

# **A Study on the Correlation between Residential Interior Decorating Element Preferences and Emotional Experiences: Chinese Urban Millennials**

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## **Abstract**

Given that people spend much of their time indoors, the impact of interior decorative elements (IDE) on mental well-being has garnered widespread attention. This study aims to investigate the influence of these elements on the emotional experiences and housing interior decoration preferences (HIDP) of China's urban millennials and explore the relationship between them. Using Virtual Reality (VR) technology, we recruited 40 Chinese urban students aged between 20 and 30, comprising 20 males and 20 females, to immerse themselves in four groups distinct interior design scenarios, encompassing four key design elements: styling contour, styling style, material brightness, and material texture. These IDE significantly affected their emotional experiences and HIDP.

Curved contour styling, style-less design, light-colored materials, and wood-grain textured materials were found to be more appealing in terms of emotional experiences. Furthermore, a correlation was observed between emotional experiences and HIDP, with scores of pleasure and nonarousal exerting a significant positive influence on four dimensions of HIDP. Conversely, displeasure significantly influenced the dimension of material texture negatively. This research provides crucial insights into how interior design impacts the emotional experiences and HIDP of China's urban millennials, offering practical value for real estate developers and interior designers. Additionally, the study underscores the effectiveness of VR as a tool for assessing responses to interior design.

**Keywords:** Interior design; Emotional experience; Decoration preferences; Virtual reality (VR)

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## **1. Introduction**

With the accelerating pace of urbanization, multi-unit residences buildings (MURBs) have become the primary housing choice for urban Chinese residents [1]. Simultaneously, the outbreak of the pandemic has prompted people to rethink their living spaces, with comfort, safety, and adaptability becoming crucial factors in housing selection. Numerous studies indicate that the MURBs interior form of residences significantly influences residents' quality of life and emotional states [2,3]. It's worth noting that a series of housing policies enacted in 2006 effectively addressed the issue of inadequate housing per capita. However, current design practices for MURBs unit often lack a thorough understanding of residents' preferences and emotional experiences, limiting the adaptability and proximity of living environments.

Surveys from China have shown that the proportion of young homebuyers in Chinese cities is gradually increasing, primarily concentrated between the ages of 25 and 40 [4,5]. Individuals in this age group are

actively seeking housing that suits their needs, making their housing preferences and emotional experiences essential factors in housing design. Moreover, the Chinese real estate market is gradually evolving towards sophistication and diversification. Therefore, the findings of this study can provide valuable market references for real estate developers.

This study aims to delve into the relationship between IDE of MURBs units and HIDP and emotional experiences, with a specific focus on young urban Chinese homebuyers. This has significant implications for future housing design and market development, potentially offering robust guidance to better meet people's needs for healthy, comfortable, and personalized housing.

Combining subjective emotional experiences with VR environments provides more realistic evidence for evaluating residents reactions to interior design [2,6]. Y. Zhang et al. proposed an innovative approach based on Immersive VR for user-centered interior decoration material selection [8]. One study showed that spaces with curved features were preferred across age groups compared to spaces with sharp/straight lines, inducing higher positive emotions. However, different stylistic decorations did not show differences [2]. Another study conducted in a laboratory setting used virtual reality and physiological markers (i.e., heart rate variability). The results showed that people's preferences for warm

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and cool colors depended on the type of room [7]. None of these three studies evaluated the impact of emotional experiences on HIDP.

While the correlation between indoor environments and our emotional well-being has been well established, IDE are multifaceted, and people often evaluate them along single dimensions. Moreover, we know little about specific aspects of HIDP and their effects on negative and positive emotions. Therefore, this study aims to classify HIDP and investigate the relationships and impacts of emotional experiences on HIDP.

## 2. Materials and Methods

This study seeks to assess the relationship between IDE of HIDP and emotional experiences, as well as their impact on residents. To achieve this goal, we employed a controlled experimental design to evaluate the influence of shape and material perception on emotional states. The independent variables included style perception (categorized as stylized, less stylized, and un-stylized), contour perception (comprising straight and curved), color perception (encompassing light and dark), and material perception (including metal, wood, stone/brick imitation, and concrete). Data on these emotional states were collected after participants viewed panoramic images of different interior spaces' designs while wearing VR glasses.

### 2.1. Questionnaire

This study employed Mehrabian and Russell's (1974) emotional state model, the PAD (pleasure, arousal, and dominance) questionnaire, to assess emotional states under different decoration conditions[8]. The Pleasure (PL)-Displeasure (DP) Scale measures the pleasantness or unpleasantness of one's feelings. The Arousal (AR)-Nonarousal (NAR) Scale measures the level of arousal or drowsiness one feels. The Dominance (DM)-Submissiveness (SB) Scale represents the degree of control and dominance versus submission one feels. For example, while both fear and anxiety are unpleasant emotions, relaxation is a dominant emotion, while fear is a submissive emotion.

### 2.2. Scenes

Real indoor scene panoramic pictures is best for showcasing the visual information of an environment. However, such panoramic pictures contain multiple visual features (e.g., styling contour, styling style, material brightness and material textures), making it challenging to isolate visual perceptual components. Therefore, we controlled variables in the scenes. We invited professional interior designers to provide design schemes for a multi-unit residential unit's public space (living room, dining room, kitchen, balcony). In the styling group, scenes were divided into contour style and styling style groups. The contour style group included scenes with straight lines and curved lines, while the styling style group comprised three scenes (modern style, transitional style, and classical style). In

the material group, scenes were divided into material brightness and material texture. The material brightness group included scenes with dark and light colors, while the material texture group included scenes with wood, concrete, metal, and stone materials. All scenes were created using SketchUp 2021 models and rendered with the Enscape plugin (Figure 1).

Styling Contour

Straight Lines



Curved Lines



Styling Style

Modern Style



Transitional Style



Classical Style



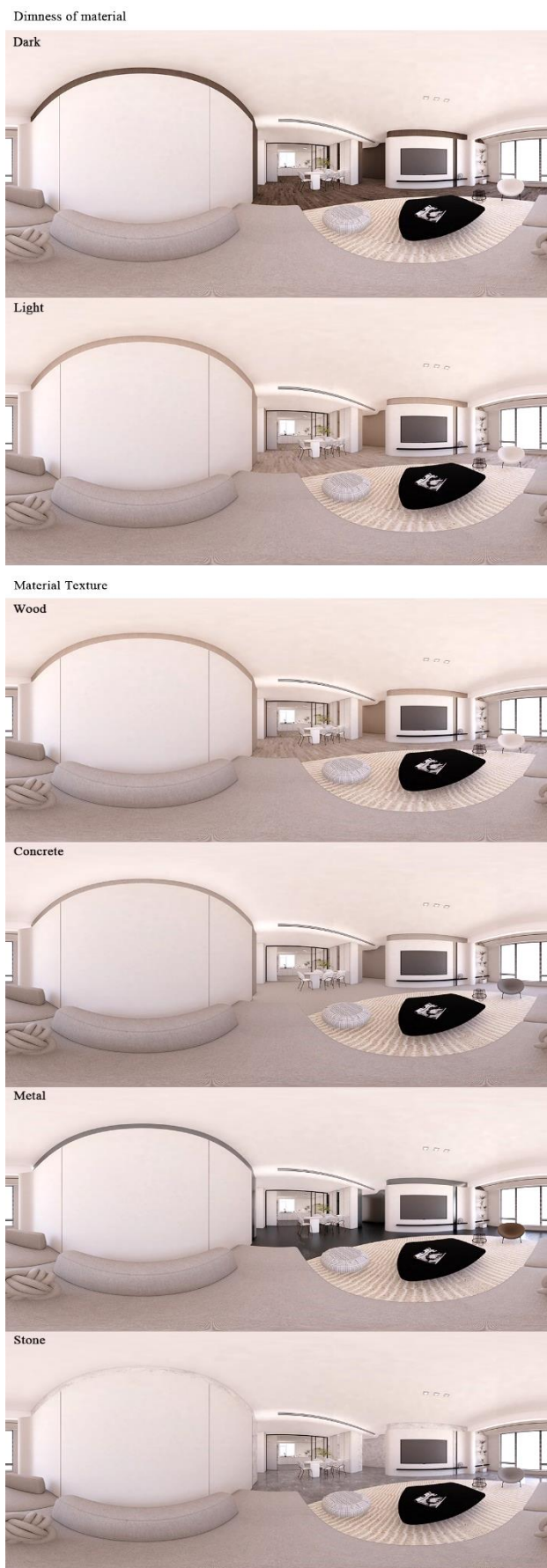


Fig.1. Multi-unit residential unit LDKB panorama

## 2.3. Experimental Participants

Figure 2 displays the operation interface of the reading test and experimental photos. All participants in this study signed informed consent forms, including detailed explanations of the experimental procedures and their potential benefits and risks.

We recruited 40 Chinese university students with normal vision and good health (20 males and 20 females, aged 18 to 35 years) through campus advertisements. All participants were required to abstain from caffeine, alcohol, and strenuous exercise for at least 24 hours before measurements. All measurements were conducted in quiet rooms to minimize distractions. Before measurements, subjects underwent baseline testing to measure their emotional states. They received verbal instructions and were asked to pay attention to the emotional states elicited by the residential unit panoramic images projected onto the VR glasses.



Fig.2. Participants during the experiment with the VR

## 2.4. Experimental Procedure

The entire experimental procedure is divided into three phases to ensure scientific rigor and replicability (Figure 3).

In the first phase, participants are situated in a climate-controlled room for 15 minutes to acclimate to the environment and mitigate interference from pre-experiment activities.

Moving to the second phase, participants receive baseline testing and an experimental briefing. Assisted by experimenters, they don VR glasses and engage in experiential training within virtual reality rooms.

The third phase involves participants wearing VR goggles during the test. They navigate and experience four sets of interior scenes within virtual residential units. Subsequently, they provide verbal responses to preference inquiries and the PAD emotional state questionnaire, with experimenters recording their responses. (It's worth noting that all virtual scenes are modeled based on natural lighting conditions in Beijing, China; thus, assessments regarding the connectivity of residential units with external surroundings may not be



applicable to other countries or regions).

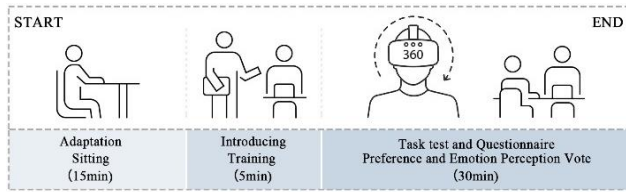


Fig.3. Schematic diagram of the experimental process

### 3. Results

#### 3.1. Differences in Residential Interior Decoration Preferences

This study analyzed participant preferences regarding different styling contours, styling styles, material brightness, and material texture. The analysis results in Figure 4 indicate significant differences in HIDP within two dimensions: styling style and material texture.

Independent sample t-tests were employed to compare participant preferences for different styling contours and material brightness, revealing no significant differences. The test results showed P-values greater than 0.05. One-way analysis of variance (ANOVA) results indicated that participant preferences for different styling styles and material textures had P-values less than 0.05, signifying significant differences in preferences in these dimensions. Subsequent Tamhane's T2 multiple comparison data analysis, guided by homoscedasticity results ( $P > 0.05$ ), revealed that, compared to the modern style and transitional style, participants favored the modern style for interior decoration. Wood emerged as the most preferred decorative material, followed by stone, concrete, and finally metal.

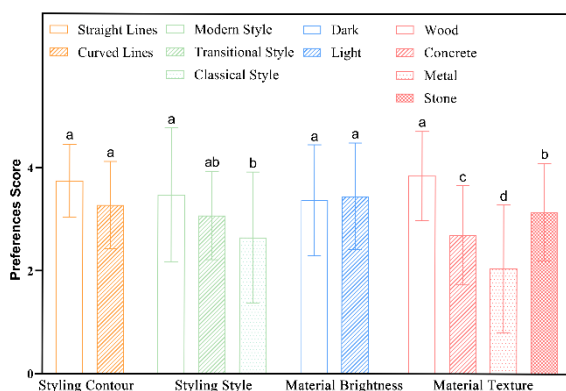


Fig.4. Comparison of residential interior decoration element preferences

#### 3.2. Influence of Residential Interior Decoration Elements on Emotional Experience

Independent sample t-tests were conducted to compare the impact of styling contours group and material brightness group in residential interior decoration on participants' emotional experiences. The

results are presented below (Figure 5, Figure 6).

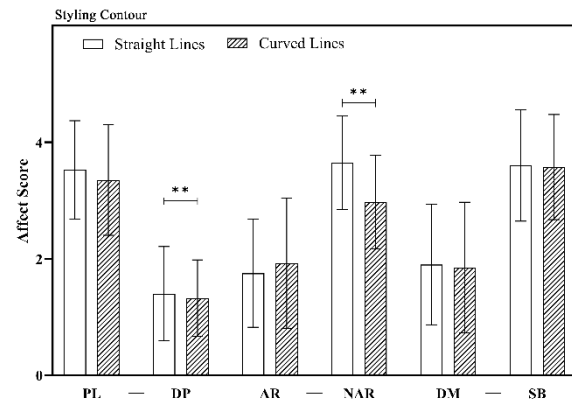


Fig.5. Differences in Average PAD Emotional States across Different Styling Contours

( \*\* $p < .005$  Indicating Significant Conditions. )

This study conducted independent sample t-tests to compare the impact of straight contours and curved contours on emotional experiences, as well as the impact of dark materials and light materials on emotional experiences. The results revealed significant differences in DP and NAR between straight contours and curved contours, as well as significant differences in DP and AR between dark materials and light materials. This suggests that, compared to curved contours and light materials, straight contours and dark materials are more likely to trigger negative emotions associated with displeasure and arousing emotions related to anxiety and tension. Conversely, curved contours and light materials are more likely to evoke positive emotions associated with pleasure and lower levels of arousal, such as relaxation and calmness.

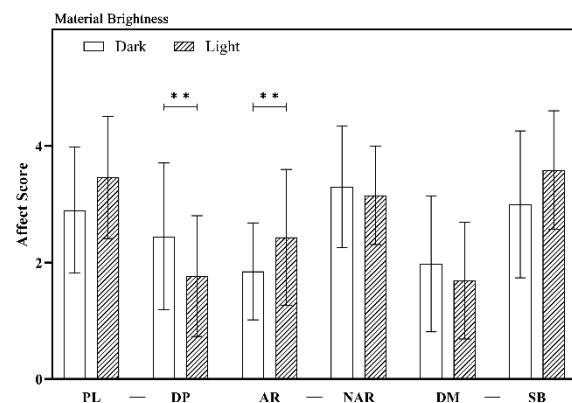


Fig.6. Differences in average PAD emotional states across different material brightness

( \*\* $p < .005$  Indicating Significant Conditions. )

This study conducted one-way analysis of variance (ANOVA) to compare the influence of three decorating styles on emotional experiences and the impact of four material colors on emotional experiences.

The results indicated that there were no significant differences among the three styles in terms of PL and DP perceptions (Figure 7). However, in terms of NAR

and SB, the classical style significantly scored lower than the other two styles. Conversely, in the case of AR and DM, the classical style scored significantly higher than the other two styles.

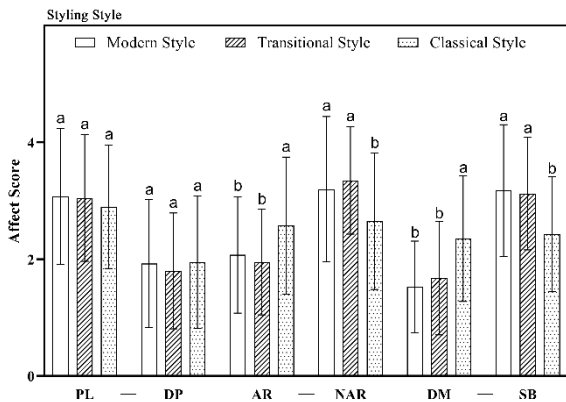


Fig.7. Differences in average PAD emotional states across different styling style

(Letters indicate significant between-group differences ( $P < 0.05$ ).)

In the comparison of the four material textures (Figure 8), significant differences were observed in emotional experiences related to PL, DP, NAR, DM, and SB. Specifically, wood significantly scored higher than stone and concrete in terms of PL, NAR, and SB, while metal scored significantly lower than these three materials in the same aspects. This suggests that wood is more likely to elicit positive emotions and feelings of stability, clam and relaxation compared to the other materials. Conversely, in DP and DM, metal significantly outperformed stone and concrete, while stone and concrete scored significantly higher than wood. This implies that metal may be more likely to evoke negative emotions such as displeasure, tension, and anxiety compared to the other materials. However, no significant differences were observed among the four materials in terms of AR.

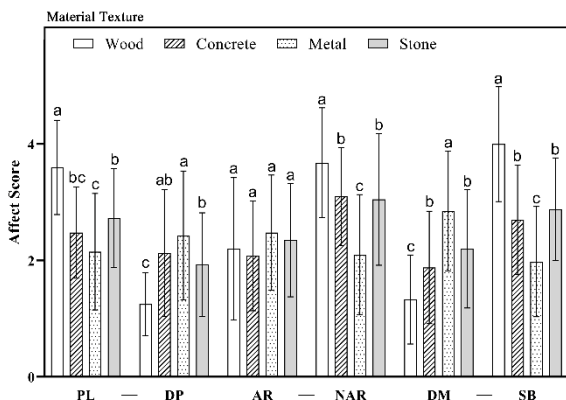


Fig.8. Differences in average PAD emotional states across different material texture

(Letters indicate significant between-group differences ( $P < 0.05$ ).)

### 3.3. The Correlation between Interior Residential Unit Decor Preferences and Resident Emotional Experiences

We conducted an analysis to examine the associations between HIDP and PAD emotional state across the four groups (Table.1).

Table 1. Correlation between interior residential unit decor preferences and resident emotional experiences

PAD Emotional State	Interior Decoration Factors			
	Styling		Material	
	Contours	Style	Brightness	Texture
Pleasure	0.522**	0.574**	0.659**	0.716**
Arousal	0.147	0.221*	0.064	0.019
Dominance	-0.115	-0.165	-0.091	-0.491**
Displeasure	0.024	-0.139	-0.335**	-0.541**
Nonarousal	0.472**	0.599**	0.442**	0.640**
Submissiveness	0.336**	0.570**	0.498**	0.771**

In the comparison of emotional experiences related to the four groups of IDE, PL, AR, NAR and SB displayed significant positive correlations with HIDP. In the styling style dimension, AR exhibited a significant positive correlation with HIDP. All significance levels ( $P$ ) for these correlations were less than 0.05, with correlation coefficients greater than 0.

In the dimensions of material brightness and material texture, DP showed a significant negative correlation with HIDP. In the material texture dimension, both DP and DO displayed significant negative correlations with HIDP. All significance levels ( $P$ ) for these correlations were less than 0.05, with correlation coefficients less than 0."

On the basis of the above relevant analyses, we conducted further examination of the impact of emotional experiences on HIDP (Table 2).

In the regression analysis, we selected emotions that exhibited correlations with various dimensions of IDE as independent variables and HIDP as the dependent variable. The results indicated a good model fit, with adjusted R-squared values of 0.457, 0.490, 0.458, and 0.696 for the four sets of independent variables: styling contour, styling style, material brightness, and material texture. These values signify that these independent variables collectively account for 45.7%, 49.0%, 45.8%, and 69.6% of the variance in HIDP, respectively.

Specifically, within the four groups of styling contour, styling style, material brightness, and material texture, PL and NAR (with  $\beta$  values greater than 0.00,  $p < 0.01$ ) significantly positively influenced HIDP. Furthermore, in the material texture group, DM (with  $\beta$  values greater than 0.00,  $p < 0.01$ ) also significantly positively impacted HIDP. DP (with  $\beta$  values greater than 0.00,  $p < 0.01$ ) significantly negatively affected HIDP. AR and SB did not have an impact on the four group of HIDP.

### 4. Discussion

This study aims to investigate the influence of IDE

on emotional experiences and HIDP, with a specific focus on young Chinese homebuyers. Through VR technology, we successfully simulated various IDE, including styling contours, styling styles, material brightness, and material textures, to comprehensively understand their impact on emotional experiences and HIDP.

Firstly, we found significant differences in emotional experiences due to different IDE. Specifically, curved contours, light materials, wooden textures, and non-stylized designs were capable of eliciting positive emotions such as active, happiness, quiescent, quiet, still, while straight contours, dark materials, metallic textures, and classical styles were more likely to induce negative emotions like sadness, loneliness, aroused, astonished. These findings provide valuable guidance for the practical application of interior decoration, especially for young homebuyers, for whom emotional experiences are crucial.

Secondly, this study revealed associations between emotional experiences and HIDP. We found that positive emotional experiences, such as pleasure calm and relaxation, had a significant positive impact on HIDP. Furthermore, we observed that unpleasant emotional experiences had a significant negative impact on HIDP.

## 5. Conclusions

This study delved into the impact of IDE on emotional experiences and HIDP, offering valuable guidance for urban residential design in China.

1.The selection of IDE significantly influences emotional experiences. Curved contours, light-colored materials, wooden textures, and modern design elements tend to evoke feelings of pleasure, calmness, and relaxation, whereas straight contours, dark materials, metallic materials, and classical styles are more likely to trigger unpleasant and tense emotional experiences.

2.PL and NAR emotional experiences significantly positively influence HIDP, while DP emotional experiences have a significant negative impact on preferences for material textures in residential decoration. To enhance residential attractiveness, it is recommended to increase the use of curved contours, light-colored materials, wooden textures, and modern

style elements in HIDP while reducing the incorporation of straight contours, dark materials, metallic materials, and classical styles.

3.The results of this study hold significant implications for meeting the needs of young homebuyers and promoting diversification and personalization in China's urban housing market. As the younger generation's demands for housing become increasingly diverse, designers and developers can customize residences based on their emotional experiences and preferences, offering more appealing living environments.

In summary, IDE not only influence aesthetic decisions but also have a profound impact on people's emotional experiences and quality of life. By delving into the psychological effects of these elements, we can better cater to people's desires for healthy, comfortable, and personalized homes, driving China's urban housing market toward greater diversity and personalization. This has a positive social impact on improving people's quality of life and urban living environments.

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Table 2. Associations of housing interior decoration preferences and emotional experiences by interior decoration elements

PAD Emotional State	Housing Interior Decoration Elements							
	Styling				Material			
	Contour		Style		Brightness		Texture	
	$\beta$ (95% CI)	P-value	$\beta$ (95% CI)	P-value	$\beta$ (95% CI)	P-value	$\beta$ (95% CI)	P-value
Pleasure	0.43[0.21,0.56]	0.00	0.35[0.21,0.55]	0.00	0.56[0.31,0.77]	0.00	0.27[0.16,0.48]	0.00
Arousal			0.06[-0.09,0.22]	0.41				
Dominance	0.02[-0.17,0.20]	0.87	0.14[-0.06,0.37]	0.16	-0.05[-0.27,0.18]	0.67	0.38[0.23,0.55]	0.00
Displeasure					-0.11[-0.26,0.07]	0.24	-0.15[-0.32,0.03]	0.02
Nonarousal	0.35[0.14,0.53]	0.00	0.37[0.20,0.57]	0.00	0.25[0.07,0.48]	0.00	0.19[0.07,0.33]	0.00
Submissiveness							-0.01[-0.15,0.12]	0.88