# Reflections on Technical Pathways and Value Orientations of Decision-Making Models in SimCity Games

**Ding Meichen, Shen Guoqiang**

**Abstract:** Since their inception,city video games like SimCity have emerged as excellent human-computer interactive platforms for simulating urban development.The core technical pathways and value orientations of these games are believed to align with those of actual urban decision-making,although systematic studies to support this are scarce.The research analyzes simulation results from two representative Simcity games, SimCity and Block'Hood,and compares the optimal solutions of input-output models on spatial efficiency and circular economy equilibrium.The study reveals that within the same algorithmic framework,different objective functions and pertinent factors lead to significant variations in algorithmic structures and outcomes.Furthermore,it elaborates on the inevitable utilization of instrument rationality in the technical pathways and underscores the importance of value rationality in urban decision-making.Finally,the research contemplates on urban planning em powered by the latest artificial intelligence,urban value orientations embodied in human interventions, algorithmic refinements through amendments,and dynamic participation by multiple stakeholders.These elements aim to foster human-machine collaboration and value-led urban decision-making models.

**Keywords:** simcity games; decision-making models; technical algorithms; value orientations; reflections and responses

## 1 Research origin

In the 1960s, data in human society began to grow explosively. From telegraphs and televisions to computers and mobile phones, from texts and symbols to sounds and images, all kinds of information have penetrated into all spaces of citizens' lives at an ever-increasing speed, volume and diversity, recording everyone's digital footprint and building an information age with overloaded data[1]. Faced with billions of data every day, human beings' ability to obtain and analyze data is obviously unable to handle even one ten-thousandth of it. Taking the Decision Support System (DSS) proposed by Keen et al.[2] as a typical example, urban development decisions have changed from traditional human behavior based on intuition and experience to a "man-machine" system model based on data decision-making[3]. At that time, video games had just been born and quickly became popular around the world. Today, video games have become one of the most important forms of entertainment for young people today, and have had a huge impact on the economy, society and culture. Jesper Juul, a scholar of video game theory[4], emphasized simulation in his book Semi-Reality: Video Games Between the Laws of Reality and the World of Fiction. He believed that video games are game rules and human-computer interactions in a simulated world. SimCity, an urban simulation game first created by Will Wright in 1989, combines cities, decision-making, simulation and game entertainment. Gaber [5] used SimCity in planning teaching classes to let students understand how cities work as a system through the game. Minnery et al. [6] used it to help students understand how decision-making system settings affect urban planning. Woessner [7] used urban simulation games for simulation teaching in political science, and Wiseli et al. [8] used urban simulation games for simulation teaching in smart city management. Scholars represented by Terzano et al. [9] found that using simulation games would increase students' enthusiasm and interest in planning learning. Urban simulation games have begun to become an excellent simulation and teaching stage for human-computer interactive decision-making on urban development.

In 2023, ChatGPT was born, enabling a new generation of AI to enable urban planning and bring new opportunities and challenges. Batty [10], Long Ying and other [11] proposed the research paradigm of large urban model driven by large-scale data, Wu Zhiqiang et al [12] proposed the development of AI city, and data and algorithms are becoming more and more important. At present, many scholars, supported by data and based on spatial and economic mathematical methods, put forward various algorithm models to evaluate urban development in the aspects of industry [13], employment [14], population [15], land [16], transportation [17], and environmental [18-19]. At the same time, the value bias of the empirical data itself, as well as the values and ideological preferences of the technicians who specify the algorithm, are also concerned about [20-21]. When the application of A I G C tools in urban planning gradually deepens into [22], the challenges of ethics and fairness, the social value orientation behind the algorithm and other issues urgently need to be explored in [23]. For most people, the knowledge composition of urban decision model is strange and complex, and the decision rules and value orientation hidden behind it are abstract and difficult to detect, especially in the moment when information explosion is in urgent need of various algorithm models for lengthy computational analysis. Never discuss technology and value, people and artificial intelligence in novels, dramas, movies and games. Complex with reality Compared with the multiple urban decision model, the decision model in the urban simulation game is the real mirror, technical rule and value desire, which strengthens the conflict between urban form, operation state and decision direction. Game technology has built a growing virtual simulation city, by strengthening the "dramatic tension" of decision-making, allowing players to face the impact of its urban development. European and American scholars generally use SimCity as a simulation teaching platform, allowing students to understand the influence of decisions on urban development, but they rarely reflect on the value orientation implied by the game model on users decision making

Time and world change. In a sense, the evolution of cities is mostly influenced by the desire of people, or the result of peoples game. When video games are combined with urban systems, limited electronic hardware is doomed to simulate the personal ideas of thousands of the public, but it can use a model to simplify complexity. This process of simplification can only reflect peoples current thinking about the city, and the process inevitably generates a series of values and stifle other development possibilities. So much so that each games mechanic also implies an ideology that indicates how the player should view a city. This paper tries to start from the perspective of city simulation game, explore the urban mainstream planning theory and the influence of value orientation change on it, and select S i m C i t y and B l o c kH oo d as a representative game, analysis of the value of different decision rules, to understand and grasp the future AI city decision model of intelligent algorithm value orientation and guide the direction of case thinking.

## 2 The influence of the urban planning theory change on the type of urban simulation games

### 2.1 Change of planning concepts driven by events and thoughts: from systematic rationality to digital intelligence

#### 2.1.1 System rationality and urban planning

Urban planning and construction in each era are closely related to the events and major trends of thought at each stage. Before the 19th century, architects and planners never stopped exploring the "ideal city". Howard's "Garden City", Le Corbusier's "Radiant City", Wright's "Broadacre City", CIAM's "Functionalism" and other future urban visions are mostly based on physical planning concepts and form-based. [24-25] With the reconstruction of Western cities after World War II, cities in various countries have grown and expanded to vast natural and rural areas at an unprecedented speed and scale. Modern urban planning has begun to focus on urban social, economic goals and spatial order. [26] Based on the

concept of "rationality" of German sociologists, the Frankfurt School formed an important tool to explain the problems of capitalist society at that time - instrumental rationality, that is, the pursuit of maximum efficiency. [27] The rational comprehensive planning model was born in this context. [28] The core idea of this model is to systematically collect various data, rationally analyze them comprehensively, and then formulate multiple plans, and then compare them to maximize overall welfare. This is consistent with Karl Popper's scientific paradigm [29]: logical scientific procedures should be used in planning, planners are value-neutral analysts, and the results are verifiable and measurable. McLoughlin [30] pushed it to the pinnacle of rationality and proposed a rational planning model based on a system approach. Since then, many experts and scholars have proposed various urban mathematical decision-making models in the fields of economy, land, transportation, and industry. After the theoretical trend of the 1960s, Jay W. Forrester [31], who taught system dynamics at MIT, turned his attention to cities and proposed an urban dynamics model. Inadvertently, he planted the theoretical seeds for the birth of urban simulation games.

### 2.1.2 Humanism and digital intelligence

Reason and faith are the cornerstones of Western society. Once they become tools for achieving goals, scientific rational analysis and calculation processes are disconnected from reality, the rationality of values is often ignored, and only the purpose is considered. Limited by the technology of the time, when analyzing problems in complex systems such as cities, the optimization rules are often strictly and rigidly implemented, without considering whether there is a "satisfactory" criterion to replace the "optimal" criterion, which also leads to the alienation and reification of people in urban society[32]. Subsequently, throughout the 1970s and 1980s, liberalism and people-oriented thoughts dominated by postmodernism swept in. Relevant planning theories such as urban Marxism[33], urban justice[34], contextualism[35], and neighborhood revitalization[36] were successively proposed, and sociologists and urban planners turned their attention to the attention to people and the shaping of spiritual culture in cities. At the same time, with the publication of works such as "Silent Spring"[37] and "The Limits to Growth"[38] and the emergence of increasingly serious urban environmental problems, concepts such as sustainable cities[39], ecological footprint[40], and smart growth[41] have been taken seriously. In the 20 years since then, living in harmony with nature, building green, low-carbon, ecological cities, and achieving sustainable development have become the mainstream values of social development and continue to this day.

In the 21st century, with the process of global urbanization and the rapid development of information technology, cities are no longer isolated local social and economic systems, but integrated into the node and center [42] of the global economic and cultural network. The use of computers has changed the relationship between people and cities, and the cities permeated by information have become flowing and unlimited space. Urban life has been redefined, and the data-driven new urban science [43-44] driven by smart cities, twin cities and complex adaptive systems has been widely used. In 2021, the [45] of Urban Informatics (Urban Informatics), which combines the basic theories, technologies and applications of urban science, urban systems and application, urban perception, urban computing, and urban big data infrastructure, has received wide attention from the academic community. In 2022, ChatGPT will lead the development of AI AI technology in all fields. The exploration of AI city theory, and the breaking of universe cities from novels, movies, and games, they are moving into the real world [46].

## 2.2 Technology-and value-oriented game genres: from system simulation to multiple themes

### 2.2.1 System rationality and urban simulation

Since the 1950s, with the first video game Noughts & Crosses as an example, video game genres have been influenced by real life, with content focused on sports, shooting and other sports entertainment. In the 1980s, a new type of video game, God Game, quietly emerged. The Civilization series designed by British Peter Molyneux based on historical processes is a typical example. The core point is that the game itself is a God who predicts the results of players' actions but allows players to have free will. It can be understood that the game rules given by the game maker determine the path of game development, and no matter how the player chooses, the ending is predictable. On this basis, Will Wright gave players the power to make the rules in the game, and in 1989 created a derivative type of God Game - the God of God Games, namely SimCity.

According to a 2006 feature article in The New Yorker[47], Will Wright, who was born and raised in the 1960s, was inspired by Urban Dynamics, which is based on the rationality of urban systems and system dynamics theory, and Game of Life, which is based on the principle of cellular automata. Will Wright found a perfect match between real cities and video games. He applied system theory and cybernetics to games, and used the advantages of computer simulation to simulate the evolution of urban space caused by decision-making stimuli, allowing players to experience the impact of decisions on the city in the most intuitive and fastest way. Players become gods who create and manage this dynamically developing city. In 1989, the launch of SimCity opened up a new era of urban simulation games[48]. In fact, the birth and development of urban simulation games have always been deeply influenced by real cities and their planning theories, as shown in Figure 1. The first version of SimCity represents the first stage of urban simulation game development, namely the establishment of urban simulation models. Benefiting from system rationality theory and computer simulation technology, the game breaks down the city into elements such as buildings, infrastructure, resources, and environment. They are like machines, with clear division of labor and are organized and operated in a specific order. Like a real city, the game has no ending, no specific story, only a constantly evolving goal. Players only need to follow this goal and provide instant planning methods based on various information data fed back in real time in the game interface to control and guide the complex system of the city.

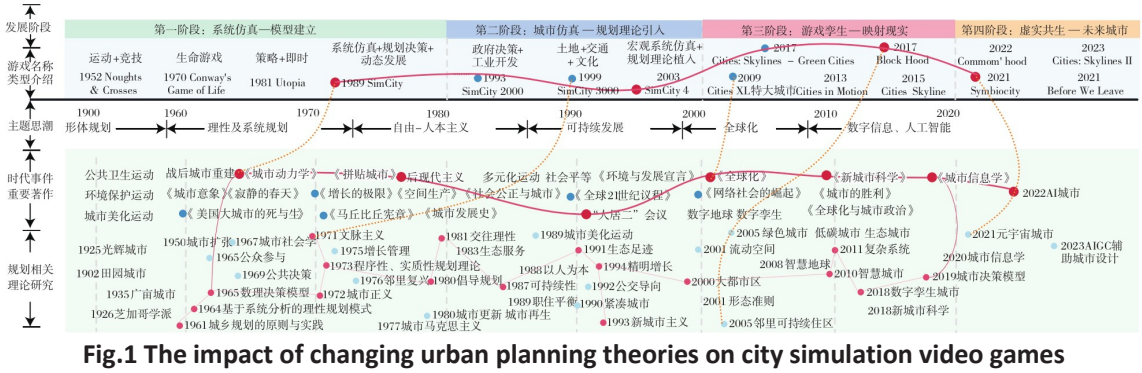


**Fig.1 The impact of changing urban planning theories on city simulation video games**

### 2.2.2 Virtual reality and multiple themes

The second stage of city simulation games is to introduce real city planning concepts. In order to help players have a more realistic city planning experience in the virtual city, SimCity2000 in 1993 added policy management and industrial development models. In SimCity3000 in 1999, land resources, transportation systems, cultural shaping and other sections were added, which were deeply integrated with the theories of industry, land,

transportation, culture and other theories emphasized in real city planning. Until 2003, SimCity4 basically realized the top-down urban macro-system simulation and bottom-up planning concept data feedback, combined with a more realistic and smooth simulation interface - real urban environment and terrain and climate, and established one of the milestone works of city simulation games. Since then, the third stage of city simulation games has begun to achieve synchronous growth and reflection with the real world. Sustainable development and globalization trends have brought about urban forms such as urban agglomerations and metropolitan areas. The concepts of regional cooperation, compact cities, smart growth, and bus-oriented in real cities have not only set off a new wave of urban development around the world, but also brought new themes to city simulation games. For example, Cities XL in 2009 provides players with a large enough map to achieve urban expansion and development, establish trade exchanges between cities, etc.; Cities in Motion in 2013 focuses on the impact of the establishment of urban public transportation networks on urban development; Cities: Skylines in 2015 is a combination of urban three-dimensional space and transportation systems (ships, airplanes, tracks, viaducts, etc.); Cities: Skylines -Green Cities and Block' Hood in 2017, the former incorporates green, low-carbon, and ecological city concepts into the game theme, and the latter takes circular economy, carbon emissions, and neighborhood sustainable settlements as game themes.

With the development of digital information and artificial intelligence technology, the themes of urban simulation games in the fourth stage are not only diverse and open, but also show the thinking about the future world and its integration with real life. For example: Frost Punk in 2018 combines doomsday, steampunk, extreme climate and urban construction; Before We Leave in 2021 carries out urban construction on a wilderness planet; Commom' Hood in 2022 focuses on economic management and future vertical communities; Cities: Skylines II in 2023 introduces the concept of an open world, emphasizing the creation of unprecedented cities. In addition, the implantation of real-world activities such as urban creation, social entertainment, and trade transactions into virtual urban spaces, and the use of NFT+VR technology to build Metaverse cities are also being explored, such as the game development project "Symbiocity" by UCL Research Cluster 12. Urban simulation games are moving from simulation and twinning to virtual-real symbiosis.

## 3 City simulation game: a value orientation based on the Input-Output Model technology path

Urban simulation games are guided by the system theory of urban dynamics. They select real urban models for simplification and use common urban decision-making technical paths as game technical rules to achieve the simulation construction of virtual cities. The technical paths of urban decision-making models are basically divided into two categories: top-down macro simulation and bottom-up micro simulation [49]. The former are mostly spatial interaction models (gravity models, maximum entropy theory models) and spatial economics models (Alonso rent models, discrete choice models, spatial input-output models, etc.), while the latter include cellular automata (CA) and agent-based models [50]. The characteristic of the decision-making model in the game is the phenomenon of urban data under the operation of technical rules. The city under the constraints of the rules has an inevitable development path, and all the players have to do is to make choices at countless nodes. The top-down macro spatial economics model - the spatial input-output model (SpaceInput-OutputModel) is particularly classic and prominent as a decision-making model that implies technical rules in urban simulation games. This article uses SimCity and Block' Hood as representatives for analysis and explanation.

### 3.1 Benefit-oriented income and expenditure optimal solution

As shown in Figure 2, taking the SimCity series as an example, players can carry out zoning construction, road layout, and building upgrades at the operational level, and use various urban planning and management decisions to achieve urban development. Its decision-making model uses the expenditure-income model as a technical path, and its value orientation is the optimal solution based on benefits. From the perspective of urban management, the decision-making logic hidden behind the game rules is obvious: taking natural resources as the source of expenditure, maximizing their economic value for urban construction; achieving population growth and economic prosperity through optimal construction configuration such as functional layout and transportation network; and finally, achieving tax revenue, profit increase and urban wealth income. When wealth grows, more money is used to improve the efficiency of natural resource expenditure, build larger cities, gather more people, achieve larger-scale economic activities, and harvest growing wealth, and this cycle repeats. Under the guidance of SimCity's technical rules, the optimal decision must be the most profitable method, which will naturally make players tend to develop high-density large cities. The game seems to have no clear achievement goals, but it secretly gives players a set development direction. The most significant problem with this type of game is that there will be no natural resources that are constantly spent, and there will be no continuous income of wealth and cities that are constantly developing. This is also the challenge that most players have to face in the later stages of the SimCity series of games. In this capital-oriented spatial input-output path, the core of the player's decision is the urban space, that is, the configuration combination of residential, commercial and industrial land. Natural space has become an object of neglect and expenditure. The source of income, wealth, is secretly concealed in the growing city. The most important thing for people in the game is just sleeping, consumption and work, and the efficiency of the connection between them. Culture, communication, ecology and environment have become subsidiary parameters. The game has become a magnifying glass - in front of the players, it magnifies the necessity of development and value-added, and reduces the needs of people and nature.

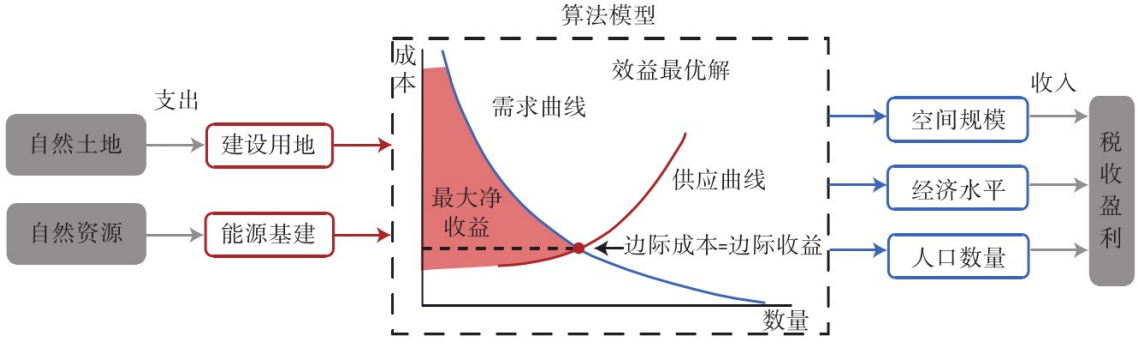


**Fig.2 The technological development path under the optimal solution of input-output model**

Although most urban simulation games are different in theme and focus, the technical path of their decision-making models and their value orientation are similar. For example, in Cities: Skylines, there is a conversation between citizens

on the subway: "You don't take the bus for a ride, you take the bus to go somewhere, what is your destination?" "It's the beach." When the only value of a person's journey is the destination, compressing commuting time becomes a natural decision. It seems that players have great freedom to make various decisions, but in fact they are guided to the "best or optimal" game rules. The fastest way to reach the destination is the best way of traffic design, the most profitable building combination is the best functional zoning plan... The thinking of only caring about the results and ignoring the process has already sneaked into every corner of the game. Game developers inadvertently planted an invisible seed of value for the SimCity game series.

### 3.2 Cycle-oriented output consumption is the most balanced solution

Take the Block'Hood simulation game launched in 2017 as an example [51]. The technical path of its decision-making model is still the input-output model, but its value orientation is based on the output-consumption balance solution of the circular economy. There is no longer a vast land in the game space, and the city can only develop vertically on limited land. The core point of Block'Hood's technical path is to balance the needs of the city and the sustainability of the environment, and regard the city and nature as a complete ecosystem, with each component taking what it needs and coexisting harmoniously. As shown in Figure 3, the city in the game is mainly composed of four types of spaces: organic environment, production environment, built environment and public space. Their construction requires the consumption of four types of resources: resources and energy, biological space, pollution and waste, and social production. The generation of different types of spaces will consume multiple types of resources and also produce other types of resources. For example: planting one grid of trees consumes 2 grids of clean water, but produces 1 grid of fresh air; building one grid of housing consumes 1 grid of fresh air, three grids of electricity and leisure space, but produces 2 grids of labor and 1 grid of organic waste; and so on. They are like a transit station, realizing the output and consumption of ecological resources. The consumption and production indicators of each space will also change according to its type, scale and height. All types of space construction need to be built on the basis of meeting the consumption indicators, and after completion, they can increase the output on other corresponding indicators. Each type of space in the game model has unique functions and impacts on the environment. Players need to combine these blocks together to build a complete ecosystem, and pay attention to the interaction between each component. If the combination is good, the city will become rich and peaceful; if the combination is bad, the city will face financial crisis, resource depletion and other problems. The biggest difficulty and advantage of the technical path in the game model is that we must clarify the advantages and disadvantages of resources brought about by the construction of space, as well as the types and quantities of resource output and consumption. The implicit value orientation lies in the balance of resources in environmental utility, that is, the optimal solution for spatial development is the balance of output-consumption resource types and quantities. Resources not only include natural energy in the traditional sense, but also include people, animals, plants, culture, leisure, and pollutants. Money is not the only measure, they are interdependent and indispensable.

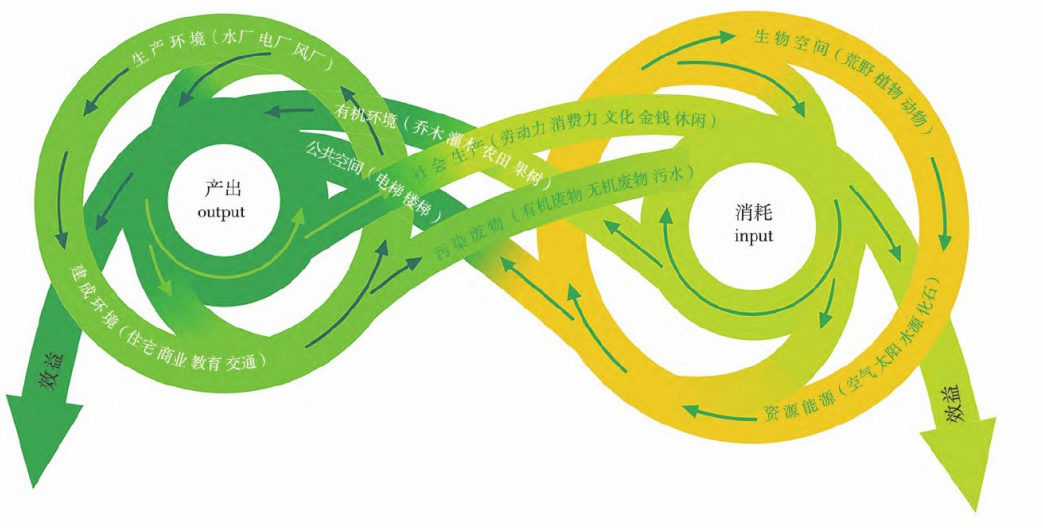


**Fig.3 The technological development path under the optimal balance of input-output model**

In the technical path of output and consumption oriented by the cycle, the input-output model seeks a balanced solution. In the entire ecosystem, any object has advantages and disadvantages. What we need to consider is how to establish a circular and balanced system, in which each resource plays its role and provides a balanced cornerstone for urban construction from the bottom up. Players are no longer plundering from nature and constantly solving the problems brought about by urban expansion, but are fighting against balance and developing in the confrontation. Although the development rate will be slow, there are more factors to consider, and one's own desires cannot be squandered at will, it is a stable, continuous and progressive development. Game developers are obviously influenced by the theme of sustainable development and global urban planning in the 1990s and 2010s, which reflects the rational return of city simulation games to urban values.

## 4 Urban decision model: the tool of technical path and the value of algorithm differences

Although urban decision-making models have similarities and differences in basic theories and modeling methods, they are generally based on functional formulas supported by economics, geography, sociology and statistics. With the input-output model proposed by economist Wassily Leontief in the 1930s, it provided a new way for people to understand the laws of economic behavior from a macro perspective and explain the spatial distribution of economic activities. Theoretical basis and analytical tools [52]. The decision-making basis of the two urban simulation games comes from the spatial input-output model. On the same mathematical algorithm, different objective functions and additional factors will bring significant differences in results.

### 4.1 Algorithm Differences Based on Input-Output Model Technology Path

From the perspective of real urban decision-making model algorithms, the former is more inclined to establish an input-output model based on the optimal solution of spatial benefits, while the latter is an input-output model based on the equilibrium solution of circular economy. One is an optimal solution input-output model with spatial benefits as the goal, the core of which is to take spatial dimensions and transportation costs into consideration; the other is a balanced solution algorithm based on the input-output model guided by circular economy, which needs to consider the core principles of circular economy: reducing

resource input, increasing recycling and reuse, and minimizing waste.

Compare the basic building steps and related mathematical expressions of the two simplified models:
(1)defined symbol:
X: Total output matrix, representing the total output of each region (or industry);
A: Direct consumption coefficient matrix, representing the direct economic interaction between each region (or industry);
Y: Final demand matrix, indicating the final consumption demand of each region.
The additional function of the spatial benefit optimal model is:
T: Transportation cost matrix, representing the unit transportation cost between the regions;
S: Space benefit matrix, indicating the spatial advantage or benefit of each region.
The additional functions of the most equilibrium model of circular economy are:
R: Recovery and reuse matrix, in which $r_{ij}$ represents the amount of resources industry i recovers and uses from industry j;
E: Environmental impact matrix that quantifies the impact of each industry on the environment.
(2) Building Model:
Basic input output equation: $X=AX + Y$
Optimal solution equation for spatial benefit: $X= (A + T) X + SY$
Circular economy balance equation: $X= (A-R) X + Y$
(3) objective function:
Maximize spatial benefits: max $S^tX$; Minimize the transportation cost: min $T^tX$
Minimizing the environmental impact: min $E^tX$; Maximize resource reuse efficiency: max $R^tX$

### 4.2 The necessity of instrumental rationality and the importance of value rationality

In the same technical path, the algorithm structure of urban decision-making models will change due to differences in additional factors and objective functions. For example, the spatial benefit model focuses on cost and benefit, while the circular balance model focuses on resource recycling. The difference in value orientation determines the difference in algorithms. In solving the objective function, additional factors represent the focus of decision calculation, and the target result is still the maximum or minimum value. This also shows that instrumental rationality represented by purpose always exists in urban decision-making models. The concepts of instrumental rationality and value rationality were proposed by Max Weber[53]. Both are inseparable and important aspects of human rationality. The so-called instrumental rationality refers to whether the selected means are the most efficient, with the lowest cost and the greatest benefit[54]. In the face of natural objects with objective laws, such as climate change, plant succession and other predictive urban decision-making models, they have extremely broad application prospects. However, in urban decision-making dominated by economic, social, political and other human factors, value rationality represented by additional factors becomes extremely important. The so-called "value rationality" means that the actor pays attention to the value that the behavior itself can represent, that is, whether it can achieve social fairness, justice, loyalty, honor, etc., and even does not care about the consequences, rather than focusing on the results of the chosen behavior. Instrumental rationality guides humans "how to do it" in the process of understanding and transforming the world, while value rationality tells humans "why to do it". The organic unity of the two can effectively guide production practice activities that meet human needs[55]. In the daily life of the city, the needs of citizens are not just basic survival instincts like animals, but more importantly, the value of existence. Similarly, in the process of urban development, spatial benefits and economic costs are not the only goals. Nature, culture and people themselves are even more important.

## 5 Inspiration from the construction of urban decision-making model: human-machine collaboration and value guidance

### 5.1 Artificial guidance of mainstream values

Our daily urban life can be reduced to a string of electronic digital traces in the technical path of the intelligent decision-making model, which has nothing to do with people's "real self". In fact, simple popularity data cannot accurately reflect the true value of urban experience. On the contrary, due to the collection and statistics of data, the instructions of the decision-making model will gradually erode and dominate people's urban life. Karl Marx [56] pointed out that "technology, as the development of human's essential power, contains people's excellent qualities and value pursuits. The value of technology must be unified with human values and cultural values, and ultimately realize human freedom." The intelligent algorithm behind the urban decision-making model empowers urban governance and development guidance. It must be dominated by holistic value needs, use technology and data as tools, define the fundamental issue of "who urban decision-making serves", and lay a solid foundation for the mainstream value of the algorithm. Holistic value needs are composed of people's common characteristics, mainly manifested in mainstream value orientation, social and humanistic care, and social common interests and basic consensus. The urban decision-making model uses the power of algorithms to efficiently collect and visualize urban perception data, but the algorithm still needs to improve its ability to grasp people's deep social psychology. Therefore, it is recommended to add periodic human guidance during the operation and calculation of the decision-making model, and to make certain judgment weights on the decisions made by the intelligent algorithm. The urban decision-making model should be used as an auxiliary tool in the process of urban planning and management, giving full play to the subjectivity and initiative of people in it, and reflecting the overall values of society in the form of a human-machine collaborative decision-making model.

### 5.2 Supervision and Correction of Algorithm Programs

In city simulation games, we still have our own judgment and choice when faced with the best and optimal choice, but artificial intelligence based on transformer algorithms no longer requires too much human intervention, and the generated content and efficiency requirements are completely determined by the context. Therefore, once the wrong direction appears during the initial training or online learning process, it will completely go in the "wrong" direction and will not turn back. Intelligent algorithm models generate decisions through data autonomous learning, and in applications, they become the "algorithm authority" and guide human practice and determine the authenticity of information. At the same time, because the moral responsibility of the urban decision-making model is decentralized, the algorithms and data in the model have different responsibilities, and no independent individual can bear the consequences of the mistakes of the decision-making model. Therefore, before the existing model can form a strong intelligence level with self-consistent cognition and logic, we need to consider the supervision and correction mechanism of the algorithm program when specifying the model and using the training data set.

### 5.3 Dynamic participation of multiple subjects

The data collected by the urban decision-making model does not have complete information fairness, and it is necessary to consider the data gaps caused by development or quantity issues in some regions or groups. The purpose of analyzing data is to make decisions more comprehensively, but sometimes the beneficiaries of the decision are mostly objects with

data, and objects with more data. Therefore, urban decision-making models based on data and algorithms are difficult to avoid bias and discrimination in analysis and services. On the other hand, data in the information age changes rapidly, and only the full-process and dynamic information sharing and decision-making of participants can ensure the comprehensiveness of decision-making analysis. The purpose of human-machine collaboration is to achieve the inclusiveness and openness of the decision-making model. Consider setting up open ports in the decision-making model, such as urban simulation games, so that all kinds of citizens can participate in the interactive communication with the urban decision-making model at any time, so as to realize the empowerment of everyone in urban development.

## 6 Conclusion

The development of history is sometimes like a circle. In the 1960s, the concept of complex systems and urban decision-making models were implemented in urban development based on the rationalist urban planning concept. With the awakening of humanism and the limitation of technology, it was not mentioned for a long time. The rapid development of computer technology and the decline in the marginal cost of digital information have provided an excellent stage and opportunity for the intelligent city decision-making model. The industry is in the ascendant in terms of technological development and the academic community is in the process of exploring the intelligent city decision-making model. In this process, the continuation and reconstruction of the existing urban planning order by algorithms, the complex interaction between algorithms and people, etc. are worthy of attention. Like a city simulation game, algorithms will truly change the future city we live in, and even play an important role in the process of interaction between people and society. We must clearly recognize the necessity of its instrumental rationality and the importance of its value rationality, and even need to continuously explore the synergistic symbiosis model between people and algorithm models. But no matter what the final result is, we have now entered an era where intelligent algorithms are powerful enough to attract attention.

## References


[1] MARCUS A, WANG W T, et al. Design, user experience, and usability: designing interactions[C]. 7th International Conference, DUXU 2018, held as part of HCI International 2018. Las Vegas, NV, USA, 2018.

[2] KEEN P G, SCOTT MORTON M S. Decision support system: an organizational perspective[M]. Reading, MA: Addision Wesley, 1978.

[3] MARDANIA,ZAVADSKASEK, KHALIFAH Z, et al. A review of multi- criteria decision-making applications to solve energy management problems: two decades from 1995 to 2015[J]. Renewable and Sustainable Energy Reviews, 2017, 71(5): 216-256.

[4] JESPER J. Half-real:video games between real rules and fictional world[M]. The MIT Press, 2006.

[5] GABER J. Simulating planning: SimCity as a pedagogical tool[J]. Journal of Planning Education and Research, 2007, 27(2): 113-21.

[6] MINNERY J, SEARLE G. Toying with the city? using the computer game SimCity4 in planning education[J]. Planning, Practice and Research, 2014,29 (1): 41-55.

[7] WOESSNER M. Teaching with SimCity: using sophisticated gaming simulations to teach concepts in introductory American government[J]. Political Science & Politics, 2015,48 (2): 358-63.

[8] WISELID,TANUSETIAWANR, PURNOMO F. Simulation game as a reference to smart city

management[C]. Inter‐ national Conference on Computer Science and Computational Intelligence, 2017,116: 468-475.

[9] TERZANO K, MORCKEL V. SimCity in the community planning classroom: effects on student knowledge, interests, and perceptions of the discipline of planning[J]. Journal of Planning Education and Re‐ search, 2017,37(1): 105-95.

[10] BATTY M. Building a science of cities[J]. Cities, 2012,29:9-16.

[11] 龙瀛, 吴康, 王江浩, 等. 大模型: 城市和区域研究的新范式[J]. 城市规划学刊, 2014,(6): 52-60.

[12] 吴志强, 甘惟, 刘朝晖, 等. AI城市: 理论与模型架构[J]. 城市规划学刊, 2022(5): 17-23.

[13] 方创琳.“中国城镇产业布局分析与决策支持系统”开发研究成果[J]. 地理研究, 2011, 30(4): 770.

[14] 王亚如. 基于决策树算法的大学生就业预测模型及应用研究[D]. 华中师范大学, 2018.

[15] 王晓军, 陈惠民, 赵晓月. 我国男女两性老龄人口死亡率联合建模与预测[J]. 统计研究, 2021, 38(10): 151-160.

[16] LIANG X, GUAN Q F, CLARKE C K, et al. Understanding the drivers of sustain‐ able land expansion using a patch generating land use simulation (PLUS) model: a case study in Wuhan, China[J]. Computers, Environment and Urban Systems, 2021, 85(1): 101569.

[17] WANG J, ZHANG J P, XIONG N N, et al. Spatial and temporal variation, simulation and prediction of land use in ecological conservation area of Western Beijing[J]. Remote Sensing, 2022, 14(6): 1452.

[18] WANG H, ZHANG C, YAO X, et al. Scenario simulation of the trade off between ecological land and farmland in black soil region of Northeast China[J]. Land Use Policy, 2022, 114(3): 105991.

[19] GAO L, TAO F, LIU R, et al. Multi-scenario simulation and ecological risk analysis of land use based on the PLUS model: a case study of Nanjing[J]. Sustainable Cities and Society, 2022, 85(10): 104055.

[20] BABUTA A, OSWALD M. Data analytics and algorithmic bias in policing[M]. Royal United Services Institute for Defence and Security Studies, 2019.

[21] ENSIGN D, FRIEDLER S A, NEVILLES, et al. Runaway feedback loops in predictive policing. conference on fairness, accountability and transparency[C]. New York City, NY, USA, 2018.

[22] 甘惟, 吴志强, 王元楷, 等. AIGC辅助城市设计的理论模型建构 [J]. 城市规划学刊, 2023(2): 12-18.

[23] HERZOG O, 潘海啸, 邓智团, 等. 新一代人工智能赋能城市规划: 机遇与挑战 [J].城市规划学刊, 2023(4): 1-11.

[24] 仇保兴. 19 世纪以来西方城市规划理论演变的六次转折[J]. 规划师, 2003(11): 5-10.

[25] 张京祥. 西方城市规划思想史纲[M]. 东南大学出版社, 2005.

[26] 于文波, 刘晓霞, 王竹. 美国城市蔓延之后的规划运动及其启示[J]. 人文地理, 2004(4): 55-58.

[27] WEBER M. Economy and society: an out‐ line of interpretive sociology[M]. Univesity of California Press, 1978.

[28] INNES J E, BOOHER D E. A turning point for planning theory? overcoming dividingdiscourses[J]. Planning Theory, 2015, 14(2): 195-213.

[29] 张华夏. 波普尔的证伪主义和进化认识论[J]. 自然辩证法研究, 2003(3): 10-13.

[30] MCLOUGHLIN J B. Urban and regional planning: a systems approach[M]. London: Faber and Faber, 1969.

[31] FORRESTER J W. Urban dynamics[M]. The MIT Press, 1969.

[32] 李强, 张鲸. 理性与西方城市规划理论[J].城市发展研究, 2019, 26(4): 17-24.

[33] KIPFER S. Urbanization, everyday life and the survival of capitalism: Lefebvre, gramsci and the problematic of hegemony [J]. Capitalism, Nature, Socialism, 2002, 2(13):117-149.
[34] HARVEY D. Social justice and the city [M]. University of Georgia Press, 2010.
[35] 孙俊桥. 走向新文脉主义[D]. 重庆大学,2010.
[36] RUPP L A, ZIMMERMAN M A, SLY K W, et al. Community - engaged neighbor- hood revitalization and empowerment: busy streets theory in action[J]. American Journal of Community Psychology, 2020, 65(1-2): 90-106.
[37] 蕾切尔·卡逊. 寂静的春天[M]. 吕瑞兰, 李长生, 译. 上海译文出版社, 2007.
[38] 德内拉·梅多斯, 乔根·兰德斯, 丹尼斯·梅多斯. 增长的极限[M]. 李涛, 王智勇, 译.机械工业出版社, 2013.
[39] YIGITCANLAR T, KAMRUZZAMAN M, FOTH M, et al. Can cities become smart without being sustainable? a systematic review of the literature[J]. Sustainable Cities and Society, 2019, 45(2): 348-365.
[40] DANISH W Z. Investigation of the ecological footprint's driving factors: what we learn from the experience of emerging economies[J]. Sustainable Cities and Society, 2019, 49(8): 101626-101633.
[41] 唐相龙.“精明增长”研究综述[J]. 城市问题, 2009(8): 98-102.
[42] 曼纽尔·卡斯特. 网络社会: 跨文化的视角[M]. 周凯, 译 . 社会科学文献出版社,2009.
[43] BATTY M, AXHAUSEN K W, GIANNOTTI F, et al. Smart cities of the future[J]. The European Physical Journal Special Topics, 2012, 214(12): 481-518.
[44] BATTY M. The new science of cities[M]. MIT Press, 2013.
[45] SHI W Z, GOODCHILD M F, BATTYM, et al. Urban informatics[M]. Singapore: Springer, 2021.
[46] 邓智团. 元宇宙与城市发展: 逻辑阐释与规划应对[J]. 城市规划学刊, 2022(3): 44-49.
[47] SEABROOK J. Game master [EB/OL].2006-11-06. https://www.newyorker.com/magazine/2006/11/06/game-master
[48] GAMER_南桥. 城市: 天际线1200W销量的背后, 40 年城市模拟营造游戏的重要里程碑和发展史 [EB/OL]. 2022-12-01. https://www.bilibili.com/video/BV1gM411676K/?spm_id_from=333.788.top_right_bar_window_custom_collection. content. click&vd_source=23506254933e35e232600552708ff985
[49] 万励, 金鹰. 国外应用城市模型发展回顾与新型空间政策模型综述[J]. 城市规划学刊, 2014(1): 81-91.
[50] 龙瀛, 张雨洋. 城市模型研究展望[J]. 城市与区域规划研究, 2021, 13(1): 1-17.
[51] SANCHEZ J. Block'hood-developing an architectural simulation video game[C]. Real time - proceedings of the 33rd eCAADe Conference, 2015,(1):88-97.
[52] ISARD W. Interregional and regional in- put-output analysis: a model of a space-economy[J]. The Review of Economics and Statistics, 1951,33(4):318-328.
[53] 王锟. 工具理性和价值理性: 理解韦伯的社会学思想[J]. 甘肃社会科学, 2005(1):120-122.
[54] 陈振明. 工具理性批判: 从韦伯、卢卡奇到法兰克福学派[J]. 求是学刊, 1996(4): 3-8.
[55] MURRAY D. A critical analysis of communicative rationality as a theoretical underpinning for collaborative approaches to integrated resource and environmental management[D]. Griffith University, 2006.
[56] 中共中央马克思恩格斯列宁斯大林著作编译局. 马克思恩格斯全集: 第3 卷. 1842 年 11 月—1844 年8 月[M]. 北京: 人民出版社, 1998.