

ORIGINAL RESEARCH REPORT

Perception and Evaluation of Buildings: The Effects of Style and Frequency of Exposure

Cheuk Fan Ng

The perception and evaluation of environmental and architectural spaces is an important concern of environmental psychology. Various environments ranging in scope from landscapes to room interiors have been studied, but old buildings have seldom been studied. As historical buildings make way for modern buildings, preservation of historic buildings has often been a hot issue. Proponents for preservation argue for the beauty, harmony and character of these buildings and that people derive satisfaction from them. This study examined the perception and evaluation of old-style buildings (constructed in late 18th to early 19th century) and modern-style buildings on three dimensions: aesthetic evaluation, organization, and friendliness. In addition, the effect of frequency of exposure on the ratings of these buildings as stimuli was studied. Two hundred and thirty-six university students rated each of the three old-style and three modern-style buildings on a set of fifteen bipolar adjectives scales. The frequency of exposure of each building was manipulated within subject. Repeated-measures analyses of variance revealed significant differences between the ratings. The modern-style buildings were evaluated as more aesthetically appealing and perceived as less organized and more complex than the old-style buildings. The effect of frequency of exposure was significant on the aesthetic evaluation dimension only. The relationship was in the form of an inverted U-shape function. However, no interaction effect was found. The results could be explained by Berlyne's hypothesis (1960, 1970) and Zajonc's mere exposure hypothesis (1968). Although the study was conducted in the 1980s, the psychological effects of perception and evaluation may remain the same. Given the scarcity and paucity of research on heritage buildings in the discipline of psychology, this paper reviews current research literature in the subject area, discusses if and to what extent the results still hold true, and proposes a way forward.

Keywords: Old-style building; modern-style building; perception and evaluation of buildings; frequency of exposure

People can perceive and respond to perceptual cues embedded within physical environments and architectural spaces. How do they react to various aspects of the natural environment and design characteristics of their built environment? The perception and evaluation of environmental and architectural spaces has been an area of research in environmental psychology for several decades (Craik, 1973; Gifford, 2014). In this paper, a small experiment that involved comparing evaluation ratings of old-style and modern-style buildings is reported and its findings are discussed within the context of current research literature.

Research on the perception and evaluation of various environments with a wide range in the degree of naturalness-artificiality and scale was conducted in the 1970s, for example, landscape (Calvin, Dearing & Curtin, 1972); various man-made versus natural environments

(Pedersen, 1978); residential areas (Horayangkura, 1978); city districts (Lowenthal & Riel, 1972); houses (Canter, 1969); interiors of buildings (Canter & Wools, 1970; Vielhauer, 1965, cited in Hershberger, 1972); urban spaces (Herzog, Kaplan, & Kaplan, 1976); building entrances (Oostendorp, McMaster, Rosen, & Waind, 1978). However, few studies that focused on old buildings had been conducted, even though buildings of a variety of architectural styles from different historical periods or geographical regions had been studied (Oostendorp & Berlyne, 1978 a, b, c). Since the 1980s, additional studies have been conducted on landscapes (see meta-analysis by Stamps, 2004), urban nature (Herzog, 1989), residential scene (Nasar, 1983); urban spaces (Herzog, 1992; Herzog Kaplan, & Kaplan, 1982); urban neighborhoods (Bonaiuto, Fornara, & Bonnes, 2003); building exterior (Herzog, & Gale, 1996; Herzog & Shier, 2000; Nasar, 1994); and building facades (Akalin, Yildirim, Wilson, & Kilicoglu, 2009; Ikemi, 2005; Stamps, 1999). More studies have been conducted on people's responses to buildings of various architectural styles and historical periods:

buildings of different architectural style in Britain (Cook & Furnham, 2012); high- versus popular-style residential buildings (Devlin & Nasar, 1989; Stamps & Nasar, 1997); modern- versus post-modern buildings (Groat, 1982); high-rise buildings (Stamps, 1991); and large, modern office buildings (Gifford, Hine, Muller-Clemm, Reynolds, & Shaw, 2000). However, studies that focus on “heritage buildings” are hard to find, even though a few studies have included older buildings: old buildings (Frewald, 1989); old versus new buildings (Herzog & Gale, 1996; Herzog & Shier, 2000; Stamps, 1994); classical versus modern buildings (Mastandrea, Bartoli, & Carrus, 2011).

In addition to any theoretical significance, the study of the perception and evaluation of buildings is of practical interest. As historical buildings make way for modern buildings, preservation of historic buildings has been a hot issue for decades. Proponents for preservation have argued for the beauty, harmony, and character of these buildings and that people derive satisfaction from them. Cantell (1975) wrote,

‘Modern development may be exciting and impressive, but for such qualities as beauty, harmony, friendliness and human scale we depend more and more on conservation of the old.’ (p. 7)

Even fake historic architecture is viewed as attractive, despite people’s ability to discriminate between authentic and fake historic architecture (Levi, 2005). The repetition of arches, pilasters, columns, ornaments, and detailing gives historical building facades a sense of legibility, coherence, and harmony (Askari, Dola, & Soltani, 2014).

According to sociologist Milligan (2007), one argument put forward by the preservation movement is that buildings serve as collective memory of historical events. Other rationales for preservation have included cultural and educational, economic, and environmental benefits. Aside from the claim of architectural significance, heritage buildings and its surrounding built environment have been marketed in “heritage tourism” (Milligan, 2007). Even fake historic architecture has received support for historic preservation (Levi, 2005). The attractiveness of specific historical buildings is often depicted repeatedly in advertisements in the mass media and social media, and in tourist guidebooks. How are people’s perception and evaluation of buildings as a form of stimuli affected by repeated exposure? Does familiarity influence our evaluation of buildings?

This paper reports a study conducted in 1981 that compared people’s perception and evaluation of ‘old-style’ and ‘modern-style’ buildings. In addition, the effect of repeated exposure on the evaluation of these buildings as stimuli was examined. Because of the age of the experiment, its findings are discussed in the context of current literature. For this experiment, ‘old-style’ buildings referred to building of late nineteenth and early twentieth century. These were typically built of natural materials, elaborately decorated or ornamented in demonstration of fine craftsmanship. On the other hand, modern architecture was characterized by an ‘international style’ and being functionalistic. Man-made materials were

used, and the structural framework was often displayed. Wolfgang (1964) summarized the transition into modern architecture as follows:

‘Instead of the natural charm of uncultivated material, the broken effect of glass, intricately textured surfaces, clouded colors, fused enamels and the weathering of walls, we now have the attraction of cultivated material, clear glass, shining curved surfaces, the sparkling and brilliance of color and the glitter of steel.’ (p. 19)

Evaluation Scales of buildings

In the early research of perception and evaluation of buildings, researchers used primarily verbal judgment (e.g., semantic differential scales, Osgood, Suci & Tannenbaum, 1957) to determine the underlying variables in people’s psychological responses to the built environment. Attempts were made to develop a taxonomy of descriptive properties of architectural environments, for example, Kasmar (1970). Factor analysis of semantic differential scales and multidimensional scaling yielded several fundamental dimensions: friendliness (e.g., friendly-unfriendly), coherence (e.g., harmonious-discordant), character (e.g., interesting-boring) (Canter, 1969); ‘natural beauty’ (e.g., beautiful) and ‘natural forces’ (e.g., rugged and complex) (Calvin, Dearing, & Curtin, 1972); evaluative (e.g., pleasant-unpleasant), spiritual, activity, and aesthetic appeal (Pedersen, 1978); evaluation (e.g., good-bad), urbanization, and organization (e.g., ordered-chaotic) (Horayangkura, 1978); aesthetic appeal and physical organization (Vielhauer, 1965, as cited by Hershberger, 1972); aesthetic, friendliness, organization, and potency (review of factors identified by seven researchers, Hershberger, 1972); clarity, hedonic tone/arousal, uncertainty, and familiarity (Oostendorp & Berlyne, 1978 a, b, c); arousal, repulsion, and elegance (Oostendorp et al., 1978). Despite some discrepancies in the scales used and the dimensions identified in these studies, three dimensions had been consistently identified – aesthetic, organization, and friendliness. Thus, these three dimensions were used in the experiment reported in this paper.

Some early researchers questioned the validity of verbal measures because researchers may not have included in their verbal measures the most important environmental attributes in people’s perception (Canter & Wools, 1970; Horayangkura, 1978; Oostendorp et al., 1978a). As a result, researchers had begun to use non-verbal measures in addition to verbal measures. Examples of non-verbal measures included looking time (Oostendorp et al., 1978 a, b & c; Stamps, 2004), exploratory choice and reward value (Oostendorp et al., 1978 a, b & c), and multiple sorting task (Groat, 1982). The results of some studies (e.g., Horayangkura, 1978) had shown general agreement between the verbal and the non-verbal approaches. Thus, in the absence of any evidence to the contrary, the use of verbal rating scales as a measure was justified at the time of the experiment. More recently, researchers have used additional non-verbal measures, such as reaction time for automatic affective processing of aesthetic response

in Implicit Association Tests (Mastandrea et al., 2011). Other approaches have included experimental aesthetics (Berlyne, 1971, 1974).

Frequency of exposure

Zajonc (1968) reported the first experiment that demonstrated the 'mere exposure hypothesis' – repeated exposure of a person to a stimulus was a sufficient condition for enhanced liking of that stimulus. Repeated exposure was hypothesized to reduce negative affect (e.g., fear) evoked by a novel stimulus; as a result, positive affect increased because no negative consequence was experienced after exposure. Stang's (1974) early review showed that the stimuli used in various studies had included contemporary paintings, music, idiographs, portraits, and other objects and the effect of exposure was more pronounced for novel or unfamiliar objects than for familiar objects. Subsequently, researchers predicted an inverted U-shape function (Berlyne, 1970; Harrison & Crandall, 1972; Zajonc, Shaver, Tavis & van Kreveld, 1972), linear decrements, and other functions, depending on the nature of the stimuli used. To account for the inverted U-shape relationship, Berlyne (1970) and Stang (1974) proposed the 'two-factor theory'. It assumed the operation of two antagonistic factors: 'stimulus habituation', the positive affect that arose with increased familiarity and reduced uncertainty; and 'tedium', which set in as the amount of boredom increased. The result was an inverted U-shaped relationship with liking. The hedonic value, i.e., the reward value and preference, of complex stimuli tended to increase as they became less novel.

There was empirical evidence contrary to the mere exposure hypothesis, particularly in the areas of exploration and curiosity. For instance, an organism would move towards a novel rather than a familiar stimulus (Berlyne, 1960). Berlyne (1970) found a direct relationship between novelty and hedonic value. Simple stimuli became less pleasant but complex stimuli became more pleasant as the stimuli became less novel. Zajonc (1968) argued that exploratory behavior allowed the organism to discover if the novel stimulus was a source of danger. If the exploratory behavior served to change the novel stimulus into a familiar stimulus, it made the stimulus object more attractive.

Later reviews of research on repeated exposure (Bornstein, 1989; Montoya et al., 2017) has confirmed the occurrence of a reliable effect of exposure on liking and an inverted U-shaped function between frequency of exposure and liking. The magnitude of effect is moderated by exposure duration and stimulus type. Liking can decrease even after a very brief repeated exposure. Liking for simple stimuli reaches its peak faster and at lower frequency of exposure than for complex stimuli. Recognition is not required for the mere exposure effect to occur, but recognition itself does not inhibit liking. Familiarity may lead to liking (Montoya et al., 2017).

In the studies of repeated exposure cited above, the evaluation of stimuli was of a general nature, primarily liking. In the present experiment, the buildings were evaluated on the friendliness and organization dimensions, in addition to aesthetic appeal. In summary,

the experiment was concerned with any differential perception and evaluation of old- and modern-style buildings, effects of frequency of exposure, and their interaction effects.

Method

Experimental Design

A within-subjects design was used in this experiment, with building style and frequency of exposure as factors. Presentation of the buildings at the three frequencies was counterbalanced among 36 groups of research participants. In other words, each participant watched a sequence of slides of three pairs of old- and modern-style buildings: one pair once, another pair six times, and another pair eleven times. Altogether 36 slides of six different buildings were presented in each session.

Research Participants

The participants were 236 male and female students taking introductory psychology courses at a Canadian university in 1981. They were awarded credit for their participation.

Materials

Color plates of two old-style and three modern-style buildings were selected from architectural journals and books. One slide of an old-style building was borrowed from the slide library of the Department of Architecture. The criteria for selection were as follows: Multi-storeyed (at least 6 floors); Office or public buildings; Typicality of design (i.e., representative of the type of building design); Comparable conditions of upkeep; and Daylight view. For the sources of these plates and slide, see **Table 1**. Twelve copies of Kodachrome slides were made from each of the color plates selected and the slide borrowed from the slide library. Eleven copies were used in the exposure phase, and one was used in the rating phase. Full scale views were taken to eliminate any confounding factors due to the presence of other features in the surrounding (e.g., trees). The slides measured 35 mm × 23 mm.

The list of items comprised 15 bipolar adjective scales representing three dimensions in perception and evaluation of environments: (1) Aesthetic evaluation, (2) Organization, and (3) Friendliness (see **Table 2**). The adjective scale simplicity-complexity was included because preference of complex stimuli tended to increase as they became less novel (Berlyne, 1970). The 15 bipolar adjective scales with a 5-point response range were listed in random order (see **Table 3**). A response of '1' was indicative as being most highly evaluated/most organized/most friendly/simpliest. A response of '5' was indicative as being the most negatively evaluated/most unorganized/most unfriendly/most complex. The adjectives within each dimension used in this experiment were based on findings from previous research reviewed earlier.

Procedure

The participants took part in the experiment in a room in small groups, up to ten participants at a time. They were told at the beginning of the session that they would

Table 1: Sources of Slides and Plates.

Old Buildings	
O1	Booly Block (1891), Salt Lake City, Utah, U.S. Architect: Sullivan. From Architectural Library, Department of Architecture, University of Manitoba.
O2	Auditorium Building (1886), Chicago, U.S.A. Architect: Sullivan and Dankmar Adler In <i>Modern Architecture in Color</i> , London: Thames and Hudson, 1972, pp. 88.
O3	Façade of Power Building (1869–70), Rochester, New York, U.S. In <i>Historic Preservation</i> , 1976 (Jan.-March), pp. 4.
Modern Buildings	
N1	Pennzoil Place (1977), Houston, U.S. Architect: Philip Johnson/Burgee In <i>American Institute of Architects Journal</i> , 1977 (Feb.), p. 60.
N2	Henry L. Moses Institute (1965) Architect: Philip Johnson In <i>Philip Johnson: Architecture, 1945–65</i> , p. 112.
N3	Research Tower for the Johnson Wax Co. (1949–51), Racine, Wisconsin, U.S. Architect: Frank Lloyd Wright In <i>Modern Architecture in Color</i> . London: Thames and Hudson, 1972, p. 332.

Table 2: Classification of the adjective scales under three dimensions.

Aesthetic Evaluation		
Interesting	–	uninteresting
Exciting	–	dull
Beautiful	–	ugly
Pleasant	–	unpleasant
Good	–	bad
Unusual	–	commonplace
Organization		
Orderly	–	chaotic
Balanced	–	unbalanced
Harmonious	–	discordant
Clear	–	indefinite
Friendliness		
Friendly	–	unfriendly
Welcoming	–	unwelcoming
Happy	–	sad
Warm	–	cold

Table 3: Bipolar Adjective Scales.

Friendly	1	2	3	4	5	unfriendly
Pleasant	1	2	3	4	5	unpleasant
Orderly	1	2	3	4	5	chaotic
Welcoming	1	2	3	4	5	unwelcoming
Interesting	1	2	3	4	5	uninteresting
Warm	1	2	3	4	5	cold
Unusual	1	2	3	4	5	commonplace
Exciting	1	2	3	4	5	dull
Simple	1	2	3	4	5	complex
Good	1	2	3	4	5	bad
Clear	1	2	3	4	5	indefinite
Balanced	1	2	3	4	5	unbalanced
Beautiful	1	2	3	4	5	ugly
Harmonious	1	2	3	4	5	discordant
Happy	1	2	3	4	5	sad

evaluate a number of slides of buildings at the end of the experimental session.

During the exposure phase, slides of the buildings (three old-style and three modern-style) were projected in sequence onto the white wall 23 ft. 6 in. in front of the

participants in a dark room using a slide projector (Model Carousel 850 with zoom Ektanar lens f:3.5). The image of the slides measured 5 ft. 10 in. by 4 ft. 1 in. The slides were loaded automatically.

Each slide was presented for 10 seconds. Then there was a lapse of 5 seconds during which the participants saw a patch of light on the wall. The same procedure was repeated until all 36 slides had been projected. The 36

slides consisting of the three pairs of old- and modern-style buildings were presented 1, 6, and 11 times, respectively, and these slides were presented in a random order.

In the rating phase that followed, slides of the six buildings were projected once more. The first slide was projected onto the wall for 15 seconds in the dim light condition. The participants were given 1 minute 15 seconds to record their ratings. The second slide was then presented. The same procedure was repeated until all the six buildings had been evaluated. The order of presentation of the slides in this phase was at random.

Data Analysis

As the six buildings were rated in different orders in the 36 groups, the data had to be rearranged. The ratings for the old- and modern-style buildings that were exposed 1, 6, and 11 times, respectively, were collapsed across the 36 groups. A repeated-measures analysis of variance (ANOVA) was then performed on each of the three dimensions. The ANOVA tests were considered quite acceptable at the time of the study. However, a MANOVA would have possibly allowed for a more nuanced interpretation of the data than had multiple ANOVAs; reducing the number of tests would possibly have lessened type 1 error.

Results

The means and standard deviations of ratings of the old- and modern-style buildings for frequency of exposure of 1, 6, and 11, respectively, are presented in **Table 4**. The analyses of variance with repeated measures indicated the following results. The main effects of building style (old versus modern) were statistically significant with respect to the aesthetic evaluation dimension, $F(1, 235) = 41.76, p < .01$ and the organization dimension, $F(1, 235) = 4.65, p < .05$, but non-significant for the friendliness dimension (**Table 5**). Modern-style buildings were more positively evaluated than old-style buildings whereas old-style buildings were perceived as more organized than

modern-style buildings. The results also showed that modern-style buildings were perceived as more complex than old-style buildings. The difference was statistically significant, $F(1,235) = 9.66, p < .01$.

As for the main effect of frequency of exposure, the data indicated a significant difference in the aesthetic evaluation dimension only, $F(2, 470) = 4.42, p < .01$; **Table 5**). A trend analysis on the aesthetic evaluation dimension yielded a significant quadratic component on the frequency factor, $F(1,235) = 7.42, p < .01$, but a non-significant linear component. The mean ratings of both the old-style and modern-style buildings decreased (i.e., evaluated more positively) as the frequency was increased until these ratings reached a minimum value (i.e., most positively evaluated), and these ratings then increased

Table 5: Results of ANOVA.

	SS	df	MS	F	p
Main effect of building style (old versus modern)					
Aesthetic evaluation	42.54	1, 235	42.54	41.76	.00*
Organization	4.29	1, 235	4.25	4.65	.03*
Friendliness	1.86	1, 235	1.85	1.34	.25
Main effect of frequency of exposure					
Aesthetic evaluation	5.15	2, 470	2.57	4.42	.01*
Organization	0.40	2, 470	0.20	0.45	.64
Friendliness	0.81	2, 470	0.40	0.60	.55
Interaction effect between building style and frequency of exposure					
Aesthetic evaluation	1.10	2, 470	0.55	1.00	.34
Organization	0.35	2, 470	0.18	0.33	.72
Friendliness	1.27	2, 470	0.63	1.08	.34

*P < .05.

Table 4: Means and standard deviations of ratings as a function of building style and frequency of exposure.

		Frequency of exposure					
		1		6		11	
		Mean	s.d.	Mean	s.d.	Mean	s.d.
Aesthetic evaluation							
Style	old	3.00	0.84	2.84	0.77	2.98	0.90
	Modern	2.68	0.79	2.55	0.79	2.56	0.82
Organization							
Style	old	2.48	0.70	2.51	0.86	2.48	0.83
	Modern	2.64	0.81	2.60	0.78	2.56	0.84
Friendliness							
Style	old	2.93	0.88	2.81	0.92	2.83	0.96
	Modern	2.93	0.90	2.95	0.84	2.92	0.91
Complexity							
Style	old	3.03	1.32	3.07	1.27	3.00	1.27
	Modern	3.13	1.24	3.43	1.25	3.28	1.24

(i.e., evaluated more negatively) as the frequency was increased further. There was no significant interaction effect between style of buildings and frequency of exposure (**Table 5**).

Discussion

In this experiment, modern-style buildings were perceived and evaluated as less organized, more complex, and aesthetically appealing than old-style buildings. At the time of the study, there was no clear research evidence regarding the relationship between age and preference of urban buildings. Nevertheless, the results of this experiment are consistent with the findings of some studies conducted since the 1990s. In the Stamp (1991) study, complex, modern style high-rise buildings were preferred over old brick or plain buildings. In the Herzog and Shier study (2000), age of building was negatively related to preference except at the higher end of the complexity range. However, the results are contrary to the findings of Stamp's (1994) study in which old buildings were preferred over new buildings. Previous research has suggested physical condition or building maintenance to be an important factor. In Frewald's (1989) study, older buildings were clearly preferred over modern buildings with similar physical condition. In the Herzog and Gale (1996) and Herzog and Shier (2000) studies, modern buildings were preferred over older buildings when building maintenance was not controlled, but when it was controlled, older buildings were preferred over contemporary buildings in the urban context. Taken together, the mixed findings reported in various studies, including the experiment reported in this paper, are likely due to differences in complexity, and physical condition or building maintenance.

Older-style buildings were rated as less complex than modern-style building in this experiment. This finding is consistent with Mastandrea et al.'s (2011) study in which classical architecture was rated as more simple than contemporary architecture by the residents of Rome, Italy. Complexity refers to how much the scene contains different kinds of elements (Stamps, 2004). As evident in Frewald's (1989) study, the older buildings that had a diversity of physical features were rated high in visual richness, or complexity. Possibly the old-style buildings in this experiment were rated as less complex because they had relatively few kinds of elements.

Organization or coherence (how well a scene hangs together, Stamps, 2004) requires a high degree of internal redundancy (Berlyne, 1960). The design of modern-style buildings may encompass simple lines and shapes, but these elements are combined in an intricate and unpredictable way (e.g., contrast in colors and materials). In contrast, finely decorated exteriors, uniformity in the materials used, and symmetry in design make old-style buildings look more organized. The finding of the experiment reported in this paper was consistent with that of the Horayangkura (1978) study, in which the older residential area was perceived as more organized, but inconsistent with the Frewald study (1989) in which older buildings were not rated higher than modern buildings on coherence. As evident in the Canter (1969) study, high

complexity was negatively correlated with the other scales on the 'coherence' factor, suggesting that high complexity is compatible with low degree of organization.

The preservationists' argument that old-style buildings are more harmonious was supported by the findings of this experiment. However, it does not necessarily imply that they are perceived as more beautiful or are more highly evaluated aesthetically than modern-style buildings.

Instead, the more complex and less organized modern-style buildings were evaluated more positively on the aesthetic evaluation dimension in this experiment. These results can be explained by Berlyne's hypothesis (1960). On the basis of his experimental findings on aesthetics, he concluded that it was diversity, complexity, novelty, and ambiguity in a composition that led to 'arousal' and 'attention', but it was order, organization, symmetry, and repetition that kept arousal within moderate and tolerable limits. Thus, an aesthetic product needs to gain and maintain observers' attention and at the same time to keep arousal within limits. Modern-style buildings were perceived as more aesthetically appealing than older-style buildings because higher complexity led to a higher-level of arousal, but arousal was kept within tolerable limits with some level of order or organization. In general, the most preferred architecture and environmental scenes seem to have a moderate level of complexity (Akalin et al., 2009; Wohlwill, 1968; Berlyne, 1971; Kaplan & Kaplan, 1989).

The effect of frequency of exposure was only significant on the aesthetic evaluation dimension. As the frequency was increased, the ratings of the buildings became more positive and then more negative as the frequency was further increased. Although the interaction effect was not statistically significant, the simpler, old-style buildings appeared to have reached its peak at the middle frequency of exposure (**Table 4**). This trend is consistent with previous research findings that liking for simple stimuli peaks faster and at lower frequency of exposure than complex stimuli (c.f. review by Montoya et al., 2017).

People generally prefer familiar environments. Familiarity was reported to be highly predictive of preferences for all architectural styles (Cook & Furnham, 2012). Familiar stimuli are also processed faster and are preferred to novel stimuli. For instance, the more familiar classical architecture as rated by residents in Rome was preferred over contemporary architecture (Mastandrea et al., 2011). The condition in the experiment may have represented short-term novelty as distinguished from complete novelty. A short-term novelty refers to things that are new with respect to its recent experience, whereas a complete novelty refers to a stimulus which is new with respect to an organism's total experience (Berlyne, 1960). As both old- and modern-style buildings were commonplace in the city where the experiment was conducted, the research participants were likely to be somewhat familiar with the stimuli. The initial enhancement in aesthetic evaluation could be the result of short-term novelty, as novelty tends to raise arousal and hedonic value (Berlyne, 1970).

In summary, the results of studies on the perception and evaluation of old-style and modern-style buildings are inconsistent. Several issues need to be addressed. First, the stimulus buildings have been rated relative to one another on various dimensions within a study and because different sets of stimuli have been used in different studies, it is difficult to compare the results across studies. Second, the evaluation ratings could depend on specific features of specific building styles. Detailed studies about the specific features of old and modern buildings would help understand what physical features affect these evaluations. For example, Gifford et al. (2000) used a lens model to associate physical attributes of modern office building with affective responses and global evaluative assessments. Third, what constitute old buildings and modern buildings change with time and place, so it is important to replicate studies in different places and times. Today's modern buildings in New York are likely different from the modern buildings on the Canadian prairies in the 1980s.

As with many studies in this research area in psychology, caution needs to be taken in generalizing the results beyond the university student population. The experiment would have been more valuable if the participants were from a representative sample of the public. However, even the public have different perception and preferences than do architects (Devlin, & Nasar, 1989; Gifford et al., 2000; Groat, 1982; Fawcett, Ellingham, & Platt, 2008).

Future Research Direction

Research on the perception and evaluation of old buildings was scarce at the time this study was conducted and is still limited at the present time. The architectural styles of buildings used in the studies cited earlier can be vastly different, so that may have contributed to the discrepancies in research findings. Research on "heritage buildings" is even more scarce. Heritage buildings are not just old buildings; they can be of different architectural styles and can even include modern architecture, according to Milligan (2007). Heritage buildings can be of different building types (e.g., residence, public building), thus requiring different evaluation criteria (Nasar, 1983). These heritage buildings can also vary in complexity or visual richness, order or coherence, mystery, legibility (predictors of the environmental preference model, Kaplan, Kaplan & Brown, 1989) and other dimensions, and meaning as well (Groat, 1982).

Building maintenance has been demonstrated to be an important factor in the evaluation of buildings. For heritage buildings to be evaluated positively, they need to be well-maintained. All the studies have focused on the building exterior or façade, even though heritage buildings are often renovated for different uses (e.g., Ahn, 2013). Future studies could examine how building interiors of heritage buildings are evaluated, in terms of aesthetic appeal and functionality.

Most of the studies have used static slides or photographs as stimuli. Future studies could use dynamic video, computer simulations, and even virtual reality as tools for presentation of the buildings to be evaluated (Stamps, 2016). And of course, on-site evaluation would

allow for the testing of ecological validity of various modes of presentation of stimuli.

Tourism marketing of heritage buildings might take advantage of the mere exposure effect. As concluded in several reviews (Bornstein, 1989; Montoya, 2017; Stang, 1974), repeated exposure can enhance liking of a stimulus and the magnitude of its effects would depend on exposure duration, frequency, and interval, and complexity and novelty of the stimuli. Future studies could explore the effects of these and other variables (e.g., familiarity versus novelty) on the evaluation of heritage buildings. How might tourists and locals differ in their evaluation of heritage buildings?

In the past four decades, researchers have been interested in people's emotional bond to places, for example, place attachment (c.f., review by Lewicka, 2011). There is ample evidence that people develop emotional bond with a place after long-term interactions with the place. For instance, long-time residents often acquire meanings through association of life events with a place and through the process, develop a sense of self-continuity. Homeowners can develop a sense of pride of place by having maintained their residences well (Lewicka, 2011). However, some recent research has shown that prior experience can play a role in place bonding. For example, Cheng and Kuo (2015) were able to demonstrate that the addition of an element of familiarity to a stimulus scene enhanced people's bonding with an unfamiliar place. The authors suggested that tourists may form initial bonds to a destination on their first visit based on their previous experiences with similar environments and then develop that initial bonding into composite bonding with the place later. Prentice (2004) showed that for cultural tourists, familiarity with a place is an important factor that influences their affective response or sense of meaning, which in turn affects their propensity to visit a destination. Future research can be developed to integrate research on the evaluation of the built environment, or environmental aesthetics in general in theoretical development of the psychology of place (Lewicka, 2011).

Data Accessibility Statement

As this is an old study, the raw data are no longer available.

Acknowledgements

This experiment was conducted as the author's BA honours thesis at Department of Psychology, University of Manitoba, Winnipeg, Canada in April 1981. The author acknowledges the assistance of her thesis supervisor and committee.

The author would like to thank two anonymous reviewers for their constructive feedback on the manuscript.

Competing Interests

The author has no competing interests to declare.

Author Contributions

The author contributed to the conception and design, acquisition of data, analysis and interpretation of data, drafting and revising the article, and final approval of the version to be published.

References

- Ahn, Y.-K.** (2013). Adaptive reuse and historic churches. *Preservation Education & Research*, 6, 25–40.
- Akalin, A., Yildirim, K., Wilson, C., & Kilicoglu, O.** (2009). Architecture and engineering students' evaluations of house façades: Preference, complexity and impressiveness. *Journal of Environmental Psychology*, 29(1), 124–132. DOI: <https://doi.org/10.1016/j.jenvp.2008.05.005>
- Askari, A. H., Dola, K. B., & Soltani, S.** (2014). An evaluation of the elements and characteristics of historical building façades in the context of Malaysia. *Urban Design International*, 19, 113–124. DOI: <https://doi.org/10.1057/udi.2013.18>
- Berlyne, D. E.** (1960). *Conflict, curiosity and exploratory behavior*. New York: McGraw-Hill.
- Berlyne, D. E.** (1970). Novelty, complexity and hedonic values. *Perception and Psychophysics*, 8, 279–286. DOI: <https://doi.org/10.3758/BF03212593>
- Berlyne, D. E.** (1971). *Aesthetics and psychology*. New York: Appleton-Century-Crofts.
- Berlyne, D. E.** (1974). *Studies in the new experimental aesthetics*. New York: John Wiley & Sons.
- Bonaiuto, M., Fornara, F., & Bonnes, M.** (2003). Indexes of perceived residential environment quality and neighbourhood attachment in urban environments: a confirmation study on the city of Rome. *Landscape and Urban Planning*, 65(1–2), 41–52. DOI: [https://doi.org/10.1016/S0169-2046\(02\)00236-0](https://doi.org/10.1016/S0169-2046(02)00236-0)
- Bornstein, R. F.** (1989). Exposure and affect: Overview and meta-analysis of research, 1968–1987. *Psychological Bulletin*, 106, 265–289. DOI: <https://doi.org/10.1037/0033-2909.106.2.265>
- Calvin, J. S., Dearing, J. A., & Curtin, M. E.** (1972). An attempt at assessing preference for natural landscapes. *Environment and Behavior*, 4, 447–470.
- Cantell, T.** (1975). Why conserve? *Planner*, 61(1), 6–10.
- Canter, D.** (1969). An intergroup comparison of connotative dimensions in architecture. *Environment and Behavior*, 1(1), 37–48. DOI: <https://doi.org/10.1177/001391656900100103>
- Canter, D., & Wools, R.** (1970). A technique for the subjective appraisal of buildings. *Building Science*, 5, 187–198. DOI: [https://doi.org/10.1016/0007-3628\(70\)90009-5](https://doi.org/10.1016/0007-3628(70)90009-5)
- Cheng, C.-K., & Kuo, H.-Y.** (2015). Bonding to a new place never visited: Exploring the relationship between landscape elements and place bonding. *Tourism Management*, 46, 546–560. DOI: <https://doi.org/10.1016/j.tourman.2014.08.006>
- Cook, R., & Furnham, A.** (2012). Aesthetic preferences for architectural styles vary as a function of personality. *Imagination, Cognition and Personality*, 32(2), 103–114. DOI: <https://doi.org/10.2190/IC.32.2.b>
- Craik, K. H.** (1973). Environmental psychology. *Annual Review of Psychology*, 24, 403–422. DOI: <https://doi.org/10.1146/annurev.ps.24.020173.002155>
- Devlin, K., & Nasar, J. L.** (1989). The beauty and the beast: Some preliminary comparisons of 'high' versus 'popular' residential architecture and public versus architect judgments of same. *Journal of Environmental Psychology*, 9(4), 333–344. DOI: [https://doi.org/10.1016/S0272-4944\(89\)80013-1](https://doi.org/10.1016/S0272-4944(89)80013-1)
- Fawcett, W., Ellingham, I., & Platt, S.** (2008). Reconciling the architectural preferences of architects and the public: The ordered preference model. *Environment and Behavior*, 40(5), 599–618. DOI: <https://doi.org/10.1177/0013916507304695>
- Frewald, D. B.** (1989). *Preferences for older buildings: A psychological approach to architectural design*. Unpublished doctoral dissertation, University of Michigan-Ann Arbor. Dissertation Abstracts International, 51(1-B), 414–415.
- Gifford, R.** (2014). Environmental psychology matters. *Annual Review of Psychology*, 65, 541–579. DOI: <https://doi.org/10.1146/annurev-psych-010213-115048>
- Gifford, R., Hine, D. W., Muller-Clemm, W., Reynolds, D. J., & Shaw, K. T.** (2000). Decoding modern architecture: A lens model approach for understanding the aesthetic differences of architects and layperson. *Environment and Behavior*, 32(2), 163–187. DOI: <https://doi.org/10.1177/00139160021972487>
- Groat, L.** (1982). Meaning in post-modern architecture: An examination using the multiple sorting task. *Journal of Environmental Psychology*, 2(1), 3–22. DOI: [https://doi.org/10.1016/S0272-4944\(82\)80002-9](https://doi.org/10.1016/S0272-4944(82)80002-9)
- Harrison, A. A., & Crandall, R.** (1972). Heterogeneity-homogeneity of exposure sequence and the attitudinal effects of exposure. *Journal of Personality and Social Psychology*, 21, 234–238. DOI: <https://doi.org/10.1037/h0032314>
- Hershberger, R. G.** (1972). Towards a set of semantic scales to measure the meaning of architectural environments. In W. Mitchell (Ed.) *EDRA III, Proceedings of the Third Annual Conference*. Los Angeles: University of California.
- Herzog, T. R.** (1989). A cognitive analysis of preference for urban nature. *Journal of Environmental Psychology*, 9, 27–43. DOI: [https://doi.org/10.1016/S0272-4944\(89\)80024-6](https://doi.org/10.1016/S0272-4944(89)80024-6)
- Herzog, T. R.** (1992). A cognitive analysis of preference for urban spaces. *Journal of Environmental Psychology*, 12, 237–248. DOI: [https://doi.org/10.1016/S0272-4944\(05\)80138-0](https://doi.org/10.1016/S0272-4944(05)80138-0)
- Herzog, T. R., & Gale, T. A.** (1996). Preference for urban buildings as a function of age and nature context. *Environment and Behavior*, 28(1), 44–72. DOI: <https://doi.org/10.1177/0013916596281003>
- Herzog, T. R., & Shier, R. L.** (2000). Complexity, age, and building preferences. *Environment and Behavior*, 32(4), 557–575. DOI: <https://doi.org/10.1177/00139160021972667>
- Herzog, T. R., Kaplan, S., & Kaplan, R.** (1976). The prediction of preference for familiar urban places. *Environment and Behavior*, 8(4), 627–645. DOI: <https://doi.org/10.1177/001391657684008>
- Herzog, T. R., Kaplan, S., & Kaplan, R.** (1982). The prediction of preference for unfamiliar urban places. *Population & Environment: Behavioral & Social Issues*, 5(1), 43–59. DOI: <https://doi.org/10.1007/BF01359051>

- Horayangkura, V.** (1978). Semantic dimensional structure: a methodological approach. *Environment and Behavior*, 11(4), 555–584. DOI: <https://doi.org/10.1177/001391657801000405>
- Ikemi, M.** (2005). The effects of mystery on preference for residential facades. *Journal of Environmental Psychology*, 25(2), 167–173. DOI: <https://doi.org/10.1016/j.jenvp.2005.04.001>
- Kaplan, R., & Kaplan, S.** (1989). *The experience of nature: A psychological perspective*. New York, NY: Cambridge University Press.
- Kaplan, R., Kaplan, S., & Brown, T.** (1989). Environmental preference: A comparison of four domains of predictors. *Environment and Behavior*, 21(5), 509–530. DOI: <https://doi.org/10.1177/0013916589215001>
- Kasmar, J. V.** (1970). The development of a usable lexicon of environmental descriptors. *Environment and Behavior*, 2, 153–163. DOI: <https://doi.org/10.1177/001391657000200202>
- Levi, D. J.** (2005). Does history matter? Perceptions and attitudes toward fake historic architecture and historic preservation. *Journal of Architectural and Planning Research*, 22(2), 149–159.
- Lewicka, M.** (2011). Place attachment: How far have we come in the last 40 years? *Journal of environmental psychology*, 31(3), 207–230. DOI: <https://doi.org/10.1016/j.jenvp.2010.10.001>
- Lowenthal, D., & Riel, M.** (1972). The nature of perceived and imaged environments. *Environment and Behavior*, 4, 189–207. DOI: <https://doi.org/10.1177/001391657200400203>
- Mastandrea, S., Bartoli, G., & Carrus, G.** (2011). The automatic aesthetic evaluation of different art and architectural styles. *Psychology of Aesthetics, Creativity, and the Arts*, 5(2), 126–134. DOI: <https://doi.org/10.1037/a0021126>
- Milligan, M. J.** (2007). Buildings as history: The place of collective memory in the study of historic preservation. *Symbolic Interaction*, 30(1), 105–123. DOI: <https://doi.org/10.1525/si.2007.30.1.105>
- Montoya, R. M., Horton, R. S., Vevea, J. L., Citkowicz, M., & Lauber, E. A.** (2017). A re-examination of the mere exposure effect: The influence of repeated exposure in recognition, familiarity, and liking. *Psychological Bulletin*, 143(5), 459–498. DOI: <https://doi.org/10.1037/bul0000085>
- Nasar, J. L.** (1983). Adult viewers' preferences in residential scenes: A study of the relationship of environmental attributes to preferences. *Environment and Behavior*, 15, 589–614. DOI: <https://doi.org/10.1177/0013916583155003>
- Nasar, J. L.** (1994). Urban design aesthetics: The evaluative qualities of building exteriors. *Environment and Behavior*, 26, 377–401. DOI: <https://doi.org/10.1177/001391659402600305>
- Oostendorp, A., & Berlyne, D. E.** (1978a). Dimensions in the perception of architecture I: Identification and interpretation of dimensions of similarity. *Scandinavian Journal of Psychology*, 19, 73–82. DOI: <https://doi.org/10.1111/j.1467-9450.1978.tb00305.x>
- Oostendorp, A., & Berlyne, D. E.** (1978b). Dimensions in the perception of architecture II: Measures of exploratory behavior. *Scandinavian Journal of Psychology*, 19, 83–89. DOI: <https://doi.org/10.1111/j.1467-9450.1978.tb00306.x>
- Oostendorp, A., & Berlyne, D. E.** (1978c). Dimensions in the perception of architecture II: Multidimensional preference scaling. *Scandinavian Journal of Psychology*, 19, 145–150. DOI: <https://doi.org/10.1111/j.1467-9450.1978.tb00314.x>
- Oostendorp, A., McMaster, S., Rosen, M., & Waind, P.** (1978). Towards a taxonomy of responses to the built environment. *Rivista Institute Applied Psychology*, 27, 9–18. DOI: <https://doi.org/10.1111/j.1464-0597.1978.tb00352.x>
- Osgood, C. E., Suci, G. J., & Tanenbaum, P. B.** (1957). *The measurement of meaning*. Urbana: University of Illinois Press.
- Pedersen, D. M.** (1978). Dimensions of environmental perception. *Multivariate Experimental Clinical Research*, 3(5), 209–218.
- Prentice, R.** (2004). Tourist familiarity and imagery. *Annals of Tourism Research*, 31(4), 923–945. DOI: <https://doi.org/10.1016/j.annals.2004.02.008>
- Stamps, A. E. III** (1991). Public preferences for high-rise buildings: Stylistic and demographic effects. *Perceptual and Motor Skills*, 72, 839–844. DOI: <https://doi.org/10.2466/PMS.72.3.839-844>
- Stamps, A. E. III** (1994). Formal and nonformal stimulus factors in environmental preference. *Perceptual and Motor Skills*, 79, 3–9. DOI: <https://doi.org/10.2466/pms.1994.79.1.3>
- Stamps, A. E. III** (1999). Physical determinants of preference for residential facades. *Environment and Behavior*, 31(6), 723–751. DOI: <https://doi.org/10.1177/00139169921972326>
- Stamps, A. E. III** (2004). Mystery, complexity, legibility and coherence: A meta-analysis. *Journal of Environmental Psychology*, 34, 1–16. DOI: [https://doi.org/10.1016/S0272-4944\(03\)00023-9](https://doi.org/10.1016/S0272-4944(03)00023-9)
- Stamps, A. E. III** (2016). Simulating designed environments. In R. Gifford (Ed.), *Research methods for environmental psychology* (pp. 197–220). Chichester, UK: John Wiley & Sons. DOI: <https://doi.org/10.1002/9781119162124.ch11>
- Stamps, A. E. III, & Nasar, J. L.** (1997). Design review and public preferences: Effects of geographical location, public consensus, sensation seeking and architectural styles. *Journal of Environmental Psychology*, 17(1), 11–32. DOI: <https://doi.org/10.1006/jevp.1996.0036>
- Stang, D. J.** (1974). Methodological factors in mere exposure research. *Psychological Bulletin*, 81(12), 1024–1025. DOI: <https://doi.org/10.1037/h0037419>
- Wohlwill, J. F.** (1968). Amount of stimulus exploration and preference as differential functions of stimulus complexity. *Perception and Psychophysics*, 4(5), 307–312. DOI: <https://doi.org/10.3758/BF03210521>
- Wolfgang, P.** (ed.). (1964). *Encyclopedia of modern architecture*. New York: Harry N. Abrams, Inc.

Zajonc, R. B. (1968). The attitudinal effects of mere exposure. *Journal of Personality and Social Psychology Monograph Supplement*, 9(2 pt. 2), 1–27. DOI: <https://doi.org/10.1037/h0025848>

Zajonc, R. B., Shaver, P., Tavris, C., & van Kreveld, D. (1972). Exposure satiation, and stimulus discriminability. *Journal of Personality and Social Psychology*, 21(3), 270–280. DOI: <https://doi.org/10.1037/h0032357>

How to cite this article: Ng, C. F. (2020). Perception and Evaluation of Buildings: The Effects of Style and Frequency of Exposure. *Collabra: Psychology*, 6(1): 44. DOI: <https://doi.org/10.1525/collabra.324>

Senior Editor: Simine Vazire

Guest Editor: Jeremy C. Wells

Submitted: 14 January 2020 **Accepted:** 21 July 2020 **Published:** 17 August 2020

Part of Research Nexus: The Psychology of Senescent Environments

Copyright: © 2020 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.