LAF | https://doi.org/10.15302/J-LAF-2026-0037
Volume 14 / Issue 3 / 260037 / 2026
Received Date | 2026-02-05 Accepted Date | 2026-06-05
© Higher Education Press 2026

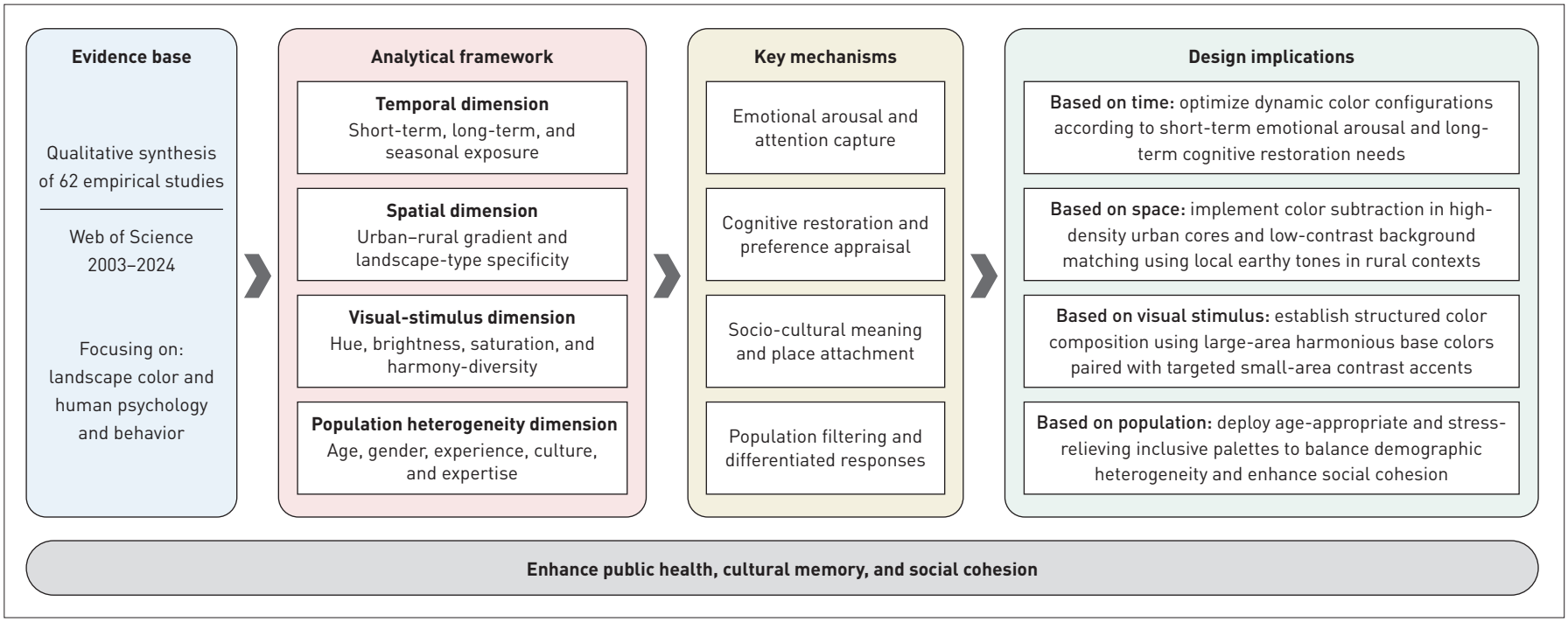
Review on Psychological and Behavioral Impact of Landscape Colors

Jing SHEN[1], Zhejun LI[2], Yi WU[3], Kaida CHEN[2,*], Chao LIU[1]

1 School of Design, Fujian University of Technology, Fuzhou 350118, China
2 College of Landscape Architecture and Art, Fujian Agriculture and Forestry University, Fuzhou 350002, China
3 School of Art, Yango University, Fuzhou 350015, China

*CORRESPONDING AUTHOR
Address: No. 15, Shangxiadian Road, Cangshan District, Fuzhou 350002, China
Email: kaidachenwhu@gmail.com

GRAPHICAL ABSTRACT



ABSTRACT

Landscape color is a critical environmental factor shaping human psychology and behavior, yet existing evidence remains fragmented and lacks an integrated theoretical framework. Based on a qualitative synthesis of 62 empirical studies, this review develops a four-dimensional analytical framework encompassing time, space, visual stimulus, and population heterogeneity. The findings indicate that landscape color operates through a dual temporal pathway: short-term exposure can produce immediate emotional and attentional effects, whereas long-term and seasonal exposure is associated with cumulative cognitive restoration and place-related responses. Spatial context further moderates these effects through urban–rural differences and landscape-type specificity. In the visual-stimulus dimension, color effects progress from hue-related emotional baselines to modulation by brightness and saturation and, ultimately, to compositional principles of harmony and diversity. These associations are also shaped by population characteristics, including age, gender, cultural background, experience, and professional knowledge. The review suggests

that landscape color design should move beyond conventional aesthetic considerations and adopt differentiated, evidence-based strategies tailored to exposure duration, spatial context, and target user groups. These strategies can support public mental health, environmental identity, and healthier human settlements.

KEYWORDS

Landscape Color Perception; Psychological and Behavioral Impact; Evidence-Based Review; Environmental Psychology; Healthy Human Settlements

HIGHLIGHTS

- Establishes a four-dimensional framework of time, space, visual stimulus, and population heterogeneity
- Synthesizes empirical evidence on the psychological and behavioral effects of landscape color
- Identifies contextual and demographic moderators that shape landscape color perception
- Translates landscape color evidence into implications for healthier and more inclusive environments

RESEARCH FUNDS

- Fujian Social Science Fund (No. FJ2025C078)
- Fujian University of Technology Research Startup Fund Project (No. GY-S22034)

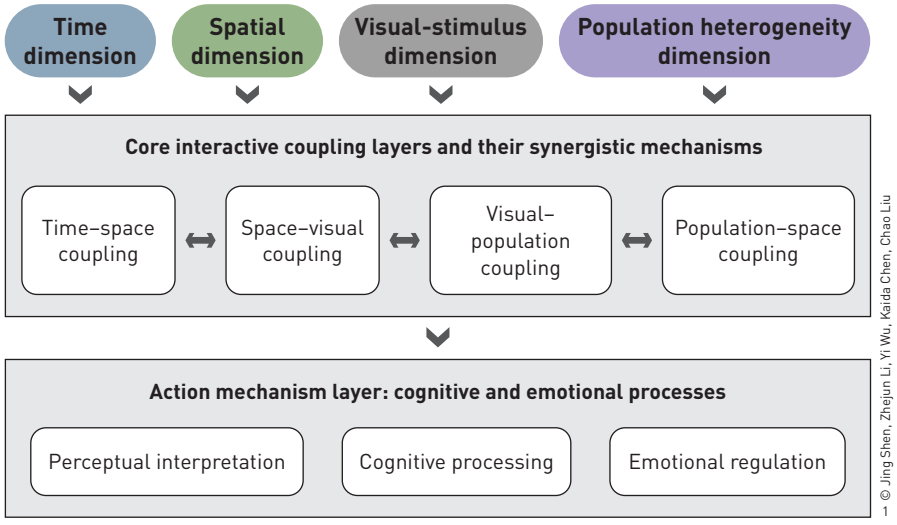
1 Introduction

With rapid urbanization and the growing influence of the "Healthy City" concept, the quality of human living environments has become a key factor affecting public physical and mental health as well as life satisfaction[1–2]. As one of the most intuitive and emotionally evocative elements of the visual environment, landscape color is increasingly recognized for its role in shaping spatial atmosphere, conveying cultural imagery, regulating emotional states, and influencing behavioral patterns[3–4]. In recent years, the convergence of Landscape Architecture, Environmental Psychology, Public Health, and Urban Planning has shifted landscape color research from traditional aesthetic evaluation toward empirical studies of health-related effects[5–6]. Although numerous observational and experimental studies have examined associations between landscape color and public perception and preference, psychological restoration, and behavioral choice[7–13], the evidence remains fragmented. Few integrate temporal dynamics, spatial context, visual attributes, and population heterogeneity. Substantial heterogeneity in research methods and sample compositions remains, and the field has yet to form a unified theoretical framework and practical guidance.

Although classical landscape preference theories, such as Stephen Kaplan's preference matrix and Roger S. Ulrich's Stress Reduction Theory[8], have provided foundational insights into how people respond to visual environments, they were not developed to explain the specific role of color. These frameworks primarily address spatial structure, naturalness, and overall scene composition, leaving the independent and interactive effects of color attributes under-theorized. Moreover, high- and low-fidelity visual cues may influence emotional and cognitive responses differently, yet color has not been systematically integrated into these established models. This theoretical gap justifies a dedicated synthesis of empirical evidence on landscape color and supports the four-dimensional frameworks proposed in this review.

This study aims to synthesize and theoretically reconstruct existing evidence through an integrated four-dimensional analytical framework encompassing time, space, visual stimulus, and population heterogeneity (Fig. 1). The framework structures the independent variables, interactive coupling networks, and core action mechanisms across these dimensions to guide comprehensive evidence synthesis and output-oriented analysis. It seeks to advance the field from phenomenological description

Fig. 1 A four-dimensional analytical framework.



© Jing Shen, Zhejun Li, Yi Wu, Kaida Chen, Chao Liu

toward mechanistic explanation and to inform future research, including dynamic measurement tools, stronger causal inference designs, cross-cultural comparisons, and interdisciplinary dialogue between neuroscience and environmental design. Ultimately, the study provides evidence-based design guidance for healthier human settlements that promote mental health, social cohesion, and cultural memory.

2 Literature Search and Review Framework

2.1 Data Source

This study followed the principles of systematic literature review and conducted literature search and screening within the framework of the PRISMA 2020 guidelines. The Web of Science (WoS) Core Collection was used as the database. The search was conducted in March, 2024, the published time span for the articles was set to January 1, 2003, to February 1, 2024. The strategy was constructed around three core elements of landscape color perception research: 1) environmental context, including terms, i.e., "urban landscape" and "city landscape"; 2) the core variable, "color" or "colour"; and 3) the research process, "perception." The resulting search string was "((TS = (urban landscape or cities landscape or city landscape)) AND TS = (color or colour)) AND TS=(perception)."

2.2 Screening Process

Literature screening strictly followed the standard process for narrative reviews, conducted through layered examination of titles, abstracts, and full texts (Fig. 2). To ensure relevance, representativeness, and evidentiary strength, included studies had to meet four criteria: 1) the publication type was a peer-reviewed journal article; 2) the research topic explicitly focused on landscape color attributes; 3) the study subjects were primarily human populations, with attention to human perception, evaluation, or behavioral responses to landscape colors; and 4) the research design was empirical and provided original data, such as questionnaire surveys, experiments, and field observations. Title and abstract screening was performed as the first stage of the two-stage process; after full-text review, 62 studies met the criteria and formed the core evidence base of this review (Fig. 2). These studies varied in methods, contexts, and subject populations, providing an empirical basis for multidimensional analysis of association patterns, effect differences, and underlying mechanisms of landscape color perception.

2.3 Research Process

After literature screening, this review subsequently summarizes, compares, and integrates the empirical evidence along the four dimensions. Based on this, it comprehensively discusses the possible mechanisms underlying the existing findings and identifies sources of methodological variation. It then outlines current limitations and future directions before drawing conclusions.

The included literature shows that existing evidence is highly concentrated on exploring and revealing the complex associations between landscape color perception and human psychological and behavioral impact. Accordingly, the article explains association patterns, effect differences, and underlying physiological, psychological, and socio-cultural mechanisms. By synthesizing evidence across these interlocking layers, the review presents a holistic picture of this complex relationship.

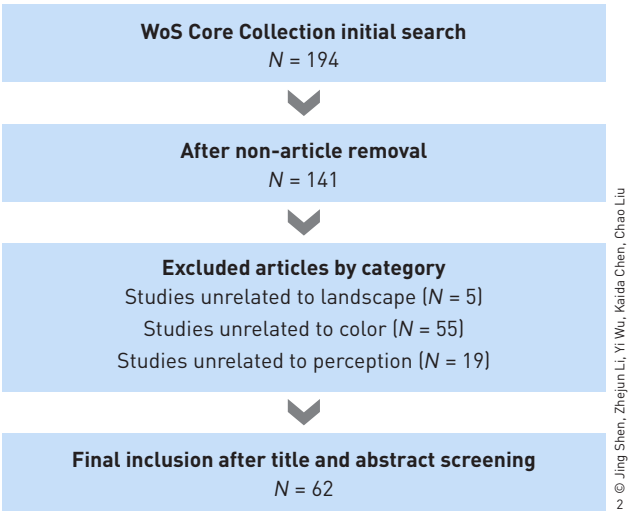


Fig. 2 Literature screening process.

© Jing Shen, Zhejun Li, Yi Wu, Kaida Chen, Chao Liu

3 Landscape Color Perception and Human Responses

Based on the analytical framework, existing empirical research can be organized across four interconnected dimensions.

In terms of the temporal dimension, studies have identified meaningful differences in the impact patterns and mechanisms between short-term exposure and long-term or seasonal exposure. Short-term exposure research primarily examines the immediate effects of color stimuli lasting from moments to several hours on psychological indicators such as emotion, preference, and attention[14]. In contrast, long-term and seasonal exposure studies track cumulative associations between color environments and psychological restoration, place attachment, and overall well-being over weeks, months, or years. Relevant evidence includes preference changes for plant landscapes across seasons, the long-term health benefits of residential green view rates[15], and

the potential influence of color environments on children's emotional development[5]. A small number of studies compare how the same color attribute may function differently in short-term aesthetic judgment and long-term environmental satisfaction[16].

Regarding the spatial dimension, differences in urban–rural environments, landscape types, and regional cultural backgrounds are major sources of heterogeneity in color perception. For example, in highly artificial urban environments, studies focus on the harmony of building facade colors[4], the role of street-furniture color in public space vitality[17], and the dynamic perception of urban color sequences[18]. In rural or suburban environments with a stronger natural foundation, research emphasizes the aesthetic value and restorative potential of natural colors[19]. Specific landscape types, such as plant landscapes, blue spaces[20], and historical districts[21], have also developed distinct research threads because of their different color compositions and functional orientations. Cultural–geographical differences provide another entry point for understanding the cultural specificity of color perception[22].

In the visual-stimulus dimension, research shows a shift from holistic scene perception to more refined attribute analysis. The emotional effects of hue have been most extensively validated[23]. Further studies delve into the modulating roles of brightness and saturation, including how high brightness combined with medium-to-high saturation can enhance preference[24] and how different saturation levels of red may be proportioned in landscapes[16]. More refined research quantifies color-combination principles, such as applying color harmony theories or using algorithms to analyze relationships among color diversity, contrast, and scenic beauty[25]. Dynamic color attributes[18] and the multi-sensory interactions of color with texture and form[26] are also emerging research frontiers.

In the population heterogeneity dimension, existing research has moved beyond the traditional assumption of a homogeneous population and has explored how socio-demographic characteristics and physiological-psychological status filter landscape color perception. Studies have shown that age and gender are fundamental factors shaping emotional responses to color[13]. Furthermore, socio-cultural attributes, such as cultural background, place attachment, and professional experience endow landscape colors with differentiated cognitive metaphors and cultural memories[21]. Landscape color research should therefore move beyond an oversimplified "average person" perspective and incorporate age, gender, experience, and their interactions into explanatory frameworks.

In summary, research across these four dimensions provides a foundation for interpreting the complex dynamic mechanism linking environmental stimulus, population heterogeneity, psychological restoration, and behavioral output in landscape color perception (Table 1).

Table 1: Summary of core findings in four dimensions

Dimension	Main effect	Key mechanism	Representative evidence	Heterogeneity source
Temporal dimension	Short-term emotion; long-term recovery; dynamic color experience	Immediate arousal and cumulative restoration pathways	Stress reduction linked to high green-view rates; high aesthetic evaluation of seasonal color diversity (e.g., autumn foliage)	Differences in exposure duration
Spatial dimension	Urban scarcity–amplification; rural visual interference; functional connection	Environmental context amplification; background contrast	High marginal psychological benefits of urban greenery; aesthetic damage from rural artificial clutter	Varied urban–rural gradients and baseline landscape types
Visual-stimulus dimension	Hue anchoring; brightness/saturation modulation; compositional harmony	Emotional anchoring; brightness–saturation modulation; harmony–diversity rule	High arousal from warm colors vs. calm from cool tones; inverted U-shaped curve for color complexity	Differences in hue, brightness, saturation, color diversity, contrast, and compositional order
Population heterogeneity dimension	Gender; age; experiential difference	Physiological filtering; Socio-cognitive evaluation	Youth preference for novelty vs. elderly preference for stability; divergent ratings between designers and laypersons	Age, gender, childhood nature contact, professional background, and their interactions

3.1 Temporal Dimension

The duration of landscape color exposure fundamentally shapes its psychological impact, distinguishing two dominant patterns: short-term emotional arousal and long-term cognitive restoration. Short-term exposure refers to color stimuli lasting from seconds to hours, whereas long-term or seasonal exposure denotes cumulative contact over weeks, months, or years. Short-term exposure primarily operates through an emotion–preference channel. Experimental studies have consistently confirmed that a single color stimulus can rapidly modulate emotional states and aesthetic judgments. Warm tones such as red and orange generally elicit high-arousal positive emotions, including excitement and warmth[9], whereas cool tones such as blue and green significantly promote low-arousal relaxed states[20]. Areas of high saturation or strong contrast can serve as visual highlights and capture attention in a bottom-up manner[14]. At the preference level, research reveals an inverted U-shaped curve indicating that moderate color complexity is optimal, whereas excessive monotony or clutter leads to a decline in evaluation[16]. Long-term and seasonal exposure primarily influences through a cognitive-restoration channel. Cross-sectional and longitudinal evidence demonstrates that long-term residence in environments with high natural color richness, such as those with a high green view rate, is significantly associated with lower self-reported stress levels, stronger psychological restoration, and higher life satisfaction[1]. Seasonal studies further reveal the value of dynamic color experience; autumn, because of its high color diversity, is often rated as having the highest aesthetic value[19,27], while the monotony of winter highlights the importance of evergreen plants and artificial color accents[28]. The rhythm and continuity of dynamic color sequences are key temporal attributes regulating visual fatigue and pleasure[18]. Overall, empirical evidence suggests that the psychological and behavioral benefits of landscape color are significantly moderated by exposure duration. This temporal differentiation implies that design practice should distinguish immediate emotional arousal mechanisms under short-term exposure from cumulative cognitive restoration mechanisms under long-term exposure.

3.2 Spatial Dimension

Spatial and environmental context is a key moderating variable shaping response patterns in color perception, operating mainly through the urban–rural gradient and landscape-type specificity. Along the urban–rural gradient, a significant scarcity-amplification effect is observed[3]. In highly artificial urban environments, the presence of natural colors can produce strong positive psychological effects with significant marginal benefits. Conversely, disordered and conflicting artificial colors, such as cluttered billboards and uncoordinated building facades, can elicit stronger negative emotions[29]. In rural environments with strong natural endowments, large expanses of natural color form the basis of aesthetic pleasure and tranquility; incongruent artificial colors may therefore cause substantial aesthetic damage[19]. As for landscape types, a clear type–color association is evident. The evaluation of plant landscapes centers on vegetation vitality, where the vegetation color richness and contrast show a stable positive correlation with scenic beauty. The vibrant colors of flowering plants are key sources of attraction[13,30]. The evaluation of architectural landscapes centers on the conveyance of cultural meaning. Color combinations that align with regional cultural contexts and traditional materials can elicit stronger cultural identification and aesthetic affirmation[4,31]. The evaluation of water landscapes focuses on restorative potential, with clear blue–green hues most stably and strongly associated with psychological restoration[20]. The contrasted preferences between urban and rural color palettes captured across multiple studies reveal a critical logic of background management across spatial gradients. In highly artificialized urban cores, color-subtraction strategies can reduce visual noise and strengthen the scarcity-amplification effect of natural interventions; conversely, in rural and natural contexts, low-contrast background matching can preserve local material color values and reinforce place identity.

3.3 Visual-Stimulus Dimension

The physical and perceptual attributes of color produce psychological effects through a progression from basic emotion to complex combination. These effects can be understood from three aspects—hue-specific emotional anchoring, modulation by brightness and saturation, and compositional harmony. Fundamentally, hue demonstrates a robust emotional-anchoring effect. Green and blue are commonly associated with calm feelings[20], whereas red, orange, and yellow are associated with the feelings of vitality and warmth. This pattern has been repeatedly observed across studies in different cultural contexts[23]. At the modulation level, brightness and saturation fine-tune the basic emotional effects. High brightness often evokes perceptions of lightness and openness, whereas low brightness tends to induce feelings of steadiness and heaviness. High saturation can enhance visual impact and attraction, but excessive use may lead to fatigue, while low saturation conveys an image of elegance and softness[24]. Brightness and saturation often interact to jointly shape the final emotional tone of a color. At the combination level, research

evidence strongly supports a harmony–diversity rule. Optimal aesthetic experience arises from moderate diversity governed by compositional harmony. Color harmony theories based on systems (e.g., Munsell Color System, Natural Color System) have been proven effective in landscape evaluation[31–32]. Simply increasing the number of colors without a coherent organizational structure can conversely lead to lower evaluation[25], whereas color schemes with clear hierarchy and order generally are more preferred. Environmental psychology experiments have further confirmed that color configuration affects cognitive load and visual preferences. Therefore, structured composition principles, such as pairing large areas of harmonious base colors with targeted small-area contrast accents, represent a scientific pathway to prevent visual fatigue and enhance spatial legibility.

3.4 Population Heterogeneity Dimension

The ultimate response to landscape color perception is significantly moderated by individual characteristics, including demographic traits, life experiences, and professional background. These factors are an important source of heterogeneity among studies.

Regarding demographic characteristics, gender differences are significant. Women generally prefer soft, uniform, and moderately saturated color combinations and show stronger requirements for coordination and subtlety. In contrast, men show greater acceptance of and preference for combinations with high contrast, varied colors, and a certain degree of visual impact[14,33]. Age is also a key influencing factor. Young people generally significantly favor vivid, dynamic, and varied color environments and tend to seek visual novelty and stimulation[13], whereas older groups often prefer steady, natural, and harmonious tones associated with tranquility and stability in color environments[34].

Regarding experiential and professional backgrounds, people's early experiences and knowledge structures shape differentiated color schemas. Individuals with rich childhood nature contact show stronger affinity and aesthetic preference for green and blue hues and their combinations in natural environments, reflecting the lasting influence of early environmental experience on color values[35–36]. Professional training also has a strong influence. Designers and planners often evaluate color through cognitive frameworks that emphasize structural attributes such as harmony, regional cultural fit, and design intent. In contrast, the general public is more directly influenced by intuitive perceptual features of the colors, such as vividness, visual attraction, and personal familiarity, reflecting a shift in evaluation criteria from professional norms towards personal experience[6,10]. These background differences indicate that the psychological effects of landscape color are not universal but are highly contextualized and personalized. Future research and practice should therefore consider target-user characteristics to improve the precision and effectiveness of interventions. These factors likely interact; for instance, older designers may evaluate color harmony differently from younger non-professionals. Such heterogeneity in color perception and behavioral responses stems from distinct physiological and socio-experiential filtering mechanisms. Healthy human settlements should therefore avoid monistic design logic and instead deploy age-appropriate, stress-relieving, and inclusive color palettes to reduce spatial exclusion and foster social cohesion.

3.5 Influencing Mechanisms

The impact of landscape color on human psychology and behavior is shaped by psychophysiological priming, cognitive-affective processing, socio-cultural construction, and inclusive design intervention. The mechanism, through which landscape color influences human psychology and behavior, operates through a parallel and synergistic network across four progressive levels: physiological arousal at the psychophysiological level, decoding at the visual-perceptual level, meaning construction at the socio-cultural level, and tailored health intervention at the inclusive-responsive level.

At the psychophysiological level, color, as a perceptual property derived from light signals, generates two initial effects through the visual system. First, light of specific wavelengths may induce physiological states of relaxation or alertness by modulating neuroendocrine and autonomic nervous system activity, laying the foundation for subsequent emotional experience[1]. Second, color attributes such as high contrast and saturation can capture attention in a bottom-up manner and guide eye-movement trajectories, thereby framing the scope and focus of information processing[14]. These physiological and attentional responses constitute the sensory and perceptual entry points for color effects and help explain why brief exposure to specific colors can trigger measurable changes in autonomic arousal and attentional orientation.

At the cognitive-affective level, color effects are interpreted and amplified through higher-order psychological processes. Natural colors, represented by green, align with the "soft fascination" mechanism of Attention Reduction Theory, offering low-effort restoration for cognitive resources fatigued by prolonged directed attention[11]. At the same time, color stimuli activate pre-existing emotional memories and cognitive schemas. Their influence may

follow two paths: 1) direct emotional arousal based on evolutionary or broadly shared experience, such as red eliciting excitement[9]; and 2) symbolic association established through cultural learning and personal experience, such as red representing celebration[22]. This level transforms raw sensory input into emotional experience and preference evaluation imbued with personal and social significance. Thus, the same color can evoke different affective responses depending on an individual's prior learning and cultural background.

At the socio-cultural level, color influence extends beyond immediate individual psychological reaction into collective identity and sense of place. Spatial environments and functional contexts, such as recreational, transportation, and residential zones, serve as carriers of socio-cultural meaning. "Color genes" formed through long-term natural and cultural interactions in specific regions enable landscape colors aligned with these genes to evoke cultural identity and place attachment[4]. This effect indicates that color is not merely a physical stimulus or individual aesthetic object but also a socio-cultural practice and representation. By shaping the spirit of place and collective memory, color can influence people's sense of belonging and identity[21]. These socio-cultural mechanisms operate alongside, and often interact with, the physiological and cognitive pathways described above.

In conclusion, population heterogeneity is not an isolated parallel component in the mechanism diagram; rather, it operates as a cross-cutting, multi-stage filtering and moderating layer. It functions as a biological filter that constrains sensory thresholds at the physiological entry point, a psychological filter that shapes affective interpretation and restorative evaluation, and a social-identity filter that influences identity resonance at the socio-cultural level. By translating general pathways into individualized variations, this heterogeneous mechanism provides a scientific basis for evidence-based design interventions at the inclusive-responsive level.

4 Discussion

4.1 Research Heterogeneity

The heterogeneity observed in existing research conclusions is not random error but arises from systematic differences in methodological approaches, subject composition, and environmental contexts. These differences collectively constitute the logical chain that generates heterogeneity (Fig. 3).

At the methodological level, variations in color quantification tools, psychological assessment methods, and research media

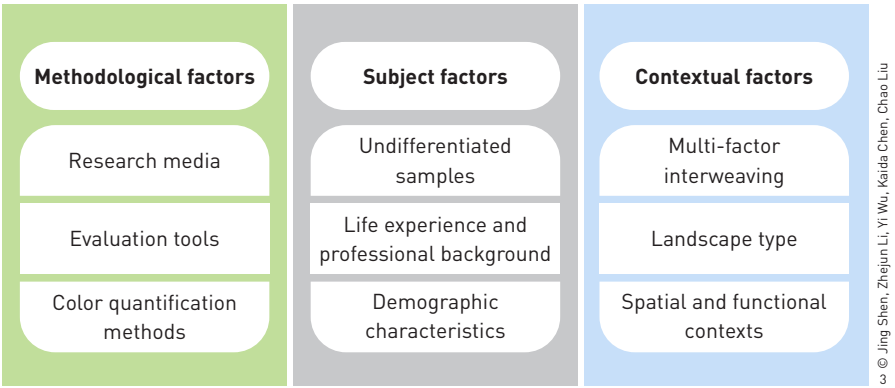


Fig. 3 Sources of research heterogeneity.

© Jing Shen, Zhejun Li, Yi Wu, Kaida Chen, Chao Liu

lead to differences in data foundations and ecological validity. Evaluation tools used to capture psychological responses, such as the scenic beauty estimation (SBE) method, which emphasizes overall ranking[28], and the semantic differential (SD) method, which examines multidimensional perceptions[37], may extract different types of information from the same color experience. More fundamentally, the choice of research medium—whether highly controlled laboratory simulations[38] or complex real-world environments filled with noise[39]—determines the boundaries of the ecological validity of the findings. Pure effects observed in laboratory settings may be enhanced, attenuated, or transformed in complex field contexts. Findings from highly controlled studies therefore cannot be directly generalized to real-world environments without considering environmental complexity.

At the subject level, individual perceptual filters can produce average effects in mixed samples, thereby masking subgroup response differences. Gender, age, life experience, and professional backgrounds shape distinctive perceptual filters and evaluative frames of reference[40]. Studies using mixed groups may yield an average effect that obscure real and potentially meaningful differences in response patterns among subgroups[13]. Therefore, undifferentiated population samples themselves can become a source of variation. For example, the same landscape color may be perceived as vivid by younger adults but overwhelming by older adults, or as harmonious by designers but dull by the general public. Such subgroup differences underscore the need for stratified analyses in future research.

At the contextual level, color effects do not occur in isolation but interact with other environmental attributes. Color often interacts with form, material, function, sound, and light to jointly shape the overall perceptual experience. For example, the aesthetic evaluation of architectural color cannot be separated from its

architectural style and historical context[41], and the attractiveness of plant color is linked to its expression of vitality[42]. This covariance of multidimensional attributes means that color effects in real environments can be enhanced, weakened, or transformed by other elements, helping explain why the same color may have different effects across contexts. Future research should therefore adopt multi-attribute approaches rather than treating color as a single independent variable.

4.2 Current Limitations

The limitations of the current research paradigm constrain the field's development from describing associations toward explaining mechanisms and translating findings into practice. In terms of causal logic in research design, cross-sectional surveys dominate, making it difficult to establish temporal sequence and causality between color exposure and psychological or behavioral outcomes[43]. Simultaneously, regarding the dynamism of research perspective, existing paradigms often treat color as a static attribute and do not adequately capture its continuous variation under natural lighting, weather changes, and seasonal cycles. Because color perception is essentially a temporal stream of experience, advancing dynamic assessment is crucial for understanding how it works[44]. In terms of the completeness of evidence types, current research over-relies on subjective self-report data and lacks objective, continuous recording and analysis of how color environments influence actual spatial behavior[45]. This evidence gap limits the ecological validity and practical relevance of current conclusions.

Theoretical integration and cultural perspective within the field also require expansion. Most studies are based on specific cultural samples, so the generalizability of their conclusions requires cautious consideration[23]. Dialogue and integration across disciplinary theories remain insufficient. Additionally, the search strategy of this review prioritized terms related to urban environments, which may have resulted in insufficient coverage of studies on purely natural, rural, and blue–green spaces. Promoting cross-cultural comparative research with standardized methods and fostering deeper dialogue among environmental psychology, cognitive neuroscience, cultural geography, and design disciplines would help build more explanatory and inclusive theoretical frameworks.

Finally, limited knowledge translation hinders the application of research findings. A lack of unified methodological standards reduces comparability and cumulative efficiency, and mechanisms for translating scientific discoveries into design guidelines, policy tools, and public education remain underdeveloped. Establishing measurement and reporting norms for core variables within the field and constructing collaborative innovation platforms that connect academia, design practice, and policymakers are inevitable paths for maximizing the social value of landscape color research outcomes. Future research should therefore focus on: 1) developing virtual and augmented reality-based experimental paradigms for dynamic color exposure that simulate diurnal and seasonal variations; 2) establishing cross-cultural color perception databases using standardized stimulus materials; 3) conducting field experiments on color-intervention policies; and 4) integrating eye-tracking with physiological sensors to capture real-time emotional responses.

5 Conclusions

This study systematically synthesized empirical evidence on the complex associations between landscape color and human psychological and behavioral responses[46]. The findings reveal that landscape color effects are structured across four dimensions. In the temporal dimension, short-term color exposure produces immediate psychological effects mainly through emotional arousal[47], whereas long-term or seasonal exposure produces cumulative effects mainly through cognitive restoration pathway[12]. In the spatial dimension, the scarcity-amplification effect in urban environments[48] contrasts with the intrusive-interference effect in rural settings. Different landscape types also show type–color association[49], reflecting the profound moderating role of environmental context on color perception. In the visual-stimulus dimension, hue serves the foundational function of emotional anchoring, brightness and saturation provide fine-grained contextual modulation, and color combinations follow the aesthetic principle of moderate diversity governed by harmony. In the population heterogeneity dimension, socio-demographic traits and psychophysiological states act as perceptual filters that shape color experience and support a shift from generic design toward age-appropriate and stress-relieving inclusive interventions. Collectively, these findings show that landscape color is co-modulated by time, space, visual attributes, and population characteristics, producing highly contextualized and personalized effects. This also partly explains the source of heterogeneity observed across studies.

Landscape color is an important and malleable environmental factor influencing human psychology and behavior. This review suggests that, as attention to healthy human settlements increases, landscape color planning and design should move beyond aesthetic considerations and be more closely integrated with public health goals, including mental health promotion and community belonging.

In practice, it is necessary to establish knowledge translation mechanisms linking scientific research, design innovation, and policymaking. A research–design–policy translation framework could help convert landscape color evidence into practical guidance for healthier, more inclusive, and more restorative human settlements with stronger place identity.

However, this field still faces challenges in the depth of mechanistic explanation, completeness of evidence types, and systematicity of theoretical construction. It is at a critical transition from phenomenological description toward mechanism-oriented explanation and theory building. Methodological bottlenecks in causal inference constrain precise analysis of effect mechanisms. Static research paradigms struggle to capture the dynamic nature of color experience[50]. The scarcity of behavioral evidence reduces the applied value of theoretical findings, while limited cultural perspectives affect generalizability[51]. Disciplinary barriers also hinder the innovation and development of integrated theoretical models. These limitations indicate the need for more rigorous research paradigms and more systematic theoretical frameworks. Future research should establish causal verification systems that combine dynamic tracking and experimental intervention, promote multimodal data collection that integrates subjective reports and objective behavioral measurements, and construct interdisciplinary explanatory frameworks encompassing physiological mechanisms, psychological processes, and socio-cultural dimensions.

Future research should strive to overcome the methodological limitations in causal inference, establish systems for tracking dynamic color-exposure processes, enrich objective behavioral evidence, broaden cross-cultural comparison, and foster interdisciplinary theoretical integration, ultimately supporting the long-term goal of improving public well-being.

ELECTRONIC SUPPLEMENTARY MATERIAL

Supplementary material is available in the online version of this article at https://doi.org/10.15302/J-LAF-2026-0037.

Competing interests | The authors declare that they have no competing interests.

REFERENCES

[1] Chen, Z., Sheng, Y., Luo, D., Huang, Y., Huang, J., Zhu, Z., Yao, X., ... Lan, Y. (2023). Landscape characteristics in mountain parks across different urban gradients and their relationship with public response. *Forests*, *14*(12), 2406.

[2] Wang, Y., Yang, G., & Lu, Y. (2023). Evaluation of urban wetland landscapes based on a comprehensive model—A comparative study of three urban wetlands in Hangzhou, China. *Environmental Research Communications*, *5*(3), 035004.

[3] Gan, Y., Zheng, Y., & Zhang, L. (2022). Audio-visual analysis of visitors' landscape preference for city parks: A case study from Zhangzhou, China. *Forests*, *13*(9), 1376.

[4] Zhang, L., Cheng, Y., & Ma, L. (2019). A quantitative study on the colour of city landmark landscape architectures. *Journal of Physics: Conference Series*, *1288*(1), 012011.

[5] Sheng, H., Li, X., & Zeng, S. (2023). Unraveling the mediating role of plant color and familiarity on children's mood in urban landscape. *Journal of Asian Architecture and Building Engineering*, *23*(6), 2091–2099.

[6] Lee, J.-Y., & Kim, Y.-J. (2009). A study of perception on the use of 'Seoul color' to establish an unique urban image of Seoul city among design practitioners. *Journal of the Korean Institute of Interior Design*, *18*(6), 166–175.

[7] Du, H., Jiang, H., Song, X., Zhan, D., & Bao, Z. (2016). Assessing the visual aesthetic quality of vegetation landscape in urban green space from a visitor's perspective. *Journal of Urban Planning and Development*, *142*(3), 04016007.

[8] Liu, W. Y., Tsao, C., & Lin, C. C. (2023). Tourists' preference for colors of forest landscapes and its implications for forest landscape planning policies. *Forest Policy and Economics*, *147*, 102887.

[9] Zhuang, J., Qiao, L., Zhang, X., Su, Y., & Xia, Y. (2021). Effects of visual attributes of flower borders in urban vegetation landscapes on aesthetic preference and emotional perception. *International Journal of Environmental Research and Public Health*, *18*(17), 9318.

[10] Li, X.-P., Fan, S.-X., Kühn, N., Dong, L., & Hao, P.-Y. (2019). Residents' ecological and aesthetical perceptions toward spontaneous vegetation in urban parks in China. *Urban Forestry & Urban Greening*, *44*, 126397.

[11] Wang, R., Zhao, J., Meitner, M. J., Hu, Y., & Xu, X. (2019). Characteristics of urban green spaces in relation to aesthetic preference and stress recovery. *Urban Forestry & Urban Greening*, *41*, 6–13.

[12] Paddle, E., & Gilliland, J. (2016). Orange is the new green: Exploring the restorative capacity of seasonal foliage in schoolyard trees. *International Journal of Environmental Research and Public Health*, *13*(5), 497.

[13] Wang, R., & Zhao, J. (2017). Demographic groups' differences in visual preference for vegetated landscapes in urban green space. *Sustainable Cities and Society*, *28*, 350–357.

[14] Liu, Y., Zhou, Z., & Xu, Y. (2023). Design element preferences in public facilities: An eye tracking study. *Land*, *12*(7), 1411.

[15] Xu, T., Wang, S., Liu, Q., Kim, J., Zhang, J., Ren, Y., ... Wu, J. (2023). Vegetation color exposure differences at the community and individual

levels: An explanatory framework based on the neighborhood effect averaging problem. *Urban Forestry & Urban Greening*, *86*, 128001.

[16] Feng, J., Zhang, K., Xu, Z., Du, C., Tang, X., & Zhang, L. (2024). Quantitative study on color characteristics of urban park landscapes based on k-means clustering and SD. method. *Earth Science Informatics*, *17*(2), 999–1012.

[17] Thorpert, P., & Englund, J.-E. (2021). Colour perception and visitor experiences of urban parks as influenced by an intense colourful urban artefact: An *in-situ* quasi-experiment. *Iconarp International Journal Architecture and Planning*, *9*(2), 485–505.

[18] Koo, M.-A. (2016). A study on the sequence analysis technique of urban landscape color and urban color characteristics in accordance with spatial openness—Focusing on the view of the Daegu monorail. *Journal of the Korean Institute of Landscape Architecture*, *44*(6), 120–136.

[19] Mu, Y., Lin, W., Diao, X., Zhang, Z., Wang, J., Lu, Z., ... Zhao, C. (2022). Implementation of the visual aesthetic quality of slope forest autumn color change into the configuration of tree species. *Scientific Reports*, *12*(1), 1034.

[20] Wan, J., Zhou, Y., Li, Y., Su, Y., Cao, Y., Zhang, L., ... Deng, W. (2020). Research on color space perceptions and restorative effects of blue space based on color psychology: Examination of the Yijie district of Dujiangyan City as an example. *International Journal of Environmental Research and Public Health*, *17*(9), 3137.

[21] Zhou, F. (2021). Research on the design language of planting landscape in the environment of Chengxiang District, Shanghai. *IOP Conference Series: Earth and Environmental Science*, *769*(2), 022064.

[22] Park, H.-C., & Lee, S.-N. (2013). Proposed color scheme with feng shui significance—Focused on the Bonmyeonggung of business owners. *Journal of the Korean Institute of Interior Design*, *22*(2), 131–139.

[23] Rahnema, S., Sedaghathoor, S., Allahyari, M. S., Damalas, C. A., & Bilali, H. E. (2019). Preferences and emotion perceptions of ornamental plant species for green space designing among urban park users in Iran. *Urban Forestry & Urban Greening*, *39*, 98–108.

[24] Ma, B., Hauer, R. J., & Xu, C. (2020). Effects of design proportion and distribution of color in urban and suburban green space planning to visual aesthetics quality. *Forests*, *11*(3), 278.

[25] Cao, Y., Li, Y., Li, X., Wang, X., Dai, Z., Duan, M., ... Xie, J. (2022). Relationships between the visual quality and color patterns: Study in Peri-Urban forests dominated by *Cotinus coggygria* var. *cinerea* Engl. in Autumn in Beijing, China. *Forests*, *13*(12), 1996.

[26] Chen, G., Yan, J., Wang, C., & Chen, S. (2024). Expanding the associations between landscape characteristics and aesthetic sensory perception for traditional village public space. *Forests*, *15*(1), 97.

[27] Wang, Z., Li, M., Zhang, X., & Song, L. (2020). Modeling the scenic beauty of autumnal tree color at the landscape scale: A case study of purple mountain, Nanjing, China. *Urban Forestry & Urban Greening*, *47*, 126526.

[28] Li, C., Shen, S., & Ding, L. (2020). Evaluation of the winter landscape of the plant community of urban park green spaces based on the scenic beauty estimation method in Yangzhou, China. *PLoS ONE*, *15*(10), e0239849.

[29] Bu, X., Chen, X., Wang, S., Yuan, Y., & Han, C. (2021). The influence of newly built high-rise buildings on visual impact assessment of historic urban landscapes: A case study of Xi'an bell tower. *Journal of Asian Architecture and Building Engineering*, *21*(4), 1304–1319.

[30] Tomitaka, M., Uchihara, S., Goto, A., & Sasaki, T. (2021). Species richness and flower color diversity determine aesthetic preferences of natural-park and urban-park visitors for plant communities. *Environmental and Sustainability Indicators*, *11*, 100130.

[31] Kim, J.-M. (2003). The methods of harmony in color combination of environmental color for apartment: Focused on Iksan city. *Journal of Korean Society of Design Science*, *16*(3), 329–340.

[32] Shen, S., Yao, Y., & Li, C. (2021). Quantitative study on landscape colors of plant communities in urban parks based on natural color system and M-S theory in Nanjing, China. *Color Research & Application*, *47*(1), 152–163.

[33] Sadeghifar, M., Pazhouhanfar, M., & Farrokhzad, M. (2018). An exploration of the relationships between urban building façade visual elements and people's preferences in the city of Gorgan, Iran. *Architectural Engineering and Design Management*, *15*(6), 445–458.

[34] Fan, R., Fan, J., Song, J., Li, K., & Ji, W. (2021). Naturalness in the city: Demographic groups' differences in preference for deciduous landscape. *Sustainability*, *13*(14), 7615.

[35] Babington, A., Hughes, M., Farrell, C., Chambers, J., & Standish, R. J. (2023). Preference for multi-layered, flowering, woody streetscape plantings in a mediterranean-type climate. *Urban Forestry & Urban Greening*, *89*, 128094.

[36] Fernandez-Cañero, R., Emilsson, T., Fernandez-Barba, C., & Herrera Machuca, M. Á. (2013). Green roof systems: A study of public attitudes and preferences in southern Spain. *Journal of Environmental Management*, *128*, 106–115.

[37] Olszewska, A. A., Marques, P. F., Ryan, R. L., & Barbosa, F. (2016). What Makes a Landscape Contemplative?. *Environment and Planning B: Urban Analytics and City Science*, *45*(1), 7–25.

[38] Gao, C., & Zhang, S. (2020). The restorative quality of patient ward environment: Tests of six dominant design characteristics. *Building and Environment*, *180*, 107039.

[39] Talal, M. L., Santelmann, M. V., & Tilt, J. H. (2021). Urban park visitor preferences for vegetation—An on-site qualitative research study. *Plants People Planet*, *3*(4), 375–388.

[40] Sun, W., & Kim, S. (2018). Landscape design from the female perspective at the Hengshui Lake Park in Hebei Province, China. *Journal of East Asian Landscape Studies*, *12*(1), 1–6.

[41] Serra, J., Llinares, C., Iñarra, S., Torres, A., & Llopis, J. (2020). Improvement of the integration of visually impacting architectures in historical urban scene, an application of semantic differential method. *Environmental Impact Assessment Review*, *81*, 106353.

[42] Melinescu, A., & Cosmulescu, S. (2022). Perception and Assessment of Fruit Trees Visual Quality During Spring in Public Green Spaces and Private Gardens. In: *Scientific Papers. Series B. Horticulture* (pp. 706–711). BucharesT.

[43] Blanchette, A., Trammell, T. L. E., Pataki, D. E., Endter-Wada, J., &

Avolio, M. L. (2021). Plant biodiversity in residential yards is influenced by people's preferences for variety but limited by their income. *Landscape and Urban Planning*, *214*, 104149.

[44] Szczepańska, A., & Pietrzyk, K. (2022). Seasons of the year and perceptions of public spaces. *Landscape Journal*, *40*(2), 19–35.

[45] Lausen, E. D., Backhaus, A., Jensen, M. B., & Lausen, E. D. (2022). Urbanites' perception of vegetation in landscape-based stormwater management elements (LSM). *Urban Ecosystems*, *25*(5), 1577–1588.

[46] Li, G., Han, C., Shen, J., Wang, X., Gu, T., Yang, Z., & Zhang, L. (2023). A demographic characteristics-based study on the visual impact assessment of the external form of entrance pavilions to the underground stations of China's subway. *Applied Sciences*, *13*(6), 4030.

[47] Todorova, A., Asakawa, S., & Aikoh, T. (2004). Preferences for and attitudes towards street flowers and trees in Sapporo, Japan. *Landscape and Urban Planning*, *69*(4), 403–416.

[48] Wang, P., Song, W., Zhou, J., Tan, Y., & Wang, H. (2023). AI-based environmental color system in achieving sustainable urban development. *Systems*, *11*(3), 145.

[49] Bulut, Z., Sezen, I., & Karahan, F. (2010). Determination of spring visual ceremonies of urban fruit trees and shrubs: A case study from Erzurum, Turkey. *Journal of Food, Agriculture and Environment*, *8*(1), 289–296.

[50] Guneroglu, N., & Bekar, M. (2022). Visual perception of urban greening in public parks: Evidence from Trabzon City, Turkey. *Journal of Environmental Engineering and Landscape Management*, *30*(1), 124–134.

[51] Botero, C., Anfuso, G., Williams, A. T., & Palacios, A. (2013). Perception of coastal scenery along the Caribbean littoral of Colombia. *Journal of Coastal Research*, *165*(SI), 1733–1738.

LAF | https://doi.org/10.15302/J-LAF-2026-0037
第14卷 / 第3期 / 260037 / 2026
收稿日期 | 2026-02-05　录用日期 | 2026-06-05
中图分类号 | TU986　文献标识码 | A

景观色彩的心理与行为影响综述

沈婧[1]，李哲军[2]，吴昳[3]，陈凯达[2,*]，刘超[1]

1 福建理工大学设计学院，福州 350118
2 福建农林大学风景园林与艺术学院，福州 350002
3 阳光学院艺术学院，福州 350015

***通信作者**
地址：福州市仓山区上下店路15号
邮编：350002
邮箱：kaidachenwhu@gmail.com

摘要

景观色彩是塑造人类心理与行为的重要环境因素，但现有证据仍较为分散，缺乏整合性的理论框架。本文基于对62项实证研究的定性综合，构建了一个涵盖时间、空间、视觉刺激和人群异质性4个维度的分析框架。研究结果表明，景观色彩通过双重时间路径发挥作用：短期暴露可产生即时的情绪和注意力效应，而长期及季节性暴露则与累积性的认知恢复和地方相关反应有关。空间语境通过城乡差异和景观类型特异性进一步调节这些效应。在视觉刺激维度，色彩效应从与色相相关的情绪基调，逐步发展到亮度和饱和度的调节作用，并最终体现为和谐与多样的组合原则。这些关联还受到人群特征的影响，包括年龄、性别、文化背景、经验和专业知识等。本文认为，景观色彩设计应超越传统审美考量，针对暴露时长、空间语境和目标使用人群，采用差异化、循证化的设计策略。这些策略有助于支持公众心理健康、环境认同和更健康的人居环境。

关键词

景观色彩感知；心理及行为影响；循证综述；环境心理学；健康人居环境

文章亮点

- 构建了涵盖时间、空间、视觉刺激和人群异质性的四维分析框架
- 综合梳理了景观色彩对心理和行为影响的实证证据
- 识别了塑造景观色彩感知的情境和人口学调节因素
- 将景观色彩相关证据转化为建设更健康、更具包容性环境的启示

基金项目

- 福建省社会科学基金（编号：FJ2025C078）
- 福建理工大学科研启动基金（编号：GY-S22034）