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Shifting from Static to Hybrid Architecture Through Flexible Spatial Systems

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Abstract.
The rapid pace of urban change and architecture in a constant state of flux have made traditional and static design strategies struggle to adapt to dynamic environments. Prescribed and predictive programs often become obsolete as they no longer correspond to their intended function and representation, making architectural hybridity increasingly important. Hybridity here focuses on multifunctional spaces, approaching the disjunction of events across 15 public building types to identify the interchangeable relation of their essential elements. Similarities of their essence then are formed as conjunctions into a spatial organization catalogue through flexible strategies such as open-plan configurations, double-helix ramp systems, modular furniture systems, and platform mechanisms capable of accommodating diverse activities within a single structure. This design approach aims to maximize space utilization so it can be easily reconfigured to suit different activities and foster more vibrant and dynamic spaces. By manipulating conflict and combining shared essentials through flexibility and modular systems, this approach offers new spaces and realities.

Keywords: *flexible; hybridization; modular; multifunction*

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1. INTRODUCTION

This study explores the design process of hybrid architecture in respond to static spatial functionalities. Human life activities are becoming increasingly complex, and the acceleration of changes in the physical environment, coupled with the radical and dynamic use of space, has led to the shortening of building institutions' lifespans. Consequently, architecture can no longer be contained within a static order of symbolic buildings and spaces (Rogers & Gumuchdjian, 1998). The requirements of modern life are so complex that cultural, social, environmental, and economic contexts are in constant flux, and any attempt by designers to anticipate all future needs in the results of prescribed and predictive plans and programs does not work and becomes obsolete due to being unsuited to their function and representation (Forty, 2000; Kassem, 2022). Unplanned functions and uses inevitably emerge within architectural spaces, challenging the original spatial qualities and intended program (Kassem, 2022). Thus, architecture should be viewed through the lens of a narrative of events, the existence of being capable of communicating with people, undergoing constant development and change, and engaging in a continuous growth process (Hong, 2020).

As Bernard Tschumi says, "Architecture never conveys a singular story" (Tschumi, 2003,

p.23); rather, there are always events within events, just as there are forms within forms (Gibson, 1986). Knowing that architecture is seen not as a static container, a singular event, or a singular product but as a dynamic product of multiple interactions between objects, materials, and humans, thus different event patterns can coexist within a single space simultaneously (Hong, 2020; Hansmann, 2021). It reinforces the idea that space in architecture is not merely a geometrical entity but is intrinsically linked with use, movement, and dynamic interactions (Tschumi, 2003). As space itself is the essence of architecture (Hansmann, 2021), it cannot exist without activity taking place within it (Tschumi, 2012). In response, the principle for supporting robustness in architecture lies within design settings that enable a variety of activities to coexist harmoniously in the public realm without inhibiting one another (Bentley et al in Alkhansari, 2018).

Therefore, to react to the increasing complexity and unpredictability of human activities, architecture calls for new ways to engage with space, use, and movement. Architecture needs to perform a transformative role by allowing changes in building functions, where spaces are designed to accommodate multiple functions and types of events simultaneously (Jamieson & Hughes, 2015). Exploring hybridity becomes an approach that disrupts expectations and slips between visible and accepted boundaries (Mosley & Sara, 2013; Sara & Littlefield, 2014). Hybrid space with heterogenous character (Ozarisoy & Altan, 2023) offers a potential to support robustness in architecture. Hybrid spaces are indicated in built environments that are required to be flexible, accommodating multiple functions, diverse users, and varied spatial types, therefore generating unprecedented solutions, highlighting the occasionality of function and a heightened sense of publicness and openness (Kassem, 2022; Paramita, 2024). Hybridization itself acts as a displacement technique between form and function, wherein a specific space designed for one function can serve alternative functions dynamically (Hong, 2020).

Flexibility, which aligns with hybridization, thus becomes a critical attribute that allows a space to adhere to one function and then transition to another over time (Paramita, 2022). It is defined as the capacity of built environments to respond to change and reorganize to new requirements (Alkhansari, 2018; Mlote, Budig, & Cheah, 2024). The growing need for flexibility stems from rapid societal changes and evolving user demands (Kim, 2008) and is proposed as a vital necessity in recent architecture (Alkhansari, 2018). Flexibility is necessary not only to accommodate continual change in human life but also to foster variety and innovation of living spaces (Alkhansari, 2018). Flexibility also offered hope of redeeming functionalist architecture from determinism by introducing the dimension of time and embracing the unknown (Forty, 2000). To enhance flexibility, modular systems, especially modular furniture, play an important role, as existing products and systems limit the ways people can interact with and inhabit their environment (Ion Servin in Mosley & Sara, 2013).

Modularity itself is understood as the capacity to offer varied configurations and options, providing flexibility in different dimensions (Temel & Kahraman, 2018; Redyantanu & Sunaryo, 2024), as is the modular furniture that further supports flexibility and enhances the potential to adapt and respond to changes (Garip, Onay, Garip, & Guzelci, 2019; Arisya & Suryantini, 2024). Existing studies rarely provide a clear methodological framework that integrates disjunction and conjunction processes with a flexible and modular system for designing hybrid architecture. This research then addresses these gaps by offering a structured catalogue of spatial possibilities derived from public building activities and demonstrating how flexible and modular systems can strengthen architectural robustness by opening new opportunities for rethinking the relationships between space, program, and movement that are implemented within a single structure. The research highlights how the shift from static to hybrid architecture can offer innovative solutions for the future of spatial design and better responses to the dynamic demands of contemporary needs.

2. METHODS

This research adopts a research-by-design methodology, emphasizing the exploration process of design and making to establish new understanding and knowledge through a cataloging diagram as a design process that reveals the design thinking (Verbeke, 2013; Karimah & Atmodiwirjo, 2021). The research begins with conducting a literature review on architectural building types, specifically focusing on public buildings that are neither functionally transitory, such as airports or stations, nor privately controlled, such as residential buildings or industrial factories. The exclusion of transitory and private-use types is intended to focus on structures with consistent occupancy by multiple users. Out of 8 different building typologies, 15 building types are then chosen as representative of various public buildings with different functions to find out their essential activities. From this review, the researcher then categorizes the essential activities of each public building type based on the disjunction of events between use, form, and social values that suggest the interchangeable relations between objects, movement, and actions (Tschumi, 1996).

The disjunctive process further breaks down the elements of each event to find out their respective aspects, such as supporting objects, number of users, sound levels, and time of activity. After identifying their essential elements, the research then moves into the conjunction phase. The conjunction phase is described as combining compatible activities based on shared attributes or elements from the disjunction phase, as multiple activities are compatible because they are derived from a common essence and meaning (Alkhansari, 2018). The conjunction process begins by looking at the similarities in the essence and meaning or function of each disjunction element, which are then catalogued into a spatial organization that is sorted based on the acoustic levels. The catalogue of conjunctions of events was then arranged within a flexible layout and modular system strategies that are further sorted to enhance hybrid design systems by manipulating conflict and combining two or more opposites, and to be able to accommodate diverse functions within a single structure.

The flexible strategies implemented in the systems include open-plan configuration within circular layouts, which are supported by double-helix ramp systems, modular systems interpreted as modular furniture, and platform mechanisms that serve as operable elements placed within central voids acting as common space between adjacent units and extended space, thereby allowing hybridity to occur (Kim, 2008; Alkhansari, 2018; Mlote, Budig, & Cheah, 2024). The modular furniture mentioned here is derived from disjunctive parts of objects associated with each essential event and is translated into modular furniture to further enhance the occurrence of multifunctional events. By manipulating conflict and combining two opposites, these design strategies then serve as hybrid tactics, offering new spaces and realities. The research method is then described as in Figure 1.

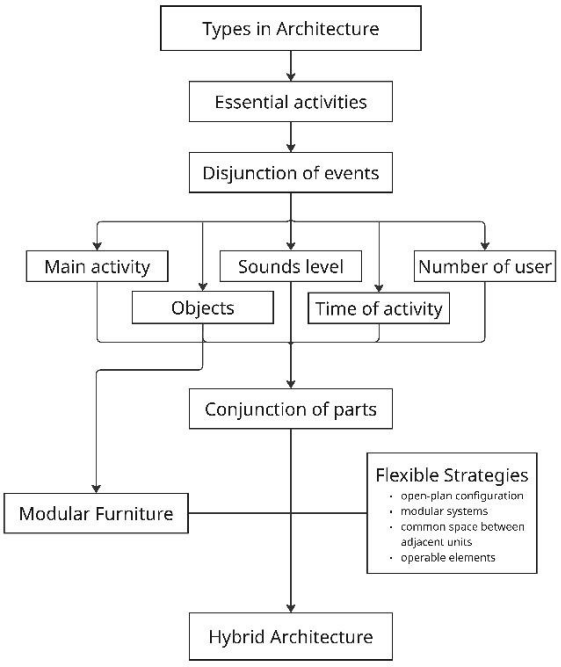

Figure 1. Research Method

3. RESULT AND DISCUSSION

3.1 Disjunction of Events

This section presents the disjunction of events, an operation used to isolate and analyse the essential characteristics of the activity of different architectural programs. This

methodological disjunction was carried out through a literature-based typological analysis, with a focus on public buildings for their potential for overlapping user engagement and activities, which sets the possibility for hybridization. The literature review draws upon the foundational typological classification presented in Chiara and Callender's seminal works on standards for building types (Chiara & Callender, 1990). By operating a disjunction from 8 building typologies, 15 public building types are chosen, such as schools, museums, libraries, theatres, hospitals, churches, courthouses, police stations, offices, banks, supermarkets, restaurants, hotels, nightclubs, and sports centers, to further analyze their essential activities and determine their spatial element and operational parameters. The aim was to catalogue the essence of activities occurring in these spaces, examining their key parameters such as supporting objects, user density, sound level, and the time of activity to create a database of events abstracted from their conventional architectural containers, as illustrated in Figure 2.

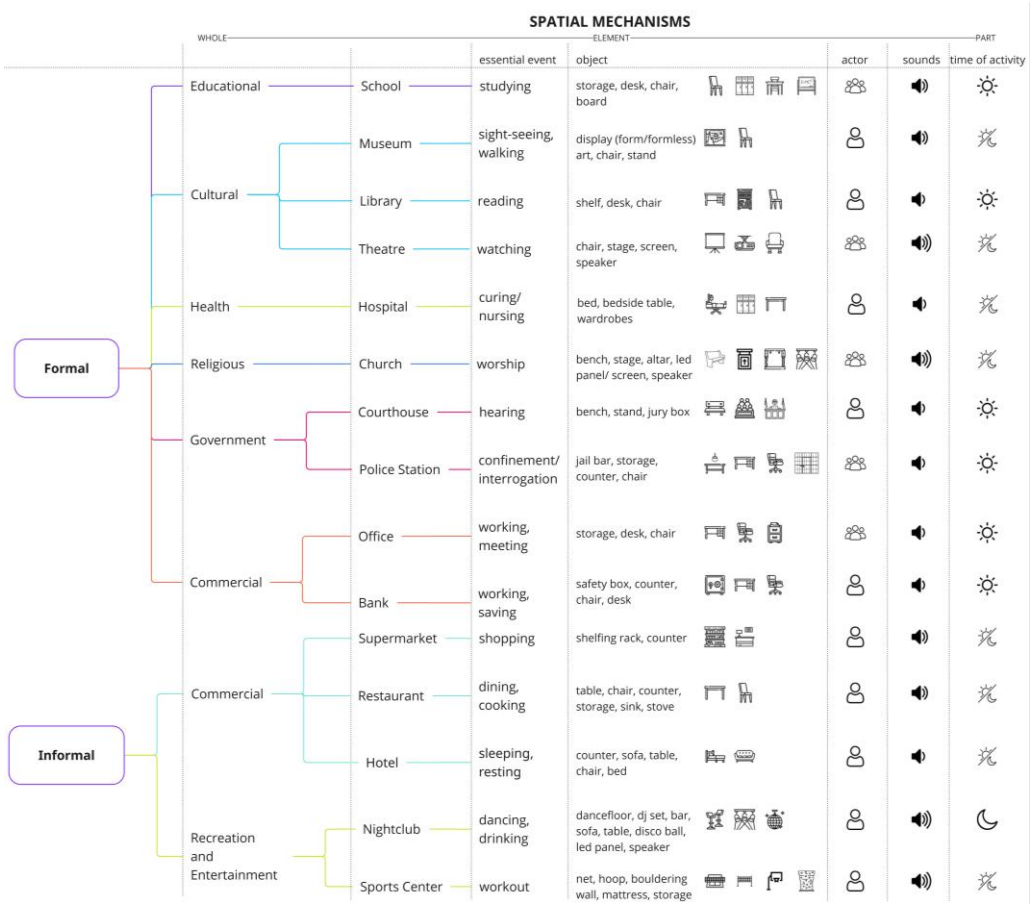

Figure 2. Disjunctive Cataloging Diagram of Activities

Temporally transitory structures like airports or train stations were excluded from the research because they lack a singular, essential event or function and are shaped primarily by momentary occupancy, as their programming emphasizes movement rather than inhabitation. Similarly, residential spaces and industrial factories were excluded due to their intimate, privatized, and highly personalized nature that discourages communal interaction or shared multifunctionality. Each essential activity within the selected public building types was therefore reframed not in terms of its expected spatial manifestations, but through the required parameters to sustain it. For instance, a church, a theatre, and a courtroom proceeding all share needs for seating arrangement, acoustic clarity, and visual orientation, but differ in their object interactivity. This catalogue then facilitates the breakdown of programmatic rigidity, allowing for later reprogramming or, in this research, to be conjunct based on shared essentials rather

than fixed function. It also revealed potential overlaps between activities that are traditionally considered distinct and suggested the possibility of interchangeability and fluidity in the relationship between object, movement, and action (Tschumi, 1996).

3.2 Conjunction of Parts

Following the disjunction analysis, the next phase of the research is conjunction, or the reassembly of disintegrated activities into functionally compatible clusters. The conjunction approach is grounded in the theoretical notion that multiple activities are derived from a shared common essence and meaning (Alkhansari, 2018), which emphasizes the potential embedded in the shared essence of different activities. The conjunction process starts with an analysis of individual activities to comprehend the hybrid programming potential by aligning them with their overlapping spatial and operational needs, as illustrated in Figure 3. Spatially, the conjunction was implemented by grouping events based on their similar spatial needs. For instance, hospital rooms and hotel suites, despite their different societal functions, both require private, low-noise environments and beds as their main supporting objects. Similarly, hearing rooms, auditorium halls, worship spaces, and party halls share similar user capacity and acoustic demands, albeit on varying scales.

The conjunction analysis was used not only to determine how spaces relate to one another but also to inform the overall spatial organization, which was further sorted by acoustic levels, ranging from low-noise intimate spaces to high-noise public areas. This gradient of acoustic levels helps determine the programming zoning of the building, as illustrated in Figure 3, activities once tied up to separate building types can now coexist with each other. The extension of existing building type sides then served as spaces for needed parts in the main structure through connective gates, as seen in Figure 4.

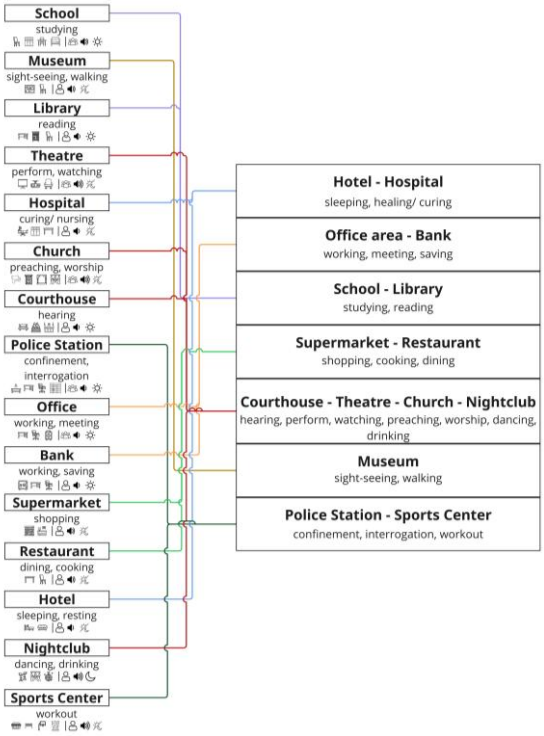

Figure 3. Conjunction of Activities

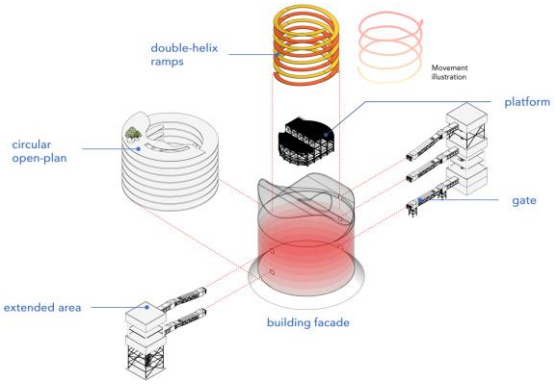

Figure 4. Public Building with Implementation of Flexibility Tactics and Methods in the Structure

3.3 Hybridity Through Flexible Systems

With the spatial program established through disjunction and conjunction analysis, the next phase of the design process focused on embedding flexibility as a tool to accommodate multifunctional and hybrid uses. An extensive review of architectural literature revealed numerous tactics for embedding flexibility, including open-plan layouts, prefabricated modules or modular systems, similar spaces, extendable and detachable units, common spaces between adjacent units, operable elements, portable furniture, arrangement of spaces, personal/public adaptation, and erasing programs (Kim, 2008;

Alkhansari, 2018; Mlote, Budig, & Cheah, 2024). From this wide range of strategies, several were adopted and reinterpreted to suit the project's goal, prioritizing open-ended spatial uses, the capacity for continuous transformation, and user empowerment to enhance hybrid architecture, as illustrated in Figure 4. The first strategy incorporated was a circular open-plan configuration, chosen for its potential to promote fluid movement and uninterrupted continuity throughout the structure. This layout was further enhanced by the integration of double-helix ramp systems, which connected various layers of buildings.

The plan also minimized rigid partitions or static enclosures by allowing furniture as spatial dividers between complementary functions. By minimizing architectural barriers, it maximizes flexibility by allowing spaces to evolve organically in response to user behavior and emerging needs.

Therefore, the next key strategy was the use of modular systems, particularly through modular furniture to support further diversity of activities in the margins of building programs that rely on portable, retractable, or foldable furniture, which can be moved, contracted, or expanded as needed (Alkhansari, 2018). These modular elements played a critical role in expanding the programmatic potential of activities in the structure. These modular furniture solutions are essential to the design model for achieving spatial flexibility, as they offer numerous configurations that accommodate a wide range of activities (Garip, Onay, Garip, & Guzelci, 2019).

Components of modular furniture used were derived from the disjunctive analysis, where each activity was examined closely for its essential supporting objects. Modular elements used here were cube-shaped with a size of 40cm x 40cm x 40cm to support the general sizing element height. These modular elements can then be combined according to the needs and height requirements based on the activity that they are used for, like sitting, dining, as a speech platform, as a base for sculpture placement, as a dancing platform, as a bed, acting as a net for sports, as a climbing wall, or as a temporary confinement when they are stacked. They were then categorized into 5 modular basic objects based on general-use objects such as tables, chairs, and storage modules, and activity-specific modular elements such as speakers and wall-climbing grip modules. All modules were designed to be retractable, foldable, and reconfigurable, empowering users to tailor the space according to shifting needs, as shown in Figure 5.

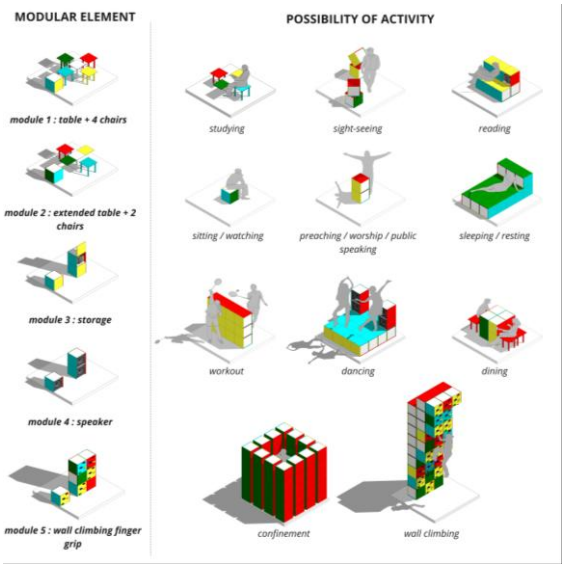

Figure 5. Modular Furniture System

The next strategy implemented was the common space area between adjacent units, or in this case, adjacent functions. This was achieved using a platform mechanism as seen in Figure 4 and 6 as operable elements of flexible strategies, place within the central circular void of the structure, which then acted as a connective bridge, forming temporary or semi-permanent spaces allowing new activities to emerge. By using platform mechanisms, it enhances the flexibility within the structure by the ability to create mechanically operable and reconfigurable space according to user needs, as flexibility can be achieved not only by the design of the space itself but also by building systems that support it (Kim, 2008). The platform's design consisted of three independently operable sections, capable of functioning at various levels or merging into one unified space. Depending on the configuration, the platforms could serve as sports halls, performance stages, or transitional zones, allowing for new events to emerge between the adjacent functions in the structure, as seen in Figure 6.

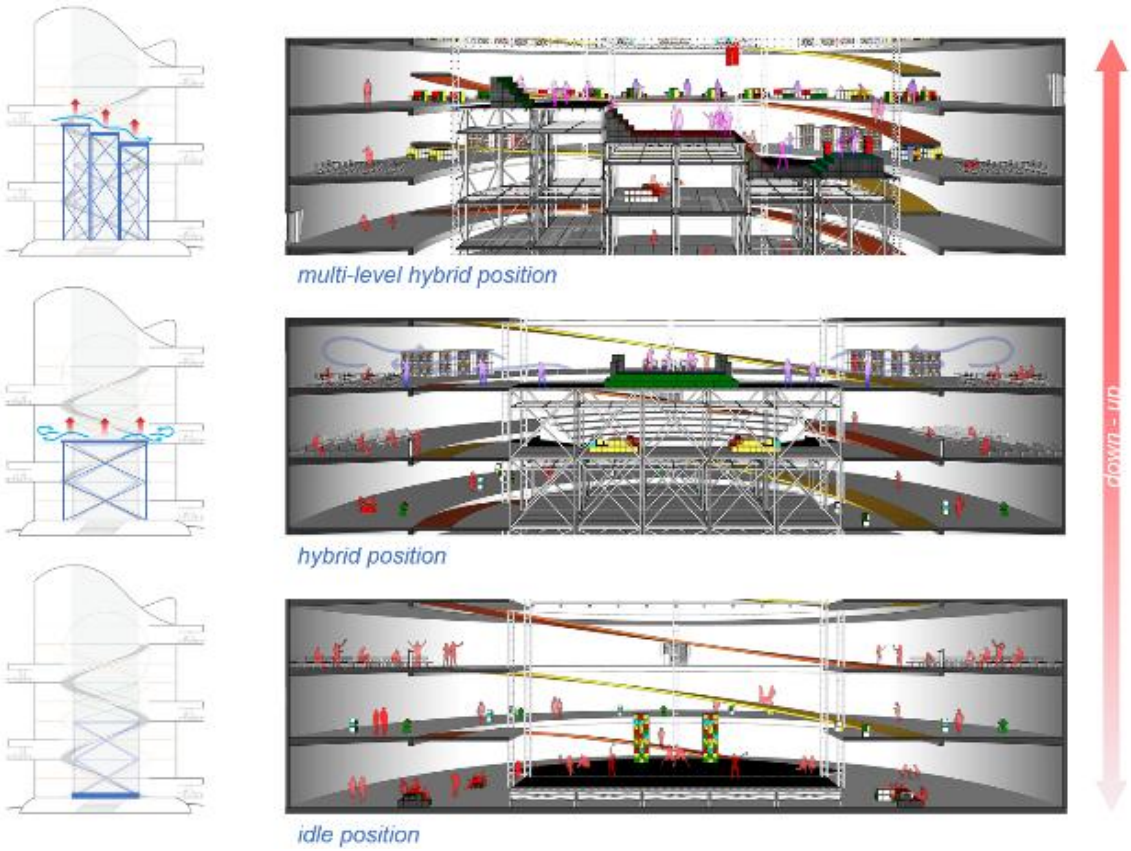

Figure 6. Possibilities of Hybridization by Platform Mechanism

The platform mechanism represents hybridization within the architectural systems. As the platform shifted, they created new interstitial spaces and realities by manipulating conflict between two opposing things (Ozarisoy & Altan, 2023), which users could claim and reinterpret as needed. When the platform is elevated, it uncovers additional space beneath for user-defined use, enabling hybridization to happen, as seen in the hybrid position in Figure 6. As the platform consists of three independent sections, it allows multi-level hybridization to happen, where it could unfold multiple new spaces as each platform arises at different levels, as seen in the multi-level hybrid position. These layered strategies, the circular open-plan design, modular furniture, and platform mechanisms then formed the basis of the hybrid design method, which is not bound by fixed programmatic rules but thrives on the transformation of changing needs and the active participation of the user in defining their spaces through the negotiation of multiple activities within the structure.

The final conceptual structure, illustrated in Figure 7, demonstrates how flexibility and modularity create new opportunities based on varieties of position in reimagining space, program, and movement within a singular architectural form (Tschumi, 1996). This study then transforms disjunction-conjunction theory into a practical design methodology, producing a new event-based catalogue of public activities and integrating flexible layout, modular furniture, and an operable platform system into a unified hybrid spatial strategy that extends current understandings of hybrid architecture.

Figure 7. Perspective of Interior System Based on Platform Movement

4. CONCLUSION

This research highlights the importance of hybridization in architectural discourse, serving as a mechanism for triggering spatial and functional revolution. Through a research by design approach, it shows that architectural approaches can move beyond conventional programmatic approaches through a series of processes of disjunction and conjunction within hybridity with flexible and modular systems. By first engaging in the disjunction of events, the research deconstructed various public building typologies to examine their essential activities and determine their essential elements, such as supporting objects, user density, sound level, and the time of activity. This disjunction process then allows a clearer understanding of the essential elements that define different spatial experiences of each type and activity. Following disjunction, the process of conjunction reorganized the essential elements based on shared characteristics and spatial needs to define the programming of the structure and inform the overall spatial organization, which was further sorted by acoustic levels.

Following the disjunction and conjunction process, the research implemented a series of flexibility strategies to enable hybrid spatial possibilities. Strategies implemented were the circular open-plan layout, modular furniture, common space between adjacent functions, and a platform mechanism to support a multifunctional environment capable of adapting to the diverse and changing needs of users. The research was also limited by its focus on selected public activities as well as its structural applicability in both structural and modular assemblage systems. For broader applicability, future research should undertake an in-depth analysis of the full operational range of public functions and how they might interact within hybrid design methodologies. This study also contributed to the wider architectural discourse by showing how event-based analysis and flexible, modular systems can support architectural adaptation in response to changing spatial demands and highlights the importance of moving beyond fixed programs toward spatial models that accommodate continuous transformation that could offer new relevant insights to the future of public building typologies and the development of hybrid architectural practices.

AUTHORS CONTRIBUTIONS

The first author (MH) initiated the research idea, literature review, data collection, conceptual drawing and design, and the synthesis of the research results; the second and third authors (KDP and YAY) contributed to data validation and analysis and verified the research results.

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