

The Application of Behavioral Mapping to Design Therapeutic Spaces for Disabled Children

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ABSTRACT

Behavioral mapping is depicted in the form of a sketch or diagram of an area where humans perform various activities (Sommer, 1986). The goal of this method is to describe the behavior on the map, identify the type and frequency of behavior, and also show the link between the behavior and the specific design features. A research that being conducted in 2011 at Disabled Children Rehabilitation Centre or YPAC (*Yayasan Pembinaan Anak Cacat*) Surakarta, used Place Center Map method-one out of two type behavioural mapping methods-to examine the movement of user activity of some sample room in that rehabilitation centre. Those stated rooms that often being used by the disabled children are Occupational Therapy Room, Physiotherapy Room, *Pendopo* Area, Hydrotherapy Pool, and The Children's Dorm. The aim of the research is to help a designer describe the activity of the room in a Disabled Children Rehabilitation Centre by using behavioural mapping methods that will lead to a design proposal for recreating more suitable therapeutic spaces for the children's rehabilitation process.

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1. Introduction

Universal Design concept can be applied to the design products, environment, buildings, public space, programs on the computer and services that can be used by all user groups, as much as possible, without the need for adaptation or special design (Ostroff, 2011 in Keumala, 2016). Equitable Use, Flexibility in Use, Simple and Intuitive Use, Perceptible Information, Tolerance for Error, Low Physical Effort, Size and Space for Approach and Use, are the 7 principles in Universal design concept that may help a designer to build spaces and places for those in need. Based on its usage and principles, this concept is more

widely applied to design a special place for people with disabilities.

Yayasan Pembinaan Anak Cacat (known as Disabled Children's Counseling Foundation) is a special foundation in Indonesia that provides rehabilitation and counseling services for disabled children either caused by cerebral palsy (CP), accident, and other causes. As the founder, Professor Soeharso aimed to make a rehabilitation and counseling centre that will be completed with the educational facilities to improve the disabled children's independency and recovery through various programs. He has a dream that someday the disabled children could be as confident and independent as other people. It was also his reason to added some therapy and

educational programs in YPAC for the children so they could feel the supporting atmosphere within their growth.

The first building-later became this research's case study-was built on 1953 and located in Surakarta. It has several therapy facilities such as Physiotherapy, Occupational Therapy, Speech Therapy, Hydrotherapy, Tool making, Surgery Room, Prana Healing, Psychological examination, and Consulting Services. Aside from the therapy facilities, the building also has Social Rehabilitation Service which provides dormitory for the patients and guest house for their family.

As explained in the early discussion, a diffability rehabilitation centre should use universal design concept in its building and site so the people in need could easily access every corners and facilities within. Ironically, the old building of YPAC Surakarta didn't properly consider the universal design concept as the access for the children and other user who need different size and type of the building elements such as door's size, corridor's size, limited ramps, furniture's dimension, and also the landscape design. Based on that concern, a redesign idea was proposed for YPAC Surakarta building by using Therapeutic Garden concept. The aim of this redesign idea was to created a therapeutic environment to improve the disabled children by offering attractive opening spaces they could experience and practice themselves within without feel any pressure and having fun with other users. The existing datas compiled with behavioral mapping methods so we could see which areas and activities were needed by the user.

2. Material and Methods

Diffability: Limited Access and Activity

ICF (The International Classification of Functioning, Disability and Health) released by United Nation in 2000's that emphasizes the interaction of 3 (three) factors in the disability issue, i.e "impairments" (specific abnormalities / damage exist in one's body), "activity limitation" (limited activity due to certain body conditions) and "participation restrictions" (restrictions on participation, eg discrimination at work, school and others). Syafi'ie (2014) mentioned that the importance of accessibility for disabled people is to ensure their independence and participation in all aspects of the community.

Universal Design in Post-Occupancy Evaluation Process

In order to improve building's fitness for purpose, it has been known worldwide about Post Occupancy Evaluation (POE), a process which produces recommendations for building solutions and ways of using buildings to enhance productivity and wellbeing. According to <https://postoccupancyevaluation.com>, the recommendations are based on stakeholders' testable observations about buildings` support and frustration of their work and wellbeing.

The purpose of POE itself is analogous to use law precedents or case study methods in business, i.e making better decisions to discover the consequences of the past decisions (Preiser, 1988). POE focuses on three evaluations which are: 1) Technical Evaluation, 2) Function Evaluation, and 3) Behavior Evaluation. The Technical Evaluation consists of all matters relate to the building's background environment. The

underlying factor of function evaluation is the things that could support the activities in the building. While the behavior evaluation factor is all things that affect the users of the building.

The following Table 1. is the matrix of the three types of evaluations, viewed from the scale of the physical environment that includes the area of discussion of each point of each evaluation.

Table 1. Post-Occupancy Evaluation Matrix (Source: Harvey Z. Rabinowitz)

		Physical Environment Scale			
		Tools	Room and Space	Building	
POE Evaluation Factors	Technical	a) Façade			
		b) Roof			
		c) Energy			
		d) Structure			
		e) Fire Prevention			
		f) Interior			
		g) Lighting			
		h) Acoustic HVAC			
	Functional	a) Workflows			
		b) Human factors			
		c) Storage			
		d) Flexibility and Circulation			
	Behaviour	a) Usage			
		b) Space Attachment			
		c) Territory			
		d) Privacy			
		e) Interaction			
		f) Image			

BRE Trust (2017) stated that POE will help designer and stakeholders to review several things inside the used building, such as:

- Highlight any immediate teething problems that can be addressed and solved.
- Identify any gaps in communication and understanding that impact on the building operation
- Provide lessons that can be used to improve design and procurement on future projects
- Act as a benchmarking aid to compare across projects and over time.

The stated points above lead a designer to create the best solution for an used building that need more proper design for specific user such as disabled children.

Behavioral Mapping as Tool to ‘Read’ the Disabled Children’s Activities

The first survey in YPAC Surakarta was conducted in 2011 through visual documentation with camera and sketch, also from open-ended interviews with the stakeholders and management, those datas later became the primary source of this research. From the data, it can be concluded that only less than 20% part of the whole sites followed the National’s Technical and Accessibility Standard as stated in Public Work Ministry’s Policy No 30 year 2006.

As seen in the Figure 1, the building is divided in 6 area that can be detailed as follows:

- Area A: Administration and rehabilitation services centre. Consists of several therapy rooms and administration rooms.
- Area B: Dormitory area for inpatients, those who want more intensive rehabilitation services. There is a separate-

shared bedroom between men and women also several skills rooms.

- c) Area C: Extraordinary school area for disabled children with 15 classes (from elementary to high school) and equipped with special basketball court for the students.
- d) Area D: Office area, center of any foundation administration. There is an office space, a meeting room, and a boardroom.
- e) Area E: There is an unused pavilion and a hydrotherapy pool.
- f) Area F: A Hall that can be rented out for the public and sometimes becomes the venue for special events of the foundation.

limited so the user couldn't have any proper outdoor activities. However, the existed site have a potential focal-point which also a part of its outdoor therapy space, it is a hydrotherapy pool (Figure 2).



Figure 2. Hydrotherapy Pool of YPAC Surakarta



Figure 1. Existing Site Plan of YPAC Surakarta

Since the initial building of the foundation has been established on 1953, the provided medical services, such as therapy rooms and wards for boarding children, were limited because it only based on the existed building. The available open-spaces are also very

The stakeholders became worried of the building's sustainability and the foundation's role in helping disabled children achieve their level of independence. Some changing ideas for the foundation's building were presented by the board in every opportunity where all the stakeholders could attend. Since there isn't any architect within the stakeholders, they were so excited when i gave some opinions about the future development and proposed the idea to redesign the building. For the first step to observe the user's need in the building, a designer need to pay any attention to every detail in their activities and habit with a certain method such as behavioral mapping.

Behavioral mapping is a systematic type of observational study that tracks behavior over space and time. Tracking may focus on a particular place or based on individual movements. The results obtained from this technique will be the form of information about a phenomenon (especially the behavior

of individuals and a group of humans) associated with the spatial system.

Behavioral mapping is depicted in the form of a sketch or diagram of an area where humans perform various activities (Sommer, 1986). The goal is to describe the behavior in the map, identify the type and frequency of behavior, and show the link between the behavior and the specific design features. This behavioral mapping can be done directly at the time and place where the observations are made or done later based on the records performed

Based on The Ittelson Principal, behavioral mapping, in general, will follow the procedures of the five basic elements, namely:

- 1) The basic sketch of the area or setting to be observed
- 2) Clear definitions of behavioral forms to be observed, quantified, or described.
- 3) One clear time plan at which the observations will be made.
- 4) A clear systematic procedure shall be followed during the observation.
- 5) An efficient coding system to further streamline work during observation.

The types of behavior that are mapped as follow:

- 1) Travel pattern
- 2) Migration
- 3) Consumptive behavior
- 4) Household activities
- 5) Neighbouring
- 6) Use of various public facilities (eg pedestrian, open space, etc.)

There are two ways to conduct behavioral mapping (Ittelson et al., 1976), namely:

a) Place-centered mapping (Mapping by place)

This behavioral mapping technique is used to find out how humans or groups of people accommodate their behavior in a given situation at the certain time and place. This technique shows how people adapt in a particular location. The main point of this technique is the place must be specific in any size.

The first step to be done is to sketch a place or a setting includes all of the physical elements that are predicted to affect the user's behavior. Researchers can use a pre-made base map and they should be familiar with the observed place.

The next step is to create a list of behaviors to be observed and to specify a sketch symbol or mark for each behavior. Then, in a certain period of time, the researcher notes the various behaviors that occur in the place by drawing symbols on the prepared base map.

b) Person-centered mapping (Mapping by behavior)

This technique emphasizes the movement of people at a certain period of time. This technique will be related to not only one place or location but also in multiple places or locations. Researchers are only dealing with someone specifically observed. The first step to do is selecting a sample of a person or group of people to be observed. The next step is to follow the movements and activities performed by the selected object. This observation can be done by making sketches and notes on a prepared base map. Observations can be done continuously or only

on certain periods only, depending on the purpose of research.

The new design is expected to meet the user's requirement and still apply the appropriate design standards for the disabled by considering an environmentally friendly design, such as therapeutic garden.

Therapeutic Garden as a Therapeutic Spaces for Disabled Children

Therapeutic Garden is a garden or park that has an adapted environment adjusted to specific behavior that wants to be formed in the area, the activities are usually in the form of physical therapy. This park is designed specifically to facilitate the users in it. It can also be specially designed for children with disabilities (either temporarily or permanently disabled), patients with Alzheimer's disease, for the elderly, inmates, and for patients in hospital (Epstein, 2011)

The landscape elements arrangement of a therapeutic garden focuses on vegetation, landscape elements, and even wildlife by combining eco-friendly aspects into an outdoor therapy spaces. The landscape arrangement incorporates landscape elements suitable for therapeutic activities. This type of therapeutic garden is also diverse, tailored to the needs of therapy desired by the user. In the park, they can apply five types of efficient learning styles for therapy, namely deductive, inductive, visual and auditory, impulsive and reflective (Thomson et al., 1994).

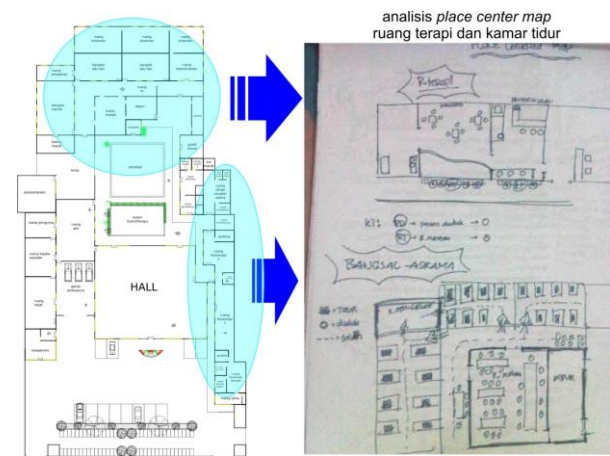
The National Park of Singapore added that Therapeutic Gardens are outdoor gardens designed to meet the physical, psychological and social needs of park users, incorporating design principles derived from scientific evidence. The garden's type itself is

differentiated based on the type of users and therapeutic facilities that will be provided in the park area. For example, Alzheimer's Gardens, Cancer garden, Healing garden, sensory garden (garden that contains elements of the landscape can stimulate the body's senses), and rehabilitation-garden (rehab park).

The types of landscape elements within the park are also tailored to the intended therapeutic goals as well as its users. For example, textured paths, handrails available in places of circulation with security needs for persons with disabilities who need assistance for movement, a water-proof or hand-planked element to train sensitivity users, even by providing some children's games that can train their motion and motor skills.

3. Results and Discussions

The first survey was conducted in 2011, author decided to use Place Center Map method to help the observation process in YPAC Surakarta. Author selected some areas that oftenly used by the occupant such as Occupation Therapy room, Physioterapy room, 'Pendopo', Hydrotherapy pool, and disabled



children's dormitory.

Figure 3. Place Center Map Therapy Rooms and Disabled Children's Dormitory

From Figure 3. it could be seen that the majority of dormitory's activities were centered on the bedroom, tv room, and dining room. Meanwhile, at the Therapy room, the users (consists of doctor, nurses, disabled childrens, and the children's family member) were mostly gathered at certain corner where the therapy tools were placed.

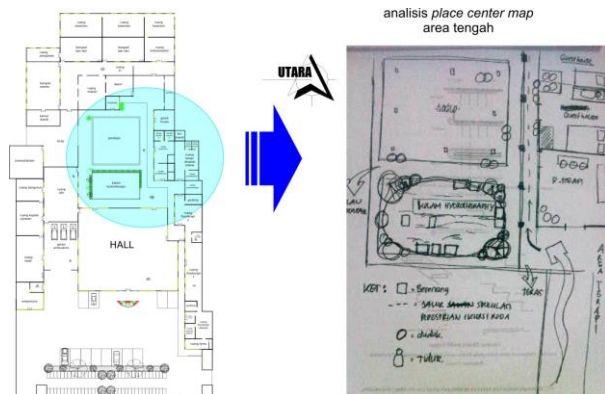


Figure 4. Place Center Map 'Pendopo' and Hydrotherapy Pool

As seen in the Figure 4, the user's activities were centered around the therapy area, hydrotherapy pool and guest house (located near the dormitory). The 'Pendopo'-A Javanese-style pavilion-area is fulfilled with some children's unused equipment, the place was not working properly, therefore it must be replaced with a new space that could be more useful.

Based on the explained point of Post-Occupancy Evaluation (chapter 2), these are details about three evaluations of YPAC's original Building that should be considered for the redesigning process:

a) Functional Evaluation

Some of rooms in YPAC Surakarta didn't properly use as its purpose and didn't consider universal design criteria in them. It might because of the management ignored comfort and different type of access for disabled children that couldn't be equated as normal people. It was also because the lack of feasibility study that should be able to accomodate the user's need-in this case is disabled children.



Figure 5. Unused 'Pendopo' at The Centre of YPAC Surakarta's Site.

The first example is the 'Pendopo' building located at the centre of the site. This area should have became the focal point of the building since 'Pendopo' originally located in front of traditional javanese building and usually became gathering spot for the occupant and neighbours. Ironically, 'Pendopo' in YPAC Surakarta portrayed as unused playground and it has strong ancient impression. From the interview, the staf told author that in its first year, this place actually became center of interaction between the disabled children and people surround them.

b) Technical Evaluation

The highlight of this evaluation was on its building system such as doors, windows, plafonds, elevation, corridors, and floor textures. As we can see on Figure 6, some of the rooms didn't get proper lighting and good quality of indoor-air because some parts of the rooms were dark and according to the interview, the user who usually use the rooms, feel uncomfortable and stuffy.



Figure 6. (top) YPAC children's dining room; (bottom) YPAC children's dormitory and workshop.

Some of the doors and windows in this building are mostly retained from the original assets, although they might have been renovated or painted. However, the orientations and dimensions of the doors and windows are not feasible for the health yet since it can be seen in figure 6 that the daylighting seemed poorly obtained in those rooms. As for the ceiling and roof design, the ceiling distance to the floor height is about 3-4,5 m, which supposed to be suit with the national standard for healthy building, yet the occupants still felt stuffy since the surround of the rooms didn't have proper vegetation to give fresh air into those rooms.

Other things related to the technical aspects that need to be improved are the floor textures, mostly use glossy ceramics and cracked cement, in the rooms and corridors which didn't suit for wheelchair because they are slippery. We only can find few ramps inside the building which are also didn't have safety railing that should have been installed to help the people in need.

The hydrotherapy pool located in the center of the building site and the center for outdoor therapies for children with disabilities is included in the therapeutic element that is actually owned by this foundation. But because of the low availability of open space, the park around this pool does not look so prominent and does not work well. If there is an empty area that can be utilized, this garden can be developed into a therapeutic garden that can help the therapy programs in the foundation.

c) Behavioural Evaluation

From the early observations, the most visible activities of the students are in the extraordinary school area, the tv room, the skill room, the dormitory, and around the hydrotherapy pool. Those are enough to prove that the kids are more interested to be in a place that have fun atmosphere and attractive. Some of the kid's characters are quiet and prefer to be in a quiet place like the bedroom, as well as the library even though other kid are more active, humble, and always want to play with their friends. Unfortunately, The 'Pendopo' that was originally planned to be functionated as their gathering place, couldn't properly use.



Figure 7. Situation in Extraordinary School in YPAC Surakarta
 (source: solopos, SLB-YPAC Surakarta)

After compiled various literature and survey, author decided to redesigned unused spaces in some areas of YPAC Surakarta building that resulted negative perception from the user (obtained from interview and documentation) while maintaining some original spaces that still have big potential to be the user's favourite such as the hydrotherapy pool and the main hall. The design development focused on the middle area (The 'Pendopo' and its surrounding), the north area of the dormitory, and the medical treatment area.

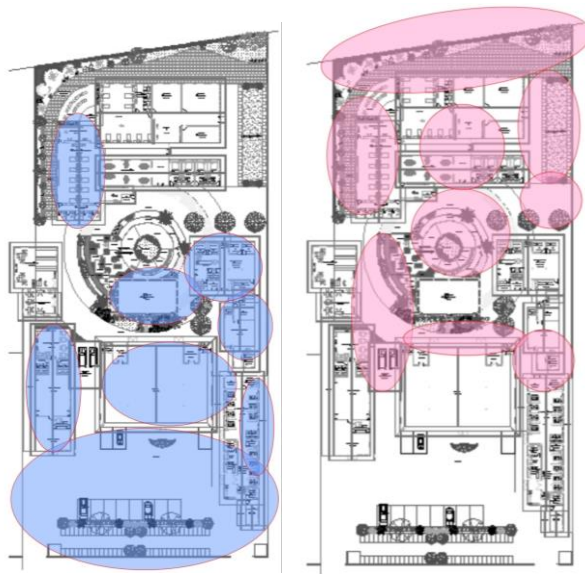


Figure 8. (Left) Maintained Area; (Right) Redesigned Area

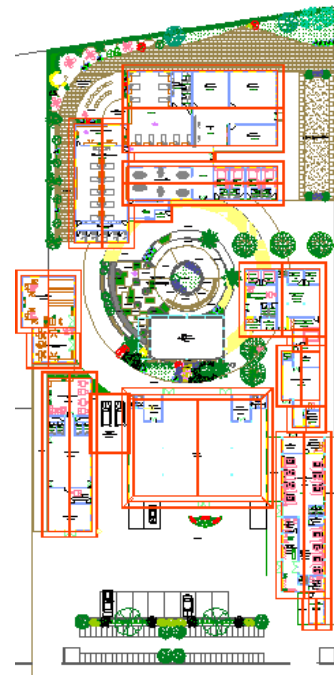


Figure 9. Final Redesign Concept of YPAC Surakarta

4. Conclusion

Behavioural mapping method applied in this project could describe and draw the user's activities, especially for disabled children who need different design than normal people. Through this method, a designer could properly know the user's need and decide which part of the original building that actually need some renovations or to be maintained. After did three steps evaluations of Post-Occupancy Evaluations (POE), a universal design concept-that was portrayed in Therapeutic Garden concept-was proposed as the main concept of the redesigning process for YPAC Surakarta. The garden later be expected could accomodate the disabled children's need in their daily and therapy activity at once [10].

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Thank you for YPAC Surakarta Staffs that became author's primary source for this project and to all disabled children who will always fight for their best future they could create with their own dignity.

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