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Future Mobility Scenario Exploration Based on Futurology and Speculative Design Tools and Methods

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ABSTRACT

This paper focuses on the use of futurology tools to explore the future of the field of mobility. This paper provides an in-depth interpretation of the core concepts of speculative design and emphasizes its importance in transcending the boundaries of reality and challenging conventional thinking. Further, combined with the four future perspectives detailed in *Speculative Everything*, we discuss how these perspectives provide new perspectives and Revelations for predicting future mobility scenarios. These four perspectives not only reveal the diversity of the future for us, but also bring more abundant and diversified possibilities to the field of smart mobility. On this basis, the conceptual framework of the future triangle is introduced, and the opportunities and challenges facing the future transportation development are deeply analyzed. This analysis helps us to understand the complexity of traffic system design in a more comprehensive way, and provides a solid theoretical foundation for future practice. Combined with the perspective of futurology, it can stimulate the society's in-depth thinking and participation in the future mobility. In summary, the goal of this paper is to provide designers, researchers and policy makers with a new perspective and methodology to promote innovation and development of future transport design and ensure the sustainability and prosperity of society.

Keywords: Speculative design, Future triangle, Future mobility, Design exploration, Transportation system

INTRODUCTION

The design conception of the future mobility has become the core issue of modern times. With the rapid changes in society, technology and the environment, social design is no longer just about meeting the needs of the present, but needs to look to the future, anticipate possible changes and prepare for them. Speculative design, as a design approach that emphasizes exploration, challenge and innovation, provides us with a perspective that transcends the boundaries of reality and helps us reveal the diversity and possibilities of the future. At the same time, combined with the concept and method of sustainable behavior design, we can consider the sustainable development of society more systematically and comprehensively, ensuring that the design scheme not only meets the existing needs, but also can adapt to future changes and

challenges. The purpose of this paper is to explore how to effectively combine speculative design in the design conception stage of future mobility to promote the sustainable development of society and future prosperity. Through in-depth analysis and empirical research, it is hoped to provide valuable theoretical and practical references for designers, researchers and social leaders, and promote the innovation and development of future social design.

In the book *Speculative Everything*, designers propose four different perspectives of the future: possible, hypothetical, dystopian, and conceptual futures. These future perspectives provide us with a framework to deeply understand the multiple possibilities of the future, and encourage us to look beyond traditional thinking patterns and notions to challenge and question existing social, cultural, and economic structures. These reflections not only help us to understand and think more comprehensively and deeply about future changes and impacts, but also provide us with an effective way and method to explore and realize the future.

At the same time, the Future Triangle, as a simple and powerful futurology tool, provides a framework and method for analyzing and thinking about the future. It discusses the interplay of the pull of the future from the perspective of the present, the push of the present, and the gravity of history to reveal the "contested space" of the future. This approach not only helps us to understand and think about future changes and impacts more comprehensively and deeply, but also provides us with an effective way and method to realize future social design.

Through in-depth research and discussion, it is hoped to provide valuable theoretical and practical reference for designers, researchers and social residents, and promote the innovation and development of future society. It is believed that by combining the ideas and methods of speculative design and applying them to the exploration and triggering of future mobility scenarios, we can jointly explore and realize a more sustainable, innovative and humanized social design scheme, and make contributions to the realization of sustainable development and future prosperity of society.

Future Exploration Tools

The Future Triangle is a simple and powerful futurology tool that discusses the interaction of future pull, present push, and historical gravity from a present perspective, and uses this as a basis for discussion of future possibilities. The Future Triangle represents the "contested space" of the future represented by the pull of these three forces. The Future Triangle also represents the cognitive position behind the approach: we should challenge the future, reflect on it, and create it.

The Future Triangle focuses on the forces and possibilities of the future, analyzing the interplay of the pull of the future, the push of the present, and the gravity of history to reveal the "contested space" of the future. They also analyze the future from different dimensions. Social innovative design starts from the needs, challenges and opportunities of social residents, and considers multiple dimensions such as society, economy and culture to provide design schemes and solutions for the sustainable development of

society. By analyzing the pull, push and gravity of the future, the future triangle explores the possibilities and changes of the future from different angles and dimensions, helping us to understand and think about the future more comprehensively. Social innovation design encourages the participation and cooperation of social residents, solves the practical problems of society through innovative methods and thinking, and promotes the development and progress of society, while the future triangle provides a framework and tools for analyzing and thinking about the future, helps us to better understand the future possibilities and challenges, and provides guidance and support for future decisions and actions.

a. Future Pull: This represents our expectations, visions and pursuits for the future. The pull of the future is a push that motivates us to look ahead, brave the unknown, and explore new possibilities and opportunities. The pull of the future is the vision of the future and the possible future that pulls us forward. For example, the development of artificial intelligence, leaps in science and technology, advances in gene therapy, etc., are more or less guiding our future.

b. Present thrust: This reflects our current actions, decisions, and practices. The present push is the practical force that drives us to take action to achieve our goals, ensuring that our efforts and investments in the present provide a solid foundation for future achievement. Present push refers to the forces that affect the future direction, including but not limited to current trends, factors that cause change, etc. There are many factors that can change the future, such as population aging, climate warming, and the normalization of epidemics.

c. The gravity of history: This represents past experiences, lessons and legacies. The gravity of history is a restraining force that reminds us to respect and value history, to learn from it, to avoid repeating it and to ensure that our decisions and actions are sustainable and responsible. The gravity of the present refers to the factors that hinder or prevent us from moving towards a different future. Every future scenario has its gravity, such as old-fashioned thinking, language barriers, labor constraints, etc. Through brainstorming, divergent thinking, and integrating the content of the future triangle, we can gain a clearer understanding of the relationship between these three and what possible futures we may lead to.

Speculative Design Methods

Speculative design is a forward-looking and deeply influential design method, which not only focuses on the immediate problems and needs, but also attaches more importance to the long-term development and future possibilities of society. At the same time, as a way of thinking and methodology, future-critical design focuses more on the exploration, imagination and conception of the future. When the two are combined, the blending and interaction between them provides new dimensions and possibilities for the sustainable development of society and the construction of the future.

In Speculative Everything, future possibilities are subdivided into four categories, each reflecting a different Angle of thought and design strategy.

Plausible Futures: This category of future possibilities extrapolates based on current technological, social, and cultural trends. Designers predict possible future directions by analyzing and interpreting existing data and information. This method emphasizes logic and feasibility, trying to present us with a relatively real and credible vision of the future.

Probable Futures: This type of future is more specific and clear, in that it predicts and assumes how the future will develop, based on current decisions and actions. By conducting an in-depth analysis of existing problems and challenges, the designer attempts to find solutions and paths to provide guidance and advice for future development.

Possible Futures: Similar to possible futures, this category of future possibilities is also based on current trends and information, but it is more open and diverse. Designers encourage people to explore and imagine various possibilities, challenge traditional thinking patterns, and open up new directions and paths for future development.

Preferable Futures: This category of future possibilities is based on people's values and expectations, and is not just a description and a vision of the future, with a greater emphasis on how the future should be. Designers show us a better and more sustainable future by coming up with a variety of innovative and radical ideas that challenge existing institutions and perceptions.

In general, speculative design provides us with a new perspective and framework for thinking by exploring and imagining multiple possibilities for the future. In the context of changing and developing times, we need to be more open and forward-thinking, and explore and shape a future full of infinite possibilities together with designers.

Scenario-Based Storytelling Approaches to Future Mobility

A futurology workshop is an activity designed to encourage participants to think about and discuss possible trends in the future. These workshops usually cover multiple topics, such as technology, society, environment, economy, etc., and use a variety of futurology tools and methods to guide participants in exploring the future.

Suppose that the participants are a group of transportation planning experts, automobile manufacturer representatives, and urban policy makers who participate in a future mobility scenario exploration workshop. The workshop aims to explore possible trends in the way people mobility in the future, as well as the impact on urban mobility and the environment. Participants will use a scenario analysis matrix to discuss the impact of different factors on future mobility over different time periods.

1. Determine variables of concern: Participants first identify key variables or factors to be analyzed according to the framework of the future triangle, such as technological development, social change, environmental impact, policies and regulations.

2. Set the time horizon: Participants set the time horizon to three phases: 2025, 2035 and 2050, in order to analyze the long-term trends and changes in the development of future mobility.

3. Fill in the matrix: Participants began to fill in the scenario analysis matrix, filling the state or possible changes of different variables in different time periods into the corresponding cells.

Table 1. Future mobility scenario analysis matrix.

Time \ Variable	Technology Development	Social Change	Environmental Impact	Policies and Regulations
2025	Autonomous driving technology Ubiquity	The rise of ride-sharing services	New energy vehicle Promotion	Environmentally friendly transport policy Implementation
2035	Air traffic system Mature	Aging population Intensifying	Improved air quality in cities	Autonomous driving regulations Enactment
2050	Superfast transport network completed	Virtual reality mobility is widely available	New energy technology mature	mobility demand management Policy

4. Analyze cross-effects: When participants analyze cross-effects, they will focus on the interactions and effects between different variables. In the case of future mobility scenarios, cross-impact analysis can involve aspects such as technological developments, social changes, environmental impacts, and policies and regulations. Here is a further discussion and evaluation of cross-impact analysis, as well as some thoughts related to future mobility scenarios:

a. Technological development and social change: With the popularization of autonomous driving technology and the maturity of air traffic systems, the future of mobility will undergo major changes. The popularization of these technologies will change the way people mobility and their habits, which will have a profound impact on the social structure and urban planning.

People may be more willing to choose ride-sharing services and virtual reality modes of mobility rather than traditional private cars or public transportation. This will prompt city policymakers to rethink transportation planning and road design to accommodate the shift in the way people mobility.

b. Social changes and Environmental impacts: Increasing population aging may lead to changes in mobility demand, especially for the elderly and persons with disabilities. Urban transport systems need to take more account of the needs of these special groups and provide corresponding services and facilities.

Meanwhile, improved air quality in cities and the maturity of new energy technologies will reduce the negative impact of transportation on the environment. The promotion of new energy vehicles and the improvement of urban air quality will help reduce air pollution and greenhouse gas emissions, thereby improving the quality of the urban environment.

c. Environmental Impact and Policies and Regulations: The implementation of environmental protection transport policies will accelerate the promotion and use of new energy vehicles and promote the sustainable development of urban transport. The government may introduce more incentive policies to encourage people to choose environmentally friendly modes of mobility, such as buying electric cars or using public transportation.

At the same time, the government needs to formulate regulations on autonomous driving to ensure the safety and reliability of autonomous driving technology. The development and application of autonomous driving technology requires the establishment of a sound legal framework and regulatory mechanism to ensure public safety and traffic order.

5. Discussion and evaluation: During the discussion and evaluation process, participants will jointly explore the challenges and opportunities of future mobility based on the analysis results of cross-impact, and put forward corresponding suggestions and solutions. They will assess the degree of correlation and influence between different variables, as well as the impact and role of policy formulation on future mobility. Through thorough discussion and evaluation, participants can better understand the complexity and diversity of future mobility scenarios, and provide more comprehensive and effective advice and support for future transportation planning and development.

Through the process of using such scenario analysis matrix, participants can clearly understand the possible scenarios and changing trends of future mobility modes, which provides an important reference and support for formulating future traffic policies and development planning. At the same time, they can also deeply explore the correlation between different variables, and provide more comprehensive and systematic thinking for future mobility planning and design.

Future Mobility Scenario Prediction: An Exploration Based on Speculative Design and Futurology Methods

Through these workshops, participants were able to think deeply and discuss the development of future cities, resulting in a *Future Mobility Scenario Report*, which summarized the design proposals and suggestions of various groups, including innovative solutions in intelligent traffic management system, green building design, community sharing space and so on. A series of policy suggestions on future urban planning and development were put forward, providing new ideas and references for the sustainable development of future cities. Jointly design innovative and forward-looking development possibilities, and provide new ideas and references for the development of future mobility:

1. Technology-driven intelligent mobility

In the future mobility scenario, technology will become the main driving force, promoting intelligent and automated mobility methods. Autonomous driving technology will be widely used, from private cars to public transportation, and even drones and unmanned aerial vehicles. Intelligent mobility

driven by this technology will greatly improve the efficiency and safety of mobility, and reduce traffic accidents and congestion.

Autonomous driving technology: Autonomous vehicles will become the mainstream, and their intelligent navigation and driving through artificial intelligence, sensors and real-time data processing will not only improve the safety of mobility, but also reduce traffic congestion and environmental pollution. Drones and unmanned aerial vehicles: In urban transportation, drones and unmanned aerial vehicles will be used for tasks such as rapid freight transportation and emergency medical rescue, bringing brand new solutions to urban transportation.

2. The popularization of shared mobility mode

The future mobility scenario will show more shared mobility modes, and people will be more inclined to use shared mobility services, such as shared cars, shared bicycles and shared electric scooters. This shared mobility mode will effectively utilize urban resources, reduce the use of private cars, reduce traffic congestion and environmental pollution, and improve urban accessibility and social inclusion.

Shared mobility services: Through the shared mobility service platform, people can easily find and book vehicles such as shared cars, shared bicycles and shared electric scooters, so as to realize flexible mobility needs.

Reduce private car use: Thanks to the popularity of shared mobility services, people will rely less on private cars, thus reducing the number of vehicles and traffic congestion problems, while also reducing the cost of personal mobility.

3. Sustainable mobility and urban planning

Future mobility scenarios will focus more on sustainability and environmental friendliness, and transport planning will focus more on improving the convenience and accessibility of public transport and reducing reliance on personal cars. Urban planning will emphasize the convenience of walking and cycling to get around, and design urban Spaces that are more humane and environmentally friendly.

Public transport improvement: The government will increase investment in and renovate public transport to improve its coverage and service quality, so that more people will choose to mobility by public transport.

Encouragement of walking and cycling: Urban planning will increase support for walking and cycling, build more sidewalks and bike lanes, and improve the safety and comfort of walking and cycling.

4. Data-driven mobility decisions

Future mobility scenarios will make full use of big data and artificial intelligence technologies to achieve data-driven mobility decisions. Individuals and cities will optimize mobility paths and traffic flow to improve mobility efficiency and comfort through real-time data analysis and prediction.

Real-time traffic information: People can obtain real-time traffic information and road condition prediction through smartphone applications, choose the best mobility routes and transportation means, and avoid traffic congestion and delays.

Traffic flow prediction: Urban traffic management departments will use big data and artificial intelligence technology to traffic.

The traffic flow will be monitored and predicted in real time, and more effective traffic management measures will be formulated to improve the operating efficiency of the traffic system.

5. The rise of new modes of mobility

In the future, there will be many new modes of mobility, such as ultra-high speed transportation network, ultra-high speed train, space mobility, etc. These new modes of mobility will change people's mobility experience and habits, and open up new mobility space.

Ultra-high speed transportation network: The future mobility will use ultra-high speed transportation network to realize the rapid connection between cities, people can achieve cross-city mobility in a short time, thus improving the convenience and efficiency of mobility.

Space mobility: With the advancement of space technology, it will be possible for people to mobility in space in the future, and the mobility time from Earth to space will be greatly shortened, which will open up new mobility experiences and markets.

The above is a prediction of the future mobility scenario, which is explored and elaborated in detail based on speculative design and futurology methods. The emergence of these scenarios will greatly change the way people mobility and live, and put forward new challenges and opportunities for the development and planning of future cities.

CONCLUSION

The status and significance of the future in the field of design is not only a clear goal or end point, but more of a philosophical thinking and exploration. In the traditional sense, the future is regarded as a destination that needs to be reached through efforts and plans, but in the modern design philosophy, the future is redefined as a medium and platform to stimulate imagination. This perspective emphasizes philosophical thinking and exploration of the future, encouraging designers and researchers to go beyond the limitations of reality and dare to challenge and question traditional thinking patterns and concepts. The future is no longer a fixed end, but an open space full of possibilities and potential, providing a broad stage for design innovation and exploration.

Under the framework of futurology, speculative design is seen as a design approach that emphasizes exploration and imagination. Different from the traditional design approach that aims at problem solving, speculative design is more concerned with opening and exploring various possibilities for the future through design practice. This approach emphasizes design as a tool of thinking and practice, which can stimulate in-depth discussion and thinking behind specific issues. Through carefully designed products and solutions, speculative design aims to guide people to think about the future in multiple dimensions and angles, so as to find possible landing points and directions. This method emphasizes the inspiration and guidance of design. Through questioning, creation and presentation, design is involved, and design practice is used to show and present these future parts and possibilities.

In design practice, the exploration and application of the future has become an important issue and challenge. How to apply the speculative design method in futurology to practical design practice has become a key issue for designers and researchers. First of all, designers need to have deep philosophical literacy and critical thinking ability, and be able to go beyond the surface phenomenon, and deeply explore and excavate the deep meaning and value of the future. Secondly, designers need to have open and innovative thinking, dare to challenge traditional thinking patterns and concepts, dare to break conventions, and explore and experiment new design methods and means. Finally, designers need to have interdisciplinary and comprehensive knowledge and ability, and can combine the knowledge of various disciplines and fields to carry out cross-border cooperation and exchange, and jointly promote the innovation and development of design. By combining theoretical research and practical exploration, designers and researchers can jointly explore and realize the possibilities and value of future design, contributing to the sustainable development and progress of society.

Finally, from a theoretical point of view, both futurology and speculative design emphasize the innovativeness and foresight of design. They both believe that design is not only a tool to solve existing problems, but also a means to explore future possibilities and shape the future. In speculative design, designers need to consider the long-term development of society and possible changes in the future, and design forward-looking and adaptive behavior patterns and interaction mechanisms. Under the framework of futurology, designers pay more attention to the imagination and innovation of design, and encourage people to go beyond the limitations of reality and have the courage to explore and experiment new design ideas and methods.

To sum up, there are profound intersections and complementarity between futurology and speculative design in methodology, practice and theory. By combining and applying the two, designers and researchers can jointly explore and realize more sustainable, innovative and humane social design solutions, contributing to the realization of sustainable development and future prosperity of society.

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