

# A STUDY ON THE DIMENSIONAL CONSTRUCTION OF TRAM VISUAL DESIGN IN THE CONTEXT OF SCENE THEORY

JiaoZi Pu<sup>1,\*</sup>, ZongXin Liu<sup>2,3</sup>

<sup>1</sup> School of Culture and Art, Chengdu University of Information Technology, Chengdu 610103, Sichuan, China.

<sup>2</sup> West China Hospital, Sichuan University, Chengdu 610041, Sichuan, China.

<sup>3</sup> School of Economics and Management, Southwest Jiaotong University, Chengdu 610031, Sichuan, China.

Corresponding Author: JiaoZi Pu, Email: pjz@swjtu.edu.cn

**Abstract:** As a significant component of urban transportation, the visual design of trams has a profound impact on the urban image and passenger experience. However, the current visual design of trams is beset by issues such as homogenisation and a lack of regional characteristics. This paper employs scene theory to construct a multidimensional analysis framework for tram visual design, proposes five key dimensions: physical, interactive, community, institutional and value, and develops specific design strategies for each dimension. The objective of these strategies is to enhance the visual performance of trams, promote cultural values and passenger experience, and facilitate the advancement of high-quality urban transport systems.

**Keywords:** Tram; Visual design; Scene theory; Design strategy

As urbanisation continues to accelerate, the tram is gradually assuming an increasingly important position in the urban transport system, offering a low-carbon and environmentally friendly means of transport. The visual design of trams is not only concerned with the aesthetics of the transport itself, but also with the urban culture [1]. Nevertheless, the current visual design of trams is beset by numerous challenges, including homogenisation of design, a paucity of regional characteristics, and a lack of coordination with the surrounding environment. These issues significantly impede the advancement of tram design.

Scene theory primarily emerged in the 1980s and was pioneered by the New Chicago School, led by Terry Clarke and Daniel Silver, focusing on the transformation and evolution of urban, community, and cultural consumption patterns in the post-industrial era. As the economy shifted from being primarily production-driven to consumption-oriented, cultural and creative industries flourished, subsequently altering the dynamic of urban and regional growth. Theory of the scene represents a significant theoretical instrument for the transformative development of urban space, offering novel research perspectives and methodologies for the visual design of trams. In the realm of design, the concept of scenario-based design was originally introduced by Carroll, who emphasized the role of scenarios in fostering work-oriented communication among stakeholders. This approach aims to enhance the accessibility of design activities to a diverse range of expertise, thus contributing to the design process [2]. This paper introduces scene theory into the field of tram visual design with the aim of exploring the intrinsic mechanism and updating strategy of tram visual design. To this end, a multi-dimensional analysis framework is constructed, providing new ideas and methods for tram visual design.

## 1 THE MEANING OF SCENE THEORY AND ITS STRUCTURAL SYSTEM

In the aforementioned scene, the relationship between each element is organic and interdependent. There is an inevitable emergence relationship between homogeneous and heterogeneous element layouts, which express subversive ideas. Terry Clark introduced this phenomenon into the study of urban society, and subsequently developed the "scene theory"[3]. The central tenet of this theory posits that "cultural consumption" is the driving force, and that the creation of "special scenes" imbued with multicultural values is contingent upon the combination of disparate elements, thereby stimulating the intrinsic developmental potential of the city.

Furthermore, scene theory divides the theoretical structural system into two main and objective levels. At the objective structural level, scene elements, including neighbourhood/community (spatial elements), material structure (physical facilities within the space), diverse people (participating subjects of spatial activities) and multiple activities (contents of activities and behaviours of activity subjects), collectively constitute the distinctive characteristics of different scenes and generate symbolic meanings and cultural values. Building upon the original four elements, Wu Jun and Terry Clark introduced further factors, including publicness, politics and policy, thus enriching the theoretical structure[4-5].

At the level of subjective structure, scene theory identifies three dimensions of cultural values: authenticity, legitimacy and theatricality. These are derived through the combination of neighbourhood/community, physical structure, diverse people and multiple activities. The concept of authenticity is concerned with the origin of the existence of things and the real and essential characteristics of things. The concept of legitimacy is concerned with social identity and norms and requires compliance with socially accepted values and codes of conduct.

The concept of theatricality is concerned with the creation of attraction and pleasure and the use of distinctive forms of expression to arouse people's emotional resonance. The diverse cultural values inherent in such a scene can attract a

diverse range of individuals to participate in activities, facilitate cultural exchange and industrial development in urban areas, and subsequently contribute to the renewal and growth of urban spaces.

## 2 ANALYSIS OF THE APPLICABILITY OF SCENE THEORY IN VISUAL DESIGN FOR TRAMS

### 2.1 Scene Theory Provides a Novel Perspective on the Concept of "Cultural Consumption" on the Context of Visual Design for Trams

The concept of scene theory posits that the shaping of cultural scenes can facilitate cultural consumption. This perspective offers novel theoretical support for the visual design of trams. The incorporation of the concept of cultural consumption into the visual design of trams has the effect of extending the scope of this design beyond the mere appearance of a single transport vehicle. Instead, it directs attention to the manner in which visual elements can be employed to convey urban culture and to attract passengers' participation, thereby enhancing the cultural value and market competitiveness of trams. The application of scene theory enables tram visual design to provide new channels and platforms for the dissemination and consumption of urban culture, thereby creating cultural consumption scenes.

### 2.2 Scene Theory Provides a Holistic Approach to Tram Visual Design

As an integral component of urban transportation, the visual design of trams must not only focus on the vehicle itself, but also integrate with the urban environment and cultural context. The holistic thinking framework of scene theory provides an important methodological guide for the visual design of trams. By integrating multiple scenario elements, including the community and spatial environment, the physical structure, diverse people and activities, the visual design of trams can form a complete and coordinated visual scenario, which can enhance passengers' sense of spatial experience and cultural identity.

### 2.3 Scene Theory Provides an Interactive Approach to Tram Visual Design

In scene theory, the concept of interactive thinking is reflected in the dynamic interaction between different scene elements. In the context of tram visual design, the term "interactive thinking" implies that the participation and interactive experience of passengers should be given due consideration throughout the design process. The design of visually appealing and engaging elements and activity scenes can help to attract the attention of passengers and enhance their sense of participation and enjoyment. Concurrently, the application of interactive thinking facilitates the profound engagement of passengers with urban culture, thereby enhancing the cultural value and influence of trams within the urban transport system.

In conclusion, the scene theory has strong applicability and guiding significance in the visual design of trams. The introduction of the cultural consumption perspective, holistic thinking framework and interactive thinking method of scene theory enables the visual design of the tram to enhance the cultural value and market competitiveness of the vehicle itself, while also providing new ideas and ways for the dissemination and consumption of urban culture. This is of great significance for the promotion of innovative development within the tram industry and the enhancement of the overall quality of the urban transport system.

## 3 DIMENSIONAL CONSTRUCTION OF TRAM VISUAL DESIGN IN THE SCENE THEORY PERSPECTIVE

This scenario dimension analysis framework is grounded in the five fundamental elements of scenario construction advocated by Terry Clark and his research team, and further integrated with pertinent elements of tramway visual design. Drawing upon the outcomes of our research and interviews conducted in Guangzhou, Shenyang, Dalian, Qingdao, Huai'an, and Chengdu during the period of 2022-2023, the visual design dimensions of tramways were categorized into five distinct dimensions: physical, interaction, community, institutional, and values. Set its sub-dimension according to the characteristics of each main dimension. A dimensional analysis framework was constructed, comprising the primary and secondary dimensions, to provide a grammatical framework and assessment basis for the visual design of trams.

**Table 1** The dimensional analysis framework for trams visual design

Dimension	Sub-dimensionality	Descriptions
Physical dimension	Styling	The styling design of the tram should pursue a streamlined, simple yet modern aesthetic to ensure uniqueness and make it stand out in the city. At the same time, practicality is also an important consideration in the design, such as a reasonable layout of the internal space, passenger comfort and so on.

	Material Selection	The choice of material should give primary consideration to safety to ensure the safety of passengers on the road. At the same time, durability is also an important consideration to extend the life of the vehicle. Environmental friendliness is the trend of modern design, and the use of environmentally friendly materials is not only conducive to environmental protection, but also enhances the overall quality of the vehicle.
	Dimensional coordination	According to the road width, traffic flow and surrounding landscape layout of the host city, the size and proportion of the tram will be reasonably determined to ensure that it can meet the operational requirements without causing negative impact on the surrounding environment.
	Colour matching	Colour matching should be selected according to the city culture and regional characteristics, through the contrast of cold and warm tones, the use of complementary colours, etc., to create a visual atmosphere with regional characteristics, so that the tram becomes an important carrier for displaying the city's image.
	Passenger Interaction	Design interactive screens, touch-sensitive devices and other creative elements to provide real-time information, entertainment features, etc. to attract passengers' attention and enhance their sense of participation and belonging. The design should also take into account the multiple travelling needs of passengers and provide convenient information services.
Interaction dimension	Cultural Experience	The historical, cultural and artistic elements of the city are displayed through the internal and external decorations of the trams, so that passengers can not only reach their destinations, but also experience the unique charm of the city during their journeys. The design should focus on creating a multi-sensory experience so that passengers can enjoy themselves visually and aurally.
	Behavioural model considerations	Design the interactive methods and contents of trams according to the travel behaviour patterns and demand characteristics of the public. For example, easy-to-recognise signs and buttons are designed for the elderly, and safety seats and children's entertainment areas are designed for children.
	Government branch	Government departments play a key role in the visual design of trams by formulating relevant policies, providing financial support and supervising and managing the design process. Involvement of government departments ensures the smooth running of the design project and reflects the city's development concept and planning direction.
	Citizen & Design Team	Citizens are an important part of the city and their needs and opinions are crucial to the design. The design team should encourage the public to participate in the design and assessment process, and listen to their views and suggestions to ensure that the design meets the actual needs. At the same time, the design team should be professional and able to provide scientific and reasonable design solutions.
Community dimension	Visitor and Operations Management	Tourists are important visitors to the city and their experience has a significant impact on the image and promotion of the city. The design should focus on the visitors' riding experience, providing convenient information services and a comfortable riding environment. The operation and management team is responsible for the daily operation and maintenance of the vehicles to ensure their safe and stable operation.
	Other communities	Community organisations, enterprises and other communities can also be involved in the visual design of trams, so that resources can be shared and mutual benefits achieved through cooperation. For example, enterprises can invest in the construction and maintenance of tram facilities, and community organisations can participate in the design and evaluation process.
Institutional dimension	Regulatory policy	The establishment of a sound system of regulations and policies is crucial to the visual design of trams. Policies should specify the planning, construction, operation and management requirements and standards for visual design to ensure that the design work is carried out smoothly and completed with high quality.

	Financial security	Financial security is the basis for the smooth running of the visual design of trams. The government should set up special funds and encourage enterprises to invest to provide stable financial support for the design. Stable financial support can ensure the smooth progress of the design work, and also help to attract more social resources to participate.
	Regulatory mechanisms	The establishment of a sound management mechanism has an important impact on the quality and progress of tram visual design. The mechanism should clarify the responsibilities and rights of all parties to ensure that all parties can work together and complete the design tasks. At the same time, the establishment of a monitoring and feedback mechanism can identify problems and rectify them in time to ensure the scientific and democratic nature of the design work.
	Validity	The visual design should truly reflect the cultural and historical characteristics of the city and showcase local elements and regional flavours. This will help enhance the citizens' sense of cultural identity and belonging, and improve the cohesion and centripetal force of the city.
Values dimension	Legality	Design activities should comply with relevant laws, regulations and ethical codes to ensure the legality and legitimacy of the design activities. At the same time, respecting the overall planning and development direction of the local area is also one of the important considerations for the design.
	Theatricality	Creating dramatic visual effects and cultural atmosphere through creative elements can enhance the market appeal and emotional resonance of trams. At the same time, focusing on the embodiment of the concept of environmental protection and the integration of humanistic care is also one of the important trends in modern design.

## 4 DISCUSSION ON THE STRATEGY OF VISUAL DESIGN OF TRAMS IN THE VIEW OF SCENE THEORY

### 4.1 Current Status and Problems of Visual Design for Trams

#### **4.1.1 Physical dimension: the homogenization of the appearance design and the internal space layout are unreasonable**

The exterior design of many trams is characterised by a lack of innovation and a tendency towards homogenisation, which makes it challenging to showcase urban characteristics and modern aesthetics. Furthermore, the interior space layout is often poorly conceived, which further detracts from the overall aesthetic appeal of the vehicle. Concurrently, the internal space layout is irrational, thereby compromising the comfort and convenience of passengers. For instance, issues such as overcrowded seating arrangements and low space utilisation are prevalent.

#### **4.1.2 Interaction dimension: insufficient passenger interaction and cultural experience**

As an important node of urban transport, trams are expected to serve as an important platform for showcasing urban culture and art. However, the existing trams are evidently inadequate in terms of passenger interaction and cultural experience. The lack of interaction between passengers and the vehicle during the journey results in a monotonous and boring experience for passengers, which is further compounded by the difficulty in obtaining a rich cultural experience.

#### **4.1.3 Community dimension: insufficient community participation and poor communication and collaboration**

In the visual design process of the tram, there is a lack of effective communication and collaboration among the government, the public and the design team. The policy support and supervision of government departments is inadequate, rendering it challenging to obtain effective feedback on the needs and opinions of the public. Furthermore, the innovation and professionalism of the design team require enhancement. This lack of community participation and poor communication and collaboration significantly impedes the advancement of visual design for trams.

#### **4.1.4 Institutional dimension: inadequate regulations and policies and inadequate financial security**

The current system of regulations and policies for the visual design of trams is not yet fully developed, and there is a lack of clear design requirements and standards. Concurrently, the financial security is inadequate, rendering it challenging to provide the requisite financial and technical support during the design process. Furthermore, there is a lack of an effective management and supervision mechanism, which makes it challenging to guarantee the quality and progress of the design.

#### **4.1.5 Value dimension: insufficient urban cultural heritage and spatial quality enhancement**

The visual design of trams represents an important form of expression and should be informed by a deep understanding of the urban culture and an enhancement of the spatial quality. However, the visual design of existing trams frequently lacks an in-depth excavation and inheritance of urban culture, and the spatial quality is insufficiently enhanced. This

situation not only affects the city's image, but also makes it challenging to meet passengers' expectations of a high-quality travelling environment.

## 4.2 Visual Design Strategy for Trams

### 4.2.1 Physical dimension: innovative styling and humanised layout

**Innovative modelling design:** Pursuing a simple but unique modelling style, incorporating urban characteristics and modern aesthetic elements to create a recognisable tram appearance.

**Humanised Space Layout:** Fully consider the comfort and convenience needs of passengers, optimise the seat layout and space utilisation to provide a spacious and comfortable riding environment.

**Modular design:** Adoption of modular design concept facilitates flexible combination of vehicle structure and future upgrading, enhancing the service life and adaptability of the vehicle.

### 4.2.2 Interaction dimension: creating diverse interactive experiences

**Introduction of interactive elements:** Through interactive screens, touch-sensitive devices and other creative elements, passengers are provided with real-time traffic information, weather forecasts and other convenient services to enhance their sense of participation and belonging.

**Create cultural experience space:** Combine the city's cultural and artistic elements to create a rich and diverse cultural experience space, such as cultural lectures and art performances, so that passengers can experience the unique charm of the city during the ride.

**Considering the needs of passengers of different ages:** Designing functional areas and facilities that meet the needs of passengers of different ages, such as children's recreation areas and barrier-free facilities, to enhance passengers' travelling experience.

### 4.2.3 Community dimension: building a pluralistic community participation mechanism

**Government policy support and supervision:** Government departments should formulate relevant policies and regulations to provide policy support and guidance for the visual design of trams. Meanwhile, the supervision and management of the design process should be strengthened to ensure that the design quality and progress meet the requirements.

**Citizen Participation in Decision Making and Evaluation:** Citizens are encouraged to participate in the decision making and evaluation process of the visual design of the tram to collect their views and suggestions to ensure that the design outcome meets the actual needs of the public.

**Professionalism and innovation of the design team:** The design team should be professional and innovative to provide scientific and reasonable design solutions according to the needs of the public and the characteristics of the city. At the same time, the design team should maintain close communication with the public and make timely adjustments to the design to meet the ever-changing needs of the public.

### 4.2.4 Institutional dimension: establishment of a sound institutional guarantee system

**Improvement of regulations and policy system:** Establishment of a sound system of regulations and policies on visual design of trams to clarify the requirements and standards for planning, construction, operation and management of visual design.

**Financial support and incentives:** Set up special funds and encourage enterprises to invest in providing stable financial support for visual design of trams. Attract more social resources to participate in the design work through financial subsidies and tax incentives.

**Supervision and feedback mechanism:** Establish a supervision and feedback mechanism to ensure that all aspects of the design process are effectively supervised and managed to ensure that the design quality and progress meet the requirements.

### 4.2.5 Value dimension: inheriting urban culture and enhancing quality

**Digging deeper into the city culture:** Digging deeper into the city's historical heritage and cultural characteristics to integrate the city's cultural elements into the visual design of the tram to show the city's cultural charm and characteristics.

**Respect local planning and development direction:** Respecting local planning and development direction during the visual design process ensures that design activities are in line with overall local planning and development requirements.

**Focus on environmental protection concepts and humanistic care:** The visual design focuses on the embodiment of environmental protection concepts and the integration of humanistic care to create a harmonious and livable urban environment and atmosphere to enhance the quality of life and happiness of citizens.

## 5 CONCLUSION

The application of scene theory provides new perspectives and methodologies for the visual design of trams. This study employs the lens of cultural consumption, holistic thinking, and interactive thinking to construct an analytical framework encompassing the physical, interactive, community, institutional, and value dimensions. This framework offers a comprehensive consideration and evaluation tool for the visual design of trams, facilitating the realization of the effectiveness and innovation of the design. The design strategies proposed in this study provide practical solutions to the problems of homogenisation, insufficient interactive experience and lack of community participation in the current

visual design of trams. They also help to promote the development of visual design of trams in a more humane, personalised and sustainable direction.

#### **FUNDING**

This research was funded by Modern Design and Culture Research Center of Sichuan Philosophy and Social Science Research Base, grant number MD22E018 and Sichuan characteristic philosophy and social science planning project "Sichuan statistical development special topic", grant number SC22TJ04.

#### **COMPETING INTERESTS**

The authors have no relevant financial or non-financial interests to disclose.

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