Evaluating Stress Relief from Architecture: A Case Study Based on Buildings in Taiwan, China and Japan

Ming-Chyuan Ho 1 and Yung-Chia Chiu 2,3,*

Abstract: The urban landscape can be improved to reduce the stress experienced by citizens. Therefore, stress-relieving buildings constitute a crucial topic and a future trend in architecture and design. In this study, different architectural styles were investigated to explore design methods for and characteristics of stress-relieving building shapes and to identify indicators for measuring participant stress relief while viewing buildings. To understand stress relief from architecture, we performed semi-structured interviews with 60 participants who viewed images of 30 buildings. The semantic differential method with a 7-point image scale was used to rate stress relief from different architectural styles. The study results revealed that the participants perceived curvilinear buildings as interesting but do not relieve stress. The participants identified as feeling high pressure considering rectilinear patterns to relieve more stress. To support this observation, we identified three principles—city image, identity, and spiritual atmosphere—as fundamental loci of designing cities for livability. We illustrate the three principles with several cases that facilitate a detailed understanding of their applicability in biodesign practices.

Keywords: stress-relief image; evaluating; building shape

1. Introduction

When design practice is used as a research tool, researchers must simultaneously consider the needs of many respondents. This paper illustrates how one research program investigated stress relief from architecture by using images. Designers and design researchers can use these results as a foundation for systematically researching design for stress relief, as a reference for developing stress-relieving shapes and as a basis for structuring empathy-based user interviews to facilitate the design process. Pressure to pursue a better quality of life results in high stress for numerous people. Quality of life includes individuals’ perceptions of their position in society, goals, expectations, standards, and mental concerns. It encompasses a person’s physical health, psychological state, level of independence, social relations, personal beliefs, and relationships to salient features in the environment. Therefore, architectural buildings should be designed with a focus on facilitating communication and interactions between buildings and people. Moreover, elements that synergistically create the spatial pattern of a city influence how city residents perceive and value their environment. Accordingly, the cultural cognition of citizens should be included in any discussion of spatial pattern creation.

By using a theoretical framework and statistical methods, this study revealed the correlations between architectural styles and the corresponding effects on stress relief for people. The rest of this paper is structured as follows. The remainder of Section 1 provides a review of the literature and presents this study’s theoretical framework. Section 2 presents the study methodology, including a modified categorization system for architecture classification, hypothesis development, and data collection and processing.
methods. Section 3 presents the study results and their interpretation. Section 4 provides a
discussion of the results in terms of the hypotheses. Section 5 presents the conclusions and
study limitations.

1.1. Theoretical Background and Research Framework

Goal 11 of the 17 Sustainable Development Goals of the United Nations in 2015 is
to “make cities and human settlements inclusive, safe, resilient and sustainable”, and
Goal 8 is to “promote sustained, inclusive and sustainable economic growth, full and
productive employment and decent work for all”. Building modern and sustainable cities
is necessary to accommodate the growing global population. Goal 11 suggests that cities
should be designed considering their influence on the emotions and psychology of their
citizens. Thus, city architecture is key to meeting these goals. City image includes the
unique features of the landscape and its spirituality, including the temperament, spirit,
quality, attitude, economy, and modernization of the city and its residents. Kevin Lynch [1]
suggested that city image is not solely based on information or on a concept; city image
should also provide satisfaction and safety to the people. Therefore, residents living in a
city must feel happy. As Kate Jeffery wrote in Conscious Cities, we are “creatures of the
place we’re in” [2]. This philosophy is known as neuroarchitecture.

For both city buildings and city life, the relationship and message transduction be-
tween citizens and the city have been thoroughly discussed [3]. Cities are the environments
that citizens see in their daily lives. For example, churches, mosques, and cathedrals were
constructed centuries ago but are still architectural marvels as they represent a sense of
magnificence, royalty, glory, serenity, and peace. The shape of a building may cause people
to feel a sense of tranquility. According to the World Health Organization (WHO), stress
is a major worldwide health risk [4]. The factors of city stress—defined in this paper as
psychophysiological stress in urbanites—exist in a complex matrix of environmental, so-
cioeconomic, and political conditions such as the density of buildings in a city; competition
for employment, housing, and job opportunities; various forms of environmental pollution;
loss of identity; and social isolation. All of these contribute to a poorer standard of living as
well as incur the displeasure of urbanites. In addition to being a place to live, a city should
be visually pleasing. For example, residents may feel stressed when walking in the midst
of a huge group of buildings such as those in Linkou District, New Taipei City (Figure 1).
When busy citizens return to the city after work, will they feel happy when they see
buildings with a complex shape? In addition to stress caused by the shape of buildings,
numerous stress-inducing buildings in a small could increase mental pressure.

![Huge building complex in the Linkou District, New Taipei City.](image)

**Figure 1.** Huge building complex in the Linkou District, New Taipei City.

Stress relief and mood have been explored in a variety of design disciplines such
as product design, fashion, architecture, graphic design, service design, and technology
interface design. Dr. Leonard P. [5] reported that a new trend of designing home gardens
to relieve stress was emerging in Europe. The design of stress-reducing gardens may be
based on Zen principles such as simplicity, austerity, or naturalness.
Ideation for architectural design is a set of activities for the development of goal-directed ideas, including the idea of stress relief as part of a design strategy [6], and this ideation is “core to the innovation process” [7]. Ideation is at the intersection of the design process and cognition [8]. In architecture, decorative facades appeal to the senses and emotions of viewers by providing multisensory experiences using scale, symbolism, movement and change, atypical shapes, atypical use of construction materials, and varied expressions of physical properties; they are experiments that enable novel experiences through all five senses [9]. These novel and experimental facades not only are new spatial concepts generating unique physical and somatic behaviors but also contribute to an epochal representation—an aesthetic and artistic expression of the region and era [10]. Michael Bond [11] reported that buildings and cities can affect our mood and well-being and that specialized cells in the hippocampal region of our brains are attuned to the geometry and arrangement of the spaces that we inhabit. Thus, if the shapes and designs of a building are excessive, it will cause people to feel stress due to cognitive overload. However, urban architects rarely consider the potential cognitive effects of buildings on city inhabitants.

Architecture exists to create the physical environment in which people live, but architecture is also a part of culture. Architecture is a representation of how people view themselves and the world [12]. For example, designs by Antoni Gaudi were influenced by his religious and metaphysical views. The variety and regularity of natural forms are a marvelous interaction of an all-comprehensive divine unit. Gaudi studied organic forms of nature thoroughly in his search for a method of expressing these forms in architecture, such as at Casa Mila. Do naturally-shaped buildings also cause people to feel relaxed?

This study thus proposed that buildings should be designed not only in accordance with the aesthetic conceptions of architects but also to improve the emotional state of residents and increase the sustainability of city development. Accordingly, we investigated two experimental hypotheses for stress relief through building shapes: one process-based hypothesis and one cognition-based hypothesis. We produced a sketch of each stress-relieving building candidate on the basis of interviews with participants who reported high stress in daily life. These sketches were again evaluated by these high-pressured interviewees. In the following sections, we introduce these stress relief buildings and identify their essential features.

1.2. Ideation Process

People often live in a state of tension and thus require stress relief through methods such as urban landscape improvement. Assisting people in coping with stress and by making appropriate societal adjustments is crucial in a high-pressure society. However, research has rarely investigated the correlations between people who feel pressure and the urban landscape. Stress relief could be realized through changes in the color, scale, or other properties of the surrounding environment. In this study, we investigated the possibility of relieving stress for citizens by modifying the shapes of buildings in the urban environment. For people living stressful lives, triggering a stress-relieving psychological response by designing pleasurable building complexes could have substantial benefits to mental health. Therefore, we investigated the stress-relieving properties of both straight and curvilinear building shapes.

2. Materials and Methods

2.1. Stress-Relieving Images and Ideation

Haberakn et al. [13] argued that human behavior cannot be separated from the form of the human habitat. Architecture can have negative effects on human mental health. For example, monotonously repeating architecture could lead to weariness and boredom followed by depression and social confusion. This process could increase the prevalence of psychological disorders or behavioral deviations. Although building design begins with the ideology and philosophy of the designer, a building ultimately influences human
relations in communities. An architect may design a building to showcase their design ability; however, if the designed building causes people to feel pressure, it may cause unhappiness due to the close integration of people and the urban environment.

Imposing or featureless buildings such as skyscrapers or apartment blocks could cause stress. The form of a building can have a psychological impact on people; buildings that people find aesthetically pleasing would likely cause happiness. Conversely, a poorly designed building would have the opposite effect. Similarly, a complex façade may be appreciated, whereas a monotonous building could cause feelings of boredom or pressure.

In the book The Power of the Center [14], Arnheim emphasizes a holistic interpretation of an entire image or space by considering interacting and balancing sets of forces. Arnheim’s argument rejects the concept of restricting architecture to considerations of practical use or economic costs; instead, the need for visual order should be emphasized. Achieving design balance is a complex endeavor because viewers observing buildings from different distances or perspectives may use any of the gestalt principles of visual perception to experience combinations of elements and create patterns such as similarity, continuation, closure, proximity, or figure and ground. When designing or viewing a building façade, an individual may consider certain relationships between the gestalt laws and architectural design [15]. For example, balance or symmetry can cause people to feel stable. As reported by Hadley [16], a designer might layer views in space by designing a route encouraging a slower engagement with surroundings and a prosocial environment. In floor plans and facades, bilateral symmetry communicates power and classical beauty. People intuitively prefer order and complexity, are calmed by symmetrical visuals, and are fascinated by fractal patterns. Thus, people would prefer to linger in a space that they find calming or interesting. Simple lines, but not complicated buildings, could make people feel at ease.

The geometric shapes of objects in the outdoor environment have undisclosed emotional, psychological, artistic, aesthetic, and shape-generating potentials. The buildings in our lives may also provoke curiosity, fear, or other emotions. Living beings perceive geometric objects in an information-handling process. Evidence revealed by Attneave [17] suggests that concepts and techniques of information theory may enable a deeper understanding of visual perception. The quantity of information functions can explain the concentration of information of visual contours [18]. According to Attneave, the amount of information affects judgments regarding the psychological aspects of buildings. In this study, building information was conveyed by presenting the shape of an experimental building to participants, causing a psychological reaction. This experiment can verify that the simplicity of Gestalt psychology can relieve stress.

2.2. Research Framework Connecting Process

Good mental health is essential not only for personal well-being but also for creating resilient and sustainable cities. Ellard [19], who researched the impact of design on psychology at the University of Waterloo in Canada, considered that people do not realize the degree to which their environment physically affects them. Ellard, considering data gathered to demonstrate actual physiological responses, stated the following: “This adds a layer of information that is otherwise difficult to get at. When we ask people about their stress they say it’s no big deal, yet when we measure their physiology we discover that their responses are off the charts”. The reports demonstrate that the shape of the building façade can affect the unconscious psychology of citizens; that is, stress-relieving buildings can improve mental health. Diverse changes on the outside the building will influence the complexity of people’s judgment. Increased judgment directly affects mood.

Therefore, the aim of this study was to understand the process of idea creation and judgment by using images of stress-relieving buildings. As Ellard argued, the appearance of buildings in the city affects the mood of the citizens. For example, if a curtain wall is complicated and interesting, it will affect people in a positive way. If it is simple and monotonous, it will have a negative effect. In other words, the simpler the shape is, the more stable people can be. Figure 2 illustrates the framework used in this research,
demonstrating that shapes and moods can interfere with message transmission and affect user perceptions. The shape created by the designer or architect is reflected in human perception after psychological digestion. The more complex the building line is, the longer it takes for people to digest it and, thus, the more likely it is to cause rejection. Accordingly, we examined whether joyful building forms can deliver pleasure to residents and also investigated which building types are joyful.

![Figure 2. Research framework used in this study.](image)

### 2.3. Research Method

An object (building) can hold meaning due to its ties to notable memories, experiences, people, places, or values [20]. Mugge, Schoormans, and Schifferstein [21] suggested four possible determinants of product attachment: pleasure, self-expression, group affiliation, and memories, of which all but pleasure are associative in nature. Because of our research goals and on the basis of the current theory, we first adopted a theoretical approach. [22] to develop an integrative model that could support testable propositions [23]. An experimental method was then used to understand the subjective feelings about a building, and a decision was made after a collective discussion by experts. We thus used a protocol that entailed the analysis of building design images for three types of architecture on the basis of ideation sessions performed individually by designers. We investigated what feelings people have toward architecture and the types of architecture they appreciate. We predicted that building shapes would affect the stress index of residents. Stress-relieving buildings result in happiness and the development of the city image.

### 2.4. Sample and Data

Sixty office workers in Taiwan with over 5 years of experience were enrolled. Each worked more than 48 h per week and was aged 35 years, on average. The workers separately underwent a semi-structured interview conducted in the same room. Each participant was presented with 10 images of stress-relieving buildings and was interviewed for 40 min. The sample buildings were selected after they were screened by participants. The participants were more likely to select buildings that they had visited, seen on the Internet, or seen in their daily lives. The buildings were from Taiwan, China, and Japan, and thus, they were culturally familiar to the participants. Hence, we collected photographs of 500 different buildings and separated them into three groups: public, residential, and religious buildings. The participants selected up to 10 representative buildings from each group. We also invited experts and scholars of architectural shape design to assist in the classification of the buildings as curvilinear or rectilinear, as displayed in Figures 3–5.
We next used the pressure index scale (Health Promotion Administration, Taiwan Ministry of Health and Welfare) to select 10 high-pressure office workers (Table 1). These 10 participants selected a total of 521 stress relief–related adjectives during a KJ method screening process.
Table 1. Code for interviewers.

| Code | Personal Profile          | Code | Personal Profile          |
|------|---------------------------|------|---------------------------|
| A1   | Mr. Wu (Kaohsiung)        | A6   | Mr. Wu (Chiayi)           |
|      | Age: 40–45                |      | Age: 35–40                |
|      | Occupation: firefighter   |      | Occupation: company employee |
| A2   | Mr. Lin (Tainan)          | A7   | Miss Lin (Chiayi)         |
|      | Age: 25–30                |      | Age: 25–30                |
|      | Occupation: career soldier|      | Occupation: executive assistant |
| A3   | Miss Chiang (Miaoli)      | A8   | Miss Pai (Taichung)       |
|      | Age: 30–35                |      | Age: 35–40                |
|      | Occupation: public servant|      | Occupation: scholar       |
|      | Miss Lin (Tainan)         |      | Miss Chen (Taipei)        |
|      | Age: 25–30                |      | Age: 30–35                |
|      | Occupation: Executive assistant|   | Occupation: Executive assistant |
| A4   | Miss Chen (Taichung)      | A9   | Miss Wong (Chiayi)        |
|      | Age: 40–45                |      | Age: 45–50                |
|      | Occupation: freelancer    |      | Occupation: company employee |

2.5. Analysis of Ideas

In urban open space and urban aesthetics [24], a landmark is considered to be not only the subject of a visual experience but also an association with a genius loci (i.e., a local spirit protecting and symbolizing a place that relieves stress). Ho also mentioned that designers design cities by using elements, structure, meaning, and symbols [25]. After a building has been outlined, it can be recognized as a whole. The building is defined by the simplicity of its general form; buildings with numerous details are more difficult to recognize [26]. However, city buildings are often complex. Because designers often want to display their design abilities, they use numerous design concepts in buildings, hindering understanding of the design by citizens. Because designers often ignore citizens’ perceptions of the appearance of buildings, these perceptions are likely to decrease the happiness of citizens.

Complex and varied symbols are used by designers to appear stylish but may not match the city aesthetic and may not facilitate stress relief. Some architects use curves to showcase their design ability. However, whether buildings with many intertwined curves relieve stress is unclear. Many buildings in the images used in this research were colossal, and this large scale may also increase stress in the city. Compared with the other two building types, religious buildings have relatively simple shapes. These simple lines may increase feelings of stability in citizens.

2.6. Analysis of the Ideation Process

For each of the 60 participants, the ideation process was analyzed, with the goal of understanding how each idea was related to prior and subsequent ideas as well as to external stimuli. Finally, the diastolic building scale of 70 participants was measured, as displayed in Figure 6.

Each participant was allocated to observe one of the three building types (public buildings, residential buildings, or religious buildings) as well as one of the three ideation conditions: no available stimuli (where participants were provided with only the design brief for buildings, such as place, building name, designer), limited access to stimuli (where participants could access the stimuli search tool but could use it only once in the session, that is, access the Internet to look up material), and unlimited access to stimuli (where participants could access the stimuli search tool, which they could use as many times as they wanted within the time constraints of the session). Thus, we could investigate the
influence of stimuli during the ideation process, which is critically related to the conflicting results highlighted in the Introduction section.

Figure 6. Study procedure.

3. Results

We predicted that building appearances would increase happiness by relieving the stress of participants. Thus, we studied the effects of building shapes and ideation conditions on the stress relief index. Interviews were performed, and the interview results were used to create sketches of stress-relieving buildings and to understand which architectural factors could relieve stress. Principles for designing stress-relieving buildings were also identified.

3.1. Sample Analysis

In a high-stress learning environment, living environment, or work environment, an onslaught of new information can lead to cognitive overload. Similarly, excessive information (i.e., an overly complex building) may cause residents to feel pressure—particularly if the building elements are interactive. Thus, simpler buildings are easier to process and provide stress-relieving effects for residents. The 60 interviewees evaluated the buildings by using a pressure index scale provided by the Health Promotion Administration of the Taiwan Ministry of Health and Welfare. Ten interviewees with high pressure scores identified using the Jiro Kawakita (KJ) method participated in tests to find major attractive factors. Approximately 521 words were collected and grouped into 17 adjectives. Table 2 presents the top five words: “comfortable”, “kindly”, “friendly”, “amazing”, and “fun.”

Table 2. Top three attractive feelings.

| Adjective | Votes | Related |
|-----------|-------|---------|
| Comfortable | 102 | Satisfied, easy, cozy, cheerful, quiet |
| Kindly | 80 | Safety, peaceful, amiable, gentle, benevolent, beneficent |
| Friendly | 73 | Nice, kind, heavenly, steady |

Ten pairs of adjectives were chosen from those collected and were used to measure the participants’ perceptions of the building images. The 70 participants (30 women, 40 men, the 10 high-stress participants were excluded, as displayed in Table 3) were office workers and provided informed consent to participate in this research.
Table 3. Sample statistics.

| Project          | Number of Times | %  | Project          | Number of Times | %  |
|------------------|-----------------|----|------------------|-----------------|----|
| Gender           |                 |    | Age              |                 |    |
| Male             | 40              | 57.1| 20 or below      | 2               | 2.9 |
| Female           | 30              | 42.9| 21–30            | 26              | 37.1|
| Government Official | 19             | 27.1| 31–40            | 30              | 42.9|
| Administrative   | 18              | 25.7| 41–50            | 8               | 11.4|
| Project assistant | 11             | 15.7| 51 or above      | 4               | 5.7 |
| Business         | 3               | 4.3 | Junior High School or below | 3 | 4.3 |
| Self-employment  | 3               | 4.3 | General and vocational high school | 12 | 17.1 |
| Sewardship       | 1               | 1.4 | Post-secondary school | 7 | 10 |
| others           | 15              | 21.4| University/College | 39 | 55.7|
|                  |                 |    | Master or above  | 9               | 12.9|

When testing, we first chose those residents who had visited the three testing spots (Figures 3–5). The 70 participants (30 women) were office workers, with a mean age of 35 years, who have worked for more than 5 years. The instructor briefly introduced the evaluation process and explained that the interviewee only needed to express feelings regarding the imagery in each photograph by selecting an adjective or preference to reduce the chance of the interviewee evaluating the building scale. Because the adjective pairs of this study were meaningful, a video was played while the participant performed the tests. Each slide was displayed for 50 s. After the participant had viewed the slides, they chose individual rating criteria. According to the test results, most of the participants perceived religious buildings as providing stress relief as well as stability and joy. As displayed in Figure 7, religious buildings had higher scores, indicating that these buildings were more associated with stress relief adjectives.

Figure 7. Seven-point scale of building ratings.
3.2. Filtering of the Most Representative Attractive Factors

The top three abstract feelings and corresponding building forms are listed in Table 4 and were used to select the most representative factors for the questionnaire items. A total of 13 images were chosen by 10 design experts as those most suitable for stress relief, as displayed in Table 5. Experts in the design or creation of spiritual environments with over 10 years of experiences were invited to take part in the study.

Table 4. The top three attractive feelings and their related initial reasons and concrete reasons.

| Adjective  | Form                                      |
|------------|-------------------------------------------|
| Kindly     | Pure color, smooth lines, orderly lines   |
| Comfortable| Smooth lines, simple, pure color, orderly in construction of space |
| Friendly   | Smooth lines, pure color, spatial interaction |

Table 5. Code for interviewers.

| Code | Personal Profile | Code | Personal Profile |
|------|------------------|------|------------------|
| B1   | Mr. Wu Age: 40–45 Occupation: Professor | B6   | Mr. Ho Age: 55–60 Occupation: Professor |
| B2   | Mr. Guo Age: 45–50 Occupation: Professor | B7   | Miss Liu Age: 40–45 Occupation: Assistant researcher |
| B3   | Miss Wu Age: 35–40 Occupation: Designer | B8   | Miss Pai Age: 35–40 Occupation: Professor |
| B4   | Miss Lin Age: 35–40 Occupation: Designer | B9   | Miss Liu Age: 40–45 Occupation: Designer |
| B5   | Miss Chen Age: 40–45 Occupation: Director | B10  | Miss Chang Age: 35–40 Occupation: Assistant researcher |

4. Discussion

4.1. Design and Measurement

Three models were designed to test architectural designs (Figure 8). The experts assisted in designing sketches and models of buildings (Figures 9–12). Stress-relieving images and stressful images were drawn. The 10 high-pressure interviewees agreed that the environment can influence stress and agreed that simple and smooth designs relieve stress more than buildings with numerous acute angles.
judgment criteria were influenced by the spiritual interests of the people.

ments of building images were based on both the current situation and the future target.

Figure 8. Testing conditions. (a) Architectural sketch; (b) building model.

Rectilinear figure
Curvilinear

Figure 9. Public building sketches.

Rectilinear figure
Curvilinear

Figure 10. Residential building sketches.

Rectilinear figure
Curvilinear

Figure 11. Religious building sketches.

Figure 12. Architectural shape. The understanding of external physical space is equivalent to the quantification of the physical space represented in the brain to account for the function and behavior of architectural shape. Substantial work has been devoted to understanding how external physical space can influence subjective feelings of extendedness and time, as well as the cognitive load of processing information.

However, the subjective feeling of extendedness—the feeling of experiencing the vast quantity of information in the building, as previously discussed, and it affects cognitive load.

Consider the experience of a blank canvas. The two words “blank canvas” seem sufficient to convey the content of the experience to other human beings. However, this brevity is just as quantitative and in need of explanation as that of shape or stress. Further research regarding this phenomenon is required.

4.2. The Problem of Architectural Qualia

However, this feeling is easier to analyze because of our ability to introspectively consider aspects of the experience of architectural structure; we typically lack this ability for shape or stress.

The limitations of this study are related to the participants’ experience, which is restricted in designing sketches and models of buildings (Figures 9–12). Stress-relieving images were drawn. The 10 high-pressure interviewees agreed that the environment can influence stress and agreed that simple and smooth designs relieve stress.

The filter group believed residential buildings should be simple and comfortable. They stated that they expect designs with simpler lines that reduce pressure in people returning home; however, this feeling is easier to analyze because of our ability to introspectively consider aspects of the experience of architectural structure; we typically lack this ability for shape or stress.

Promote spiritual feelings and a sense of tranquility. However, 60% of the filter group believed that curvilinear forms are more suitable for stress-relieving public buildings.

Three models were designed to test architectural designs (Figure 8). The experts asssessed the sketches according to the judgment criteria based on the spiritual interest. That is, the judgment criteria were influenced by the spiritual interests of the people.

Figure 10. Residential building sketches.

Figure 11. Religious building sketches.
4.2. The Problem of Architectural Qualia

The limitations of this study are related to the participants’ experience, which is related to their perception of the shape of the building. The first limitation is the experience of architectural shape. Substantial work has been devoted to understanding how external physical space is represented in the brain to account for the function and behavior of architectural shape. The understanding of external physical space is equivalent to the quantity of information in the building, as previously discussed, and it affects cognitive load. However, the subjective feeling of extendedness—the feeling of experiencing the vast canvas of the sky—is just as quantitative and in need of explanation as that of shape or stress. However, this feeling is easier to analyze because of our ability to introspectively consider aspects of the experience of architectural structure; we typically lack this ability for shape or stress. Further research regarding this phenomenon is required.

Second, architectural experience, even a relatively simple experience, is complex. Consider the experience of a blank canvas. The two words “blank canvas” seem sufficient to convey the content of the experience to other human beings. However, this brevity is only possible because it presupposes that other humans already understand the idea of a blank canvas. Characterizing the experience of extendedness without assuming architectural understanding is difficult. The phenomenal components that make a canvas feel extended must be identified. These components are the distinctions corresponding to experiences and the numerous relationships that bind these experiences into a single phenomenal structure according to connection, fusion, and inclusion and corresponding to...
the feeling of extendedness. This single phenomenon structure is also a source of pressure for participants. Phenomenal regions, locations, sizes, boundaries, and distances can then be described as substructures of this overall organization of distinctions and relations. Thus, the subject has already experienced the test building before viewing the test building, and participants already have a basic judgment of the building; that is, the building is not a blank canvas. These issues could be considered in future research.

4.3. Adding Psychological Atmosphere to the Design of Architecture Buildings

People are visually dominant [27–29]; that is, people tend to think, reason, and imagine visually. Le Corbusier [30] suggested that architectural forms “work physiologically upon our senses”. People experience images, shape, and text by using sight. If more visual information is received (i.e., the more complex an architectural form is), the time necessary for processing is longer, causing discomfort. Thus, more complex buildings cause people to feel pressure and to feel insecure. Thus, experience is critical in the perception process and in perception development. Perception development is a process in which perceived elements are obtained from the interconnections recognized from experience. Therefore, architects must aim to not only design usable buildings but also to generate a psychological effect on viewers.

The principle of the common destiny of shapes that are in the same space at the same time is that these shapes are recognized as belonging to a group; that is, the mind perceives these shapes as a single entity. This phenomenon was observed in our experiment; a fragmented curve will become a complex curve due to the combination of multiple curves, causing the testers to feel pressure. According to the principle of continuity, humans tend to perceive any complex shape as having connected lines and patterns. When a design has straight lines that cross other lines in a different direction, it is similar to an extended, even cut of the line, resulting in an increase of perceived information; increased information causes increased stress after the shape is interpreted.

Residents should be able to form shared memories and feel joy when looking at buildings. Each person has an ideal living place shaped by both livelihood and education. Designing a mental landmark to create a positive atmosphere requires the consideration of both practical space and activities. Moreover, identity, mental feelings, social meaning, and cultural agreement are necessary. [31] These elements can be established by a beautiful shape and by feelings experienced in the mind. Designers pursuing self-actualization should consider changes in the environment. Tadao Ando’s Church of Light and Ieoh-Ming Pei’s Miho Museum are projects reflecting this philosophy. Our results demonstrate that simple building forms such as Ieoh-Ming Pei’s Miho Museum increase the happiness of observers.

5. Conclusions

The goal of sustainable development is to increase the happiness of residents. We studied the association between building appearances and stress relief. Buildings designed to reduce the stress of residents can promote urban development and increase happiness. The physical city view is not the same as the mental city image. [32] Buildings in a city often have complex lines and shapes, and these shapes can cause citizens to feel pressure. Modern life is competitive; thus, people often feel pressure. Negative emotions and excessive pressure must be relieved to avoid mental and physical illness. Relief from pressure heals a person’s body and soul.

In this study, draft designs and building models were created based on the experimental results. The results reveal that although variations of curvilinear buildings are interesting, they do not relieve stress because the amount of information received by the viewer varies substantially compared with linear buildings. High-pressure people considered rectilinear patterns to be more stress relieving, despite the straightness and sharp edges of these buildings. We also observed that artwork with simple lines in harmony with landscapes could reduce stress. Architecture plays a key role in relieving stress. Thus,
building forms and the resulting environmental atmosphere affect the feelings of visitors. Samples tested in this study were from Taiwan, Japan, and China. These buildings were all upwardly developed buildings (which are common in Asia) which are also more stressful for the participants. In other words, tall buildings put more pressure on participants.

Architectural and sustainable strategies must both be considered in the design of building façades, and both passive and active design thinking should inform this process. In addition to investigating building shapes, future research should investigate the effects of texture, color, and size on citizen psychological impressions of the environment.

Author Contributions: Conceptualization, M.-C.H.; funding acquisition, M.-C.H.; investigation, Y.-C.C.; methodology, Y.-C.C.; writing—original draft, Y.-C.C.; writing—review and editing, M.-C.H. and Y.-C.C. Both authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Ministry of Science and Technology of Taiwan (grant number: MOST109-2410-H224-011).

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Lynch, K. The Image of the City; The MIT Press: Cambridge, MA, USA, 1960.
2. Jeffery, K. Conscious Cities Conference No. 2: Bridging Neuroscience, Architecture and Technology. In Proceedings of the Conscious Cities Conference, London, UK, 3 May 2017.
3. Dai, T.; Zhuang, T.; Yan, J.; Zhang, T. From Landscape to Mindscape: Spatial Narration of Touristic Amsterdam. Sustainability 2018, 10, 2623. [CrossRef]
4. Korczak, D.; Kister, C.; Huber, B. Differentialdiagnostik des Burnout-Syndroms; Schriftenreihe Health Technology Assessment (HTA) in der Bundesrepublik Deutschland; Köln, Germany. 2010. Available online: https://portal.dimdi.de/de/hta/hta_berichte/hta2_78_bericht_de.pdf (accessed on 1 December 2020).
5. Leonard, P. Garden Design to Reduce Stress; University of Vermont Extension: Burlington, VT, USA, 2011.
6. Reinig, B.A.; Briggs, R.O.; Nunamaker, J.F. On the measurement of ideation quality. J. Manag. Inf. Syst. 2007, 23, 143–161. [CrossRef]
7. Cash, P.; Storga, M. Multifaceted Assessment of Ideation: Using Networks to Link Ideation and Design Activity. J. Eng. Des. 2015, 26, 391–415. [CrossRef]
8. Hay, L.; Duffy, A.; McTeague, C.; Pidgeon, L.; Vuletic, T.; Grealy, M. A Systematic Review of Protocol Studies on Conceptual Design Cognition: Design as Search and Exploration. Des. Sci. 2017, 3, E10. [CrossRef]
9. An, J.G. A study on the sensitivity expression of architectural facade design. Korean Inst. Spat. Des. 2006, 1, 31–37.
10. Yu, J. A study on the re-interpreting the expressive property in exterior envelope of architecture. J. Archit. Inst. Korea 2003, 19, 181–183.
11. Bond, M. As More of Us Flock to Urban Living, City Designers Are Re-Thinking Buildings’ Influence on Our Moods in an Era of “Neuro-architecture”, United Kingdom. 2017. Available online: https://www.bbc.com/future/article/20170605-the-psychology-behind-your-city-design (accessed on 10 March 2020).
12. Vangelatos, G. How Does Architecture Impact Society? 2019. Available online: https://hmarchitects.com/news/how-does-architecture-impact-society-a-high-level-look-2019-10-18/ (accessed on 21 December 2020).
13. Haberakn, N.J.; Mignucci, A.; Teicher, J. Conversations with Form: A Workbook for Students of Architecture; Routledge: Oxon, UK, 2014.
14. Arnheim, R. The Power of the Center: A Study of Composition in the Visual Arts; University of California Press: Berkeley, CA, USA, 1982.
15. Wertheimer, M. Gestalt Theory; Harcourt, Brace and Co.: New York, NY, USA, 1938.
16. Maighdlyn Hadley, Hurry Up and Wait a Spatial Proposal for Urban Stress Relief—The Centre for Conscious Design, Conscious Cities Anthology 2019: Science-Informed Architecture and Urbanism. 2019. Available online: https://theccd.org/article/hurry-up-and-wait-a-spatial-proposal-for-urban-stress-relief/ (accessed on 21 April 2021).
17. Attneave, F. Some informational aspects of visual perception. Psychol. Rev. 1954, 61, 183–193. [CrossRef] [PubMed]
18. Ziatdinov, R. Visual Perception, Quantity of Information Function and the Concept of the Quantity of Information Continuous Splines. Sci. Vis. 2016, 8, 168–178.
19. Ellard, C.G. A New Agenda for Urban Psychology: Out of the Laboratory and onto the Streets. J. Urban Des. Ment. Health 2017, 2.
20. Orth, D.; Thurgood, C.; van den Hoven, E. Designing Objects with Meaningful Associations. Int. J. Des. 2018, 12, 91–104.
21. Mugge, R.; Schoormans, K.P.; Schifferstein, H.N. Product Attachment: Design Strategies to Stimulate the Emotional Bonding to Products; Product Experience; Schifferstein, H.N., Hekkert, P., Eds.; Elsevier: Amsterdam, The Netherlands, 2008; pp. 425–440.
22. Handfield, R.; Melnyk, S.A. The scientific theory-building process: A primer using the case of TQM. J. Oper. Manag. 1998, 16, 321–339. [CrossRef]
23. Wacker, J.G. A definition of theory: Research guidelines for different theory-building research methods in operations management. *J. Oper. Manag.* **1998**, *16*, 361–385. [CrossRef]

24. Kuo, M. *Urban Open Space and Urban Aesthetics*; Artist Magazine: Taipei City, Taiwan, 2006.

25. Ho, M.-C. *Lecture Notes*; National Yunlin University of Science and Technology: Yunlin, Taiwan, 2019.

26. Metwally, E. Achieving the Visual Perception and Gestalt Psychology in Sultan Hassan Mosque Building. *Open J. Appl. Sci.* **2021**, *11*, 21–40. [CrossRef]

27. Hutmacher, F. Why is there so much more research on vision than on any other sensory modality? *Front. Psychol.* **2019**, *10*, 2246. [CrossRef] [PubMed]

28. Posner, M.I.; Nissen, M.J.; Klein, R.M. Visual dominance: An information-processing account of its origins and significance. *Psychol. Rev.* **1976**, *83*, 157–171. [CrossRef] [PubMed]

29. Levin, M.D. (Ed.) *Modernity and the Hegemony of Vision*; University of California Press: Berkeley, CA, USA, 1993.

30. Corbusier, L. *Towards a New Architecture*; Architectural Press: London, UK, 1948.

31. Choue, Y.-S.; Chiou-Shan, L. *Oughtopia—Realization of the Ideal Society*; National Institute for Compilation and Translation: Taipei City, Taiwan, 2001.

32. Norberg-Schulz, C. *Genius Loci: Towards a Phenomenology of Architecture*; Rizzoli: New York, NY, USA, 1979.