

***Get Out of Your Comfort Zone: Externalization Taxonomy as an Implementation
Tool for Future Designers***

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Abstract

As global warming accelerates, buildings currently account for 39% of energy-related carbon dioxide emissions annually. Architecture, however, is increasingly designed as hermetically sealed boxes, requiring mechanical support, which in turn further contributes to the greenhouse gas emissions warming up our planet. In addition to disassociating from the natural environment, this conventional approach also creates spaces where people disconnect themselves from their communities. In this project, I will examine what spaces could be externalized, removed from mechanical support, and how in doing so would provide environmental and social benefits that contribute greatly to the vibrancy and longevity of architecture and its communities. Current literature addresses various aspects of externalization, but most are missing critical vocabulary and design taxonomy. To fill this gap, I aim to develop an online interactive externalization pattern book that can support a user's design process. This pattern book will be developed through the research of four criterias in which the externalization strategies will be evaluated - ecological integration, climatic considerations, social/cultural considerations, and contextual application. The research will analyze each criteria through a series of case studies), literature review, and iterative design process (including simulation supported decision making). This will result in a holistic set of strategies that can address various contexts and scenarios, and serve as a useful tool when applying externalization strategies into architectural practice. Through this development, architectural practice can be enabled to shift towards a direction that better incorporates social and environmental resiliency through the implementation of building program externalization.

Keywords: Externalization, Sustainable Living, Climate Change, Social Sustainability, Architecture

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Introduction

Currently the challenge is twofold- there is increase in designs where spaces are disconnected from the outdoor environment, which not only has energy demand and environmental implications, but also health and wellbeing implications. Second, by designing internalized spaces that disconnect people from the outdoor environment, designers have also created socially disconnected spaces that are not conducive to increased social interaction. Without the ability to hear neighborhood chatter and noises of the community from outside our window, people gain increasing levels of isolation, and lose a sense of belonging within their local communities. Loss of community vibrancy and a lack of diversity in terms of interactions between occupants, and an understanding result in a sense of insecurity and anonymity within the neighborhood that can greatly affect the social and cultural vibrancy and resiliency of communities.

For environmental connectivity, externalization provides building performance and energy savings, biophilic benefits for health and wellbeing, and biodiversity benefits for the environment. In terms of building performance and energy savings, robust research on passive design strategies (Wang et al. 2014), mixed mode design (Loftness 2014; Loftness and Haase 2013; Watson 2013; Liebard and Herde 2009), and daylight and thermal autonomy all increase the overall environmental connectivity while reducing the overall energy demands. Dynamic envelope design is crucial as architecture becomes increasingly flexible based on weather conditions and activity levels as it reduces the energy demand of the building, but also provides alliesthesia (thermal delight) to the occupants. Furthermore, simulation softwares enable designers to further explore the potentials of integrated passive designs to best balance between the indoor and outdoor environments given local contexts.

Another benefit of increased environmental connectivity is increased biophilic benefits in terms of occupant health and wellbeing. Biophilia is a human's innate biological tendency to seek connection with nature, which can have emotional, mental, and physiological impacts on our wellbeing. Based on Edward O. Wilson's biophilia hypothesis, biophilic design focuses on designing in connection with nature (Wilson 1986). Notable research by Stephen Kellert and Bill Browning solidified the importance of biophilic design within architecture, as well as highlighted its impact on human wellbeing (Heerwagen, Kellert, and Mador 2008; Browning, Catherine, and Joseph 2014; Terrapin Bright Green 2012). For example, several studies indicated that connection to nature could lower tension, anxiety, anger, fatigue, and confusion, and could positively influence mood and self-esteem (Alcock et al. 2014; Barton and Pretty 2010; D. K. Brown, Barton, and Gladwell 2013). Biophilic design supported the connection of humans to nature encouraged the strengthening of indoor-outdoor relationships as there are studies that indicate that application can provide both biophilic and environmental benefits to architectural practice (Dreiseitl 2019).

Lastly, increased environmental connectivity can support local biodiversity through regenerative design or the creation of nature corridors and hotspots. In research by Hes and Du Plessi, regenerative design that focused on designing for local ecologies helped rejuvenate damaged ecosystems (Hes and Plessis 2014). This encourages for a close relationship between occupants and nature. Given growing climate change and biodiversity concerns, ecologically driven approaches become increasingly important.

The integration of nature and porosity within architecture can support the migration and growth of flora and fauna within an urban setting, providing both occupants biophilic benefits while also allowing nature to have spots of habitation amongst the urban concrete jungle (Jain 2019).

Building program externalization also contribute to enhanced social connectivity, which can reduce isolation, improve community cohesion and vibrancy. In January of 2019, the Health Resources and Services Administration issued the “Loneliness Epidemic”, which notes that nearly 1 out of 3 older Americans now live alone, which can result in serious mental and physical health effects (Health Resources & Services Administration 2019). “Loneliness and social isolation can be as damaging to health as smoking 15 cigarettes a day”, and thus serious actions need to be taken to address this concern (Health Resources & Services Administration 2019). Though spatial conditions are not the sole contributor to the loneliness epidemic, there are studies that support the impact of spatial conditions on isolation. Social capital is also a growing research topic, as social connectivity becomes a growing concern within predominantly urban design (Putnam 2020). However, what are the building level implications when there is minimal social connectivity, when one cannot open the window to hear children playing, when there is not a porch where people can interact in passing? How has the internalized approach to architecture started to discourage social interaction and connectivity, and what impacts and implications it may have? These questions are explored to varying degrees by researchers, though there exists a missing link between externalization and social connectivity.

This thesis links both environmental and social connectivity, and establish why designing for externalization would be better than the current internalized approach. Especially now in the context of COVID-19 pandemic and social inequity, what role can externalization play? Existing research already support the importance of externalization as people lean towards balconies, porches, and other externalized spaces that allow them to regain connectivity in a forced disconnected environment due to quarantine (Ottoni et al. 2016; Martin 2020; Nisenson 2020). Additionally flexible boundaries such as sliding doors or outdoor classrooms enable schools to continue teaching while enforcing safe distancing, which are all enabled through externalized design (Bellafante 2020; Superville 2020; Couzin-Frankel, Vogel, and Weil 2020). Given this new context, externalization grows in value as we become increasingly aware of the disconnectivity of existing spaces. With improved social connectivity, study also show its impact on safety and wellbeing within lower-income communities, as spaces designed often don’t encourage social interaction or allow for community identity to develop (Saegert, Winkel, and Swartz 2002; Knapp et al. 2019). This can greatly affect vulnerable communities, which can lead to more severe mental and physical health impacts due to poor ventilation, lack of access to nature, etc.

Externalization Palette

First set of criteria is the environmental connectivity of building programming - based on how the space is sealed, how much daylight is available, and what kind of activity takes place in these spaces. The worst scenario is a space that is fully sealed with full mechanical support and no access to natural daylight. Then the introduction of natural daylight opportunities while remaining fully sealed and full mechanical support is the

next improvement towards environmental connectivity. With the introduction of versatility, the dynamically sealed spaces allow for added operability and access to passive strategies and natural daylight. Then externalized low function spaces introduce fully externalized transitory spaces. Lastly, the most amount of environmental connectivity represents fully externalized high function spaces where social living spaces would be fully externalized. Considerations for environmental connectivity could result in a significant amount of energy savings due to the decrease in conditioned internalized space. Additionally, this allow for an increase in physical activity and circulation, which can increase the overall social connection. Through environmental externalization, there is added visual richness and connectivity, and well as auditory and sensory richness. This allows for the community to gain a sense of vibrancy through architectural design.

Second set of criteria is the social connectivity of building programming, which focuses on the amount of social connectivity that the space enables for its occupants. The most socially disconnected is individual and disconnected spaces. Then it moves onto individual but visually connected spaces, which are typically spaces with glass facades where you can see, but not hear or interact. Then it moves onto the building community, which allows for the occupants within a building to socialize and interact with one another. It then moves onto higher levels of public engagement with the neighborhood community connection and finally the urban community connection where it is fully open to the public. The increased social connections allow for the success, resiliency, and longevity of the externalization strategies through increased social connections, an increase in the amount of outdoor activities, and allow for increased socio-cultural richness. Additionally, this encourages people to communicate and develop a level of tolerance through a sense of community, which can increase the community resiliency in times of crises such as the current COVID-19 pandemic.

When both the environmental connectivity and social connectivity are overlapped, it creates a larger palette that can then evaluate architectural design through this color schema - The Externalization Palette. The palette allows for immediate understanding of a design's externalization quality in regards to its social and environmental considerations and creates a set of vocabulary for building program externalization that can then evaluate architectural design through the criteria of environmental and social connectivity. Architectural design can then be evaluated through this palette to better understand the externalization quality of a design through this evaluation color palette. This palette is arranged so that both criteria must be considered during evaluation as both levels of connectivity determines the quality and effectiveness of externalization in application, and diversity in the types of connectivity within a design is also crucial to its overall success. This palette does not seek to over-simplify the depth of spatial quality and social spaces, but aims to better consider the multiple layers through a more defined set of criteria and vocabulary. In doing so, a better understanding of building program externalization could be reached, and result in more appropriate applications of externalization in architectural design practice.

Externalization Taxonomy

The externalization taxonomy is a series of fifty strategies that help support designers when thinking about externalization in architectural design, it doesn't serve as a

comprehensive list or a copy-paste solution, but as a series of potential inquiry sparked by existing design strategies stemming from prior case study research. However, behind each strategy generated within the taxonomy also lies deeper literature review and research that support the importance and value of the strategies generated. The full taxonomy can be divided into the following four broad categories:

- Externalize Circulation
- Externalize Family
- Externalize Community
- Embrace Ecology

Each category contains several externalization strategies, each of which includes an explanatory diagram, a description, scientific research that supports the environmental and social benefits of the strategy, and a precedent study that utilizes the specified strategy. The layout of each taxonomy is shown in Figure 1. These strategies will not be shown in this paper itself, though are accessible online. Despite each specific strategy not being covered, the broad categories will be elaborated on in this paper instead.

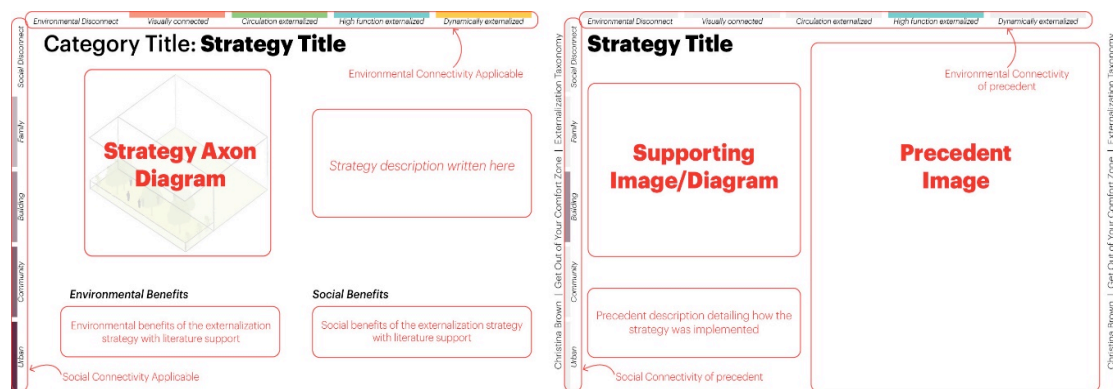


Figure 1: Externalization Taxonomy Layout

Externalize Circulation

Externalizing circulation is one of the most straightforward externalization approaches found through case study research. In most climates, (hot, cold, and benign) externalizing the building circulation was possible to certain degrees, with fire stairs and non-primary circulation routes being the most likely to be externalized. This alone can already have profound impacts on carbon emissions and the total building energy loads if all non-primary circulation was externalized. However, beyond just building energy usage, there is also additional benefits that can be found when more of the circulation and non-human dominant spaces are externalized. For example, for highly used circulatory spaces could be externalized to gain biophilic benefits and more spatial porosity that can encourage community interactions. Additionally, circulation can double as social spaces, extending beyond the function of getting occupants from point A to B, but rather help bolster the cohesion of the community instead.

In this subcategory of “circulation” also includes mechanical systems and garages, which are more transitory in nature, given that they are predominantly spaces for machines, rather than people. These spaces have greater thermal comfort flexibility, and often times for machinery the overall temperature benefits from being in a lower

temperature range. Thus, especially in climates where these conditions are naturally present outside, externalization becomes a straightforward choice to make. However even in climates that may not be the most suitable, the implementation of dynamic strategies or passive strategies allow the building to take advantage of the locale before relying on mechanical conditions. In especially synergistic case studies, the externalization of mechanical and garage spaces actually allow for those spaces to serve more human occupied functions due to the many biophilic benefits that the externalized space provides.

Externalize Family

Externalization of “family” spaces aims to apply strategies that enable small-scale spatial externalization – thus the “family”. This can be applied to residential as the name applies, but can also be applied to educational, commercial, restaurant, healthcare, and much more. The focus is that this is applied at the individual unit scale, though the specific program is quite flexible.

Within this subcategory, there are twelve strategies with varying scales of intervention – French balcony, Chicago balcony, ‘living room’ balcony, terrace balcony, dynamic balcony, dynamic façade, center box, sky box, sandwich, porous layer(s), elevated indoor + outdoor space, and lastly shutter façade.

Externalize Community

Like ‘Externalize Family’, externalizing community operates at a scale, though instead of the unit scale, this category focus on the community scale or building scale. These strategies are essential in making significant contributions to social connectivity and supporting the development of social capital, and can often times become the identifying characteristic or most utilized space within large-scale projects, serving as a connection for the building occupants to the local community and beyond.

In this category, there are eleven strategies – open/porous lobby, open/porous multipurpose space, porous layer, periphery social, wall as shading, wall as placemaker, courtyard/open atrium, covered atrium, dynamic atrium, sky lobby, and rooftop social.

Embrace Ecology

The last category is embrace ecology, which covers across spatial scales but focus on the incorporation of ecology into human spaces, to create more intimate symbiotic relationships between humans and the natural environment. Some strategies focus on gardenscape and landscaping, while others address issues of water or food (through farming). These are all aspects in which humans depend on existing natural systems, and more connective spatial relationships could help improve appreciation, education on natural systems, and value on environmental issues and climate change in the public. This not only has social and environmental implications for the occupants, but can also serve as an opportunity to encourage appreciation for the natural systems that we depend on as a society.

In this category, 10 strategies are introduced – canal connection, farming atrium, garden atrium, garden balcony, adjacent garden, terraced garden, central garden, rooftop garden, rooftop urban farming, and dynamic farming.

Conclusion

From the growing impacts of climate change and concerns for building energy loads to the established importance of nature on human health and wellbeing as we become increasingly urbanized to the growing concerns for isolation and social disconnectivity, how we understand ‘boundary’ and shape our spaces become ever more critical. The conventional approach of internalization was supported and bolstered by the development of technology, but as new concerns arise in the 21st century, it is necessary for architecture to shift from the internalized design approach that have become the ‘norm’ to a new externalized design approach that reconnect people to the environment and to each other.

This synthesis establishes foundational research, framework, and design tool (the taxonomy) to support architectural design. The externalization taxonomy aims to help designers shift from the conventional internalized architectural design approach to an externalized approach. This enables architecture to be developed in a connective, dynamic, and responsive way that can better address the climatic and social issues that as a society face and will continue to face in the future.

This research is only preliminary work that scratches the surface of ‘externalization’, with limitations of time, resources, and the COVID-19 pandemic that restricts the depth of work the authors could take on. However, the topic is still preliminary, allowing for many areas of continuation and future explorations in terms of quantifying externalization impacts, expanding the externalization taxonomy based on climate types, program types, or cultural boundaries, as well as addressing potential conflicts such as noise pollution, security concerns, and privacy issues.

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