}} + \frac{\sum \text{Sat Tmp Sos Rg}}{\sum \text{Tot Sat Tmp Sos Rg} \times \text{Jml Fakt NSL}} + \frac{\sum \text{Sat Tmp Sos Sirkl}}{\sum \text{Tot Sat Tmp Sos Sirkl} \times \text{Jml Fakt NSL}}$$

Fig. 3. The Environment Socialization Value Analysis (ESVA) calculation formula, Source image: Wardhana (2014 and 2015)

Spatial analysis environment that relied on the calculation of TS and JS Circulation through the findings of subsequent activities that occur spontaneously in an environment would show the circulation as the focus of analysis. Spatial analysis through the Environment Socialization Value Analysis (ESVA) calculation will be demonstrated through environment map with a circulation path that has more

Further analysis of the spatial pattern mentioned above can be developed more detailed and accurate through computer information technology and programming. Computerization in analyzing spatial usage patterns will make predictions and accuracy become more assured. As an end result, it would be easy to get a prediction about the density and flow of movement of the user in an environment and also can avoid various dangers and damages that may happen from the density in an environment.

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