

Designing Furniture that are Aware of Noise Absorption Case Study of Library of Jakarta

Theresia

Department of Interior Design, Faculty of Design,
Universitas Pelita Harapan, Indonesia
tarawidjaja@gmail.com

Bambang Tutuka

Department of Interior Design, Faculty of Design,
Universitas Pelita Harapan, Indonesia
bambang.nugroho@uph.edu

Kuntara Wiradinata

Department of Interior Design, Faculty of Design,
Universitas Pelita Harapan, Indonesia
kuntara.wiradinata@uph.edu

ABSTRACT

Library is an institution that is tasked with collecting, managing, storing, disseminating and preserving information. One of the new library destinations at this time is the Jakarta Library which is located in Taman Ismail Marzuki as one of the components in the TIM cultural area. The Jakarta Library is designed with an achievement strategy to be a place where communities can gather, learn and develop together. In the Jakarta Library, right next to the book reading area, there is a children's area, where they spend their time reading books and playing. The relationship between the children's and adult areas of the library is an interesting consideration. Based on data and surveys conducted by the author, there are complaints about noise from children. The most important factor that can support the success of a library is how to make library visitors feel comfortable in the library. This comfort requires changes in supporting facilities that can make users comfortable in the library with "noise control". A caring attitude towards noise attenuation can minimize the occurrence of excessive sound disturbances, disturbances that can interfere with the concentration and focus of readers in the library. Through this research, it is expected that noise control becomes an important thing to consider for the comfort of library visitors. The way that can be done is by designing and changing the interior design and furniture in the Jakarta Library that can absorb and direct noise. Furniture is an important consideration considering its function that is directly in contact with space users, space users move according to their needs and each activity requires acoustic considerations for the sounds that disturb or cause them.

Keywords: Furniture Design, Library, Acoustics, Reading Area

INTRODUCTION

A library is an institution responsible for collecting, managing, storing, and preserving information. One of the new library destinations at this time is the Jakarta Library which is located in Taman Ismail Marzuki as one of the components in the TIM cultural area. Taman Ismail Marzuki (TIM) has long been known as a gathering place for artists to express their thoughts and expressions.

In the Jakarta Library, right next to the book reading area, there is a children's area, where they spend their time reading books and playing. Based on data and surveys conducted by the author, there are complaints about noise from children which eventually becomes a problem that needs to be considered and analyzed further. According to Xiao and Aletta (2016) in their article "A soundscape approach to exploring design strategies for acoustic comfort in modern public libraries: A Case study of the Library of Birmingham", many new activities in libraries have led to the emergence of new types of sound and sound sources. Libraries have led to the emergence of different types of sound and sound sources.

Therefore, it is necessary to prevent and protect people from disturbance or danger and negative effects so that library visitors feel comfortable in the library. This comfort requires changes in supporting facilities that can make library users comfortable in the library with "noise control".

Through this research, it is expected that noise control becomes an important thing to consider for the comfort of library visitors. The way that can be done is by designing and changing the interior design and furniture in the Jakarta Library that can absorb and direct noise. Through this consideration, an interactive furniture model is thought of, namely furniture that is able to respond to the needs of its users including the need to control noise.

LITERATURE REVIEW

In this research, the author uses acoustic theory that focuses on interiors and furniture to help focus the research.

1. Acoustic theory that focuses on the interior is taken from the book "Environmental Acoustics" by Leslie L. Doelle (1985). This book describes the control of sound through architectural design to create an environment where hearing can be optimized, both indoors and outdoors, while protecting occupants from excessive noise and vibration.
2. Acoustic theory focusing on furniture is taken from the journal "Design of Indoor Furniture with Acoustic Insulation and Noise Reduction Function" by Ziqiang Chen, Jinahua Lyu, Ming Chen (2018). In this journal they explore innovative furniture designs that provide acoustic insulation and noise reduction and outline several components such as the selection of sound-absorbing materials, structural design and other elements to maximize noise reduction.
3. The theory of human senses and their relationship to architectural experience is taken from the book "Questions of Perception: Phenomenology of

Architecture” by Steven Holl, Juhani Pallasmaa and Alberto Pérez Gómez (1994). Juhani Pallasmaa addresses each of the human senses and their relationship to the architectural design experience. Through the presentation of these senses, the author takes three senses that are considered to have the closest relationship with furniture, namely: the senses of sight, hearing, and movement (vestibular).

METHODOLOGY

Data and needs of Jakarta library users consisting of the general public were identified through qualitative methods. This research is classified as a qualitative method because the aim is to investigate or study an object or place.

In this research, the author investigated the behavior of Jakarta Library visitors by using interviews, documentation and observation for data collection. Data collection with questionnaire filling techniques is carried out with the aim of supporting qualitative methods. This data was verified through the process and results of testing/experiments with the aim of corroborating the design method.

RESULT & DISCUSSION

The Jakarta Library is located at Jalan Cikini Raya No. 73, RT.8/RW.2, Cikini, Menteng District, Central Jakarta City, Special Capital Region of Jakarta 10330. In this research, the author uses the adult reading area near the children’s area as a case study. The individual reading area is intended for readers who want to study or complete certain tasks with the help of the library’s book collection.

A. Interior Design

Through the survey data, profiles and theories that have been collected, a design thinking structure emerged that was also formed based on the vision and mission, visual branding and also the existing location of the Jakarta Library architects.

I) Interior Design Concept

The concepts used in this interior design are “distributed” and “engaged”. Distributed means creating easy access from one space to another in a unified manner. Engaged means encouraging user participation and involvement, creating a two-way interaction without a passive experience.

II) Interior Color and Material Concept

The design concepts of ‘mature’, ‘earthy’ and ‘modern’ embrace the essence of nature by creating a harmonious and timeless aesthetic. This design concept perfectly blends maturity and modernity.

The library concept also incorporates elements of Betawi culture. Quoted from the journal by Purbasari et al (2016) entitled “The Dynamic of Betawi in Colors” that red, green, blue, orange, yellow, black and white area colors that are always present (dominant) visually adorning almost every Betawi art and culture.

III) Interior Shape Concept

The shapes and spaces in this design layout use a combination of basic geometric shapes, such as square or box shapes which then experience a rhythm of repetition to form a grid layout.

IV) 4th Floor of Jakarta Library Layout



Image 1 4th Floor of Jakarta Library Layout . (Source: Widjaja, 2023)

The layout concept on the 4th floor of the Jakarta Library maintains an open-plan concept so that the flow of visitors continues to run with flexibility. There is a circulation area where visitors can borrow or return books. Directly opposite, there is an active reading area that is specialized for active activities such as talking, moving and other activities with a larger sound category (>60 dB).

The staircase area of the library in its existing condition is still maintained as an attraction of this library as well as a link to the 5th floor and a barrier between the active and quiet reading areas. Behind the staircase area there is a work area and reading area for teenagers and adults (quiet reading area(for visitors who come to work or read with a more focused and quiet atmosphere (45-50 dB). A children's area is also provided and the book collection is maintained next to the reading area to challenge any 'noise' that may arise.

V) Layout Design of Specialized Room (Adult Reading Room)

Ceiling

Acourete Noise Armour as the underlayer and outer layer using Knauf Cleaneo Acoustic Tiles 12/25 R. In this hallway there is the use of BAUX Acoustic Wood Wool material.

Wall

The room divider in this area uses Acourete EchoBaffle product which is a soundproofing panel that focuses on damping high frequency sound to reduce reflections.

Floor

The floor in this area uses ½" forma cork underlay with IIC (48dB) stc (49) and ½" cork floating floor IIC (19dB).

B. Furniture Design

I) Space Requirement

At this stage, space requirements are made to create a table that can be used for reading, using a laptop/tablet, and writing. The table is 1200 mm wide and 60 mm deep.

II) Adult Reading Room Desk Concept

Transparent: the concept of transparency refers to how the workings, processes, and intentions behind products and systems are made clear and understandable to users.

Interactive: refers to the practice of creating furniture, systems and experiences that actively engage users and allow them to participate, manipulate and influence outcomes.

III) Adult Reading Room Table System Study

1. Gas Spring System Study

The idea is to provide easy access for the user by simply pushing the panel to raise and lower the panel height.

2. Tambour System Study

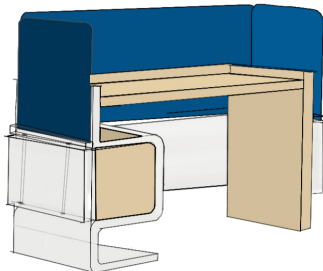
A tambour panel is a flexible panel unit that slides horizontally and can be used in curves offering a useful solution for awkward angles.

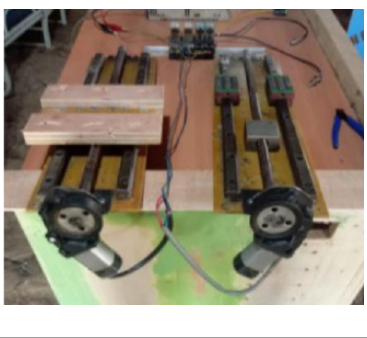



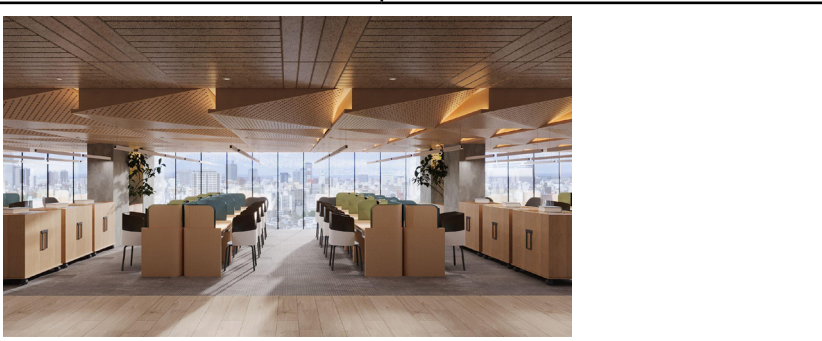
3. Actuator System Study

This development uses an electric actuator system. The idea was to make the vertical movement system automatic with the help of a button controlling the actuator.

IV) Adult Reading Room Table Development Study

Table 1 Table Furniture Progress Development. (Source: Widjaja, 2024)

Development	Image	Analysis
Development 1		<ul style="list-style-type: none"> -Easy to move, adjustable in positioning the workpiece. -Low cost -Duration of upward movement that takes maximum time -Heavy to push -Not strong enough to hold the weight of the panel in vertical position

<p>Development 2</p>		<ul style="list-style-type: none"> -Ability to start and stop instantly with no dead time or position overshoot -Work consistently and unaffected by load -The noise generated is a nuisance to users -Duration of upward movement that takes a long time
<p>Development 3</p>		<ul style="list-style-type: none"> -Easy to operate by pulling -Works quite well in indented areas -Still often hampered in indentation area -Plastic as module connection often “snags”.
<p>Development 4</p>		<ul style="list-style-type: none"> -Minimalist and solid -Works consistently in curved areas -Slightly hampered in some areas due to the confluence of wood and acrylic
<p>Development 5</p>		<ul style="list-style-type: none"> -Fabric as a replacement for plastic works better due to its limp nature -Sliding system works smoother -The rails are not yet smooth, so the sliding system is not 100% perfect yet.
<p>Final Look</p>		

VI) Pre-test and Post-test

The pre-test and post-test were measured using the theory of Pallasmaa, et al (1994) in their book "Questions of Perception: Phenomenology of Architecture".

1. Sight

The interviewees stated that the table looks heavy with 3 table legs that block the leg space on the table. In addition, the choice of wood material gives a touch of natural and neutral elements with a texture that seems warm.

2. Hearing

- **The engine noise in the actuator system creates a sound that is still quite loud.**

While a single desk may not disturb your ears, if a large number of desks are placed in an adult reading room, the noise can be quite loud. Placing soundproofing around the system is also less effective as it generates heat. Further thought could be given to a system that has a smaller sound potential.

- **The panel sliding system is still hampered; one has to stand and hold both panels and slide.**

Inclusion of the same two materials, acrylic, in the rails and panels. Through development in the third and fifth workshops, the application of wheels is effective but will require a larger rails hole spacing—which means the base thickness will increase.

- **The sliding system on the panel is less effective because it provides an opportunity to talk to people nearby.**

It is important to create a balanced library environment with concreation and social interaction and exchange of ideas. An environment that is too quiet may hinder opportunities for social interaction or collaborative study. A room that completely eliminates sound makes a person feel isolated (Freeman, 2005), so the solution is a consistent balance of interaction and silence.

3. Movement

- The location of the actuator system makes the need for an additional box that ends up giving more "bump" in the table leg. By adapting to Pallasmaa's theory in the book "Questions of Perception: Phenomenology of Architecture" (1994), the problem provides a physical and psychological result both physically and psychologically. Physically, the user can feel the compact size of the table furniture through tactile sensations, such as feeling cramped or limited in their movement.

→ Respondents didn't feel that the machine "box" was a nuisance, still comfortable. Not a nuisance due to its position out of reach of the feet.

- 2 respondents said that the table was too wide and the sense of privacy was lacking.

→ The table has gone through the space the requirement stage with 120 x

60 cm as the optimal size. The table still wants to give them “breathing space and flexibility to look around. The width of the table is optimal to accommodate the needs of users in the reading room. A table that is too close will give a sense of restraint and enclosure.

Experiments on the prototype table were also made to test how capable the table furniture is in reducing noise. From the post-test results, with the lowest height panel at 66.3 dB and at the maximum height panel at 62.6 dB. Why the slight noise reduction?

1. The inner layer still uses a substitute material that is less than optimal in reducing noise, namely foam.
2. Use of HPL. This is intended to enable the panel to meet the technical requirement of being able to stand upright. However, HPL is generally smooth and non-porous, which limits its ability to absorb sound energy effectively. Sound-absorbing materials typically have porous or fibrous surfaces that provide a larger surface area for sound energy to interact with and dampen (Doelle, 1972).
3. Post-test environmental materials. The materials on the floor, walls and ceiling of the post-test venue can be classified as non-absorbing.

Is it in line with the objective of this research? Technically, the presence of the up and down system allows the panel to be camouflaged with the table when not needed, making it quite practical. The experiment with not using any base on the panel also made it easier to remove the panel.

This desk is also compact by accommodating the user’s needs in activities while preventing acoustic problems, so it works simultaneously.

CONCLUSION

1. A table that incorporates a noise reduction system is an effort to fulfill the compact point in the research objectives. The system is also made to operate with minimal motion, providing practicality for users. There is an effort to encourage controlled interaction, creating a balance between privacy and social engagement.
2. The rudimentary materials and hampered system still make the practical point far from being achieved. The post-test proved that users still find it difficult to operate the mechanism and the impacts that arise also hinder the user’s work.

In the process of designing furniture, the author tried various ways to apply a good mechanism for the table. This table furniture is very centered on the system and mechanism, so it is necessary to do more exploration of existing ones. The actuator system is not the best system and the author felt when the system was installed and run, even until the post-test was held. However, it was not easy to find the right system that could lift the rails and the can lift rails and acoustic panels that are quite heavy. Exploration of the systems and mechanisms need to be reproduced and

the author also feels that asking furniture experts or builders directly to furniture is also very helpful, as they are already familiar with the system and experienced in the production process. That way, perhaps the exploration of development can be more and can learn the advantages and disadvantages of the system.

One of the most noticeable realizations was during the post-test and seeing users directly interact with the table furniture. Involving end users and soliciting feedback from them during the design process is very important in creating furniture that truly suits their needs and preferences. By listening to their experiences and incorporating their suggestions, the author can identify areas for improvement and iteratively refine the furniture design to better suit their expectations of the users. The author realized the importance of furthering my understanding of acoustic principles and technology to create a more effective solution.

In conclusion, designing acoustic furniture for the library reading area has been a transformative experience, shaping the author's perspective on the intersection of aesthetics, functionality and user experience. Through collaboration, reflection and a commitment to continuous improvement, the author is confident that future design endeavors will result in furniture solutions that not only enhance the visual appeal of the library space, but also contribute to a more conducive and immersive reading environment for all users.

REFERENCES

- Basuki, S. (1991). Pengantar Ilmu Perpustakaan.
- Bhattacharya, A., Talbott, N., & Kincl, L. (2001). Occupational ergonomics: Principles and applications. doi:10.1002/0471435139.tox104
- Bridger, R. (2003). Introduction to Ergonomics. 548
- BSN. (2020). Konservasi energi pada In Patty's sistem https://Spada.Uns.Ac.Id/Pluginfile.Php/822446/Mod_resource/Content/1/SN1%206197_2020_Konservasi%20energi%20pada%20sistem%20pencah_230216_092121%20%281%29.Pdf.
- Buren, M. Van. (1965). Design of Library Toxicology. pencahayaan. Furniture. <https://Core.Ac.Uk/Download/Pdf/4815534.Pdf>.
- Chen, Lyu, & Chen. (2018, May). Design of indoor furniture with acoustic insulation and noise reduction function. Research Gate. Retrieved May 20, 2024, from https://www.researchgate.net/publication/325340748_Design_of_indoor_furniture_with_acoustic_insulation_and_noise_reduction_function
- Felton, E., et al. (2012). Design and ethics: Reflections on practice. Routledge.
- Freeman, G. T. (2017, January 4). *The library as place: Changes in learning patterns, collections, technology, and use*. CLIR. <https://www.clir.org/pubs/reports/pub129/freeman/>
- Gibbs, A. (1997). Focus Groups. <https://Sru.Soc.Surrey.Ac.Uk/SRU19.Html>.
- Holl S et al. (1994). Questions of Perception: Phenomenology of Architecture. William Stout. 27-37.
- Howard, G. (2017, October). "Out of the Box: Pros and Cons of the Open-Plan Office for Startups. , Www.Businessmagazinegainesville.Com/

- out-of-the-Box-Pros-and-Cons-of-the-Open-Plan-Office-for-Startups/.
- Kobayashi, S. (1998). *Colorist* (L. Lowitz, Ed.). Kodansha International.
- L. Doelle. (1993). *Akustik Lingkungan*.
- Mappiare, A. (1983). *Psikologi orang dewasa bagi penyesuaian dan pendidikan*. Usaha Nasional.
- Mattern, S. (2007). Resonant texts: Sounds of the American public library. *The Senses and Society*, 2(3), 277–302. doi:10.2752/174589307x233521
- Mekawa et al. (2010). *Environmental and Architectural Acoustics*. CRC Press.
- Nasional, Perpustakaan. (2011). *Standar Nasional Perpustakaan (SNP)*.
- Neufert, E. (2005). *Data Arsitek : Jilid 2*. In *Nucl. Phys.* (Vol. 13, Issue 1).
- Panero, J., Zelnik, M. (2014). *Human Dimension and Interior Space: A Source Book of Design Reference Standards*. United Kingdom: Clarkson Potter/Ten Speed.
- Rosenbaum, J et al. (2006). Fine-tuning the acoustics of libraries at colleges and universities. https://www.researchgate.net/publication/272319721_Finetuning_the_acoustics_of_libraries_at_colleges_and_universities.
- Sarah Kaplan. (2014). *Mixing Quantitative and Qualitative Research Handbook of Innovative Qualitative Research Methods: Pathways to Cool Ideas and Interesting Papers*, Kimberly Elsbach and Roderick Kramer, eds. SSRN.
- Sloan et al. (2009). *Library Services for Older People - Good Practice Guide*.
- Souza, E. (2021). *Keys To Improve Architectural Acoustics: Sound Absorption and Diffusion*. 1. <https://Www.Archdaily.Com/912806/Understanding-Sound-Absorption-and-Diffusion-in-Architectural-Projects>.
- Suwarno, W. (2010). *Dasar-dasar ilmu Perpustakaan sebuah pendekatan praktis* (A. Safa, Ed.). Ar-Ruzz Media.
- Tarwaka, Solichul, H., & Sudajeng, L. (2004). *Ergonomi untuk keselamatan, kesehatan kerja dan produktivitas*. UNIBA.
- Wang, P., Xu, J., & Wu, Y. (2019). Preschool children's preferences for library activities: Laddering interviews in Chinese public libraries. *Library & Information Science Research*, 41(2), 132–138. doi:10.1016/j.lisr.2019.03.001.
- Xiao, J., & Aletta, F. (2016). A soundscape approach to exploring design strategies for acoustic comfort in modern public libraries: a case study of the Library of Birmingham. *Noise Mapping*, 3(1). <https://doi.org/10.1515/noise-2016-0018>