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Influencing Factors of Urban Residents' Garbage Classification and Recycling Behavior Driving Mechanism in Artificial Intelligence Environment

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Abstract—With the rapid development of urbanization, urban domestic waste is also increasing, if the garbage cannot be effectively classified, there will be a dilemma of garbage siege. In recent years, artificial intelligence technology has been applied in the field of garbage classification, which provides a convenient means for garbage classification. However, technological innovation can only alleviate the accumulated total amount of garbage, and finding the source of garbage generation is the key to solve the problem. Therefore, based on the theory of planned behavior, A-B-C theory and interpersonal behavior theory, from the policy level, the social level and the individual level, this paper puts forward some suggestions, it is composed of government, society, individual and other organizations, and puts forward the corresponding research hypotheses. Through interviewing and questionnaire survey in Guangzhou, the sample data are collected, and then regression analysis and structural equation model analysis are used to obtain the influence degree value of residents' attitude towards garbage classification, subjective norms, perceived behavior control, situational factors, and government legal regulation on residents' living garbage classification willingness. The results show that residents' attitude towards domestic waste classification is significant and the government's legal control factors are the key factors affecting the residents' willingness of garbage classification.

1. INTRODUCTION

In recent years, with the rapid development of China's national economy and the continuous improvement of urbanization level, the output of municipal solid waste is increasing, and the plight of garbage besieged city is becoming more and more serious. The emergence of garbage problem is closely related to the social and economic development mode, government management concept and people's life style and behavior mode. The experience of domestic waste management in developed countries shows that the effective means to solve the problem of garbage besieged city is to promote the classification of domestic waste, and to control the source of the quantity of treatment, so as to realize the harmless, reduction and resource utilization of domestic waste. With the continuous improvement of living standards there has been a variety of garbage types, and the traditional manual classification method is difficult to meet the growing total amount of garbage. Therefore, the state has issued garbage classification policies, encouraged the whole people to participate in garbage classification, and made



classification behaviors policy-oriented and standardized, in order to standardize the daily behavior habits of residents. Based on the above reasons, this paper explored the way of combining technology and mechanism from the perspective of artificial intelligence technology, and applied the advantages of current artificial intelligence technology to urban garbage classification. On the one hand, it alleviated the pressure of manual classification, and on the other hand, it was beneficial to improve the enthusiasm of resident garbage classification.

This paper focuses on the research and analysis of the key issues of urban residents' garbage classification willingness and its influencing factors under the artificial intelligence environment. The research adopts the planned behavior theory, A-B-C theory, and interpersonal behavior theory to explore the experiment. At the same time, the theoretical model of influencing factors of urban residents' garbage classification willingness suitable for this study is constructed. The purpose of this paper is to explore and verify the influencing factors of domestic waste classification intention of urban residents in China, and analyze the effective measures and policies in line with the promotion of domestic waste classification of urban residents in China, which provides a strong theoretical support for the policy of domestic waste classification of urban residents.

2. THEORETICAL BASIS

2.1 Theory of Planned Behavior

In 1991, Ajzen put forward the theory of planned behavior on the basis of rational behavior theory, and added the control variable of perceptual behavior. The theory of planned behavior [1] is a theory that explains the general decision-making process of individual behavior from the perspective of information processing and the theory of expected value. According to the theory of planned behavior, the intention of domestic waste classification behavior is the direct determinant of garbage classification behavior, and the attitude of residents, subjective norms and perceived behavior control are the three main factors determining the behavior intention. There are two kinds of human behavior, one is easy to realize, that is, the behavior completely controlled by individual will, and the other is restricted by personal ability, information, opportunity, resources. Rational behavior theory can explain the relationship between habitual behavior and attitude that is easy to realize. For the explanation of the relationship between behavior and attitude that needs resources, it needs to consider the individual's ability to control the required information, opportunities, skills. Ajzen's planned behavior theory adds a new variable perception behavior control, which is conducive to enhance the accuracy of individual behavior prediction. In the theory of planned behavior, perceived behavior control variable refers to the factors that are conducive to the implementation and reflect the obstacles to the implementation of the behavior. Its behavior intention variable has a strong predictive effect on the behavior variable, and the subjective norm variable and attitude variable determine the behavior willingness variable at the same time. In addition, belief is the most important factor that can ultimately affect individual behavior in the theory of planned behavior. It includes normative belief, behavioral belief, control belief, as shown in Figure 1.

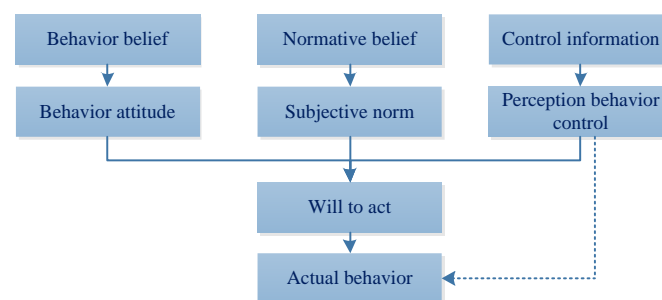


Figure 1. Theoretical model of planned behavior.

2.2 A-B-C Theory

A-B-C theory [2] is a theory for predicting the recycling behavior of municipal solid waste (MSW) proposed by guagnano et al. The theory is improved from stern and oskamp's complex environmental behavior model. According to A-B-C theory, garbage collection behavior (b) is the result of the interaction between individual attitude variable (a) and external condition (c). For the classification and recycling of domestic waste, it mainly refers to the convenience of recycling, the cleaning convenience of classified garbage cans and the distance from the residence. The vertical axis is the recycling attitude, and the positive and negative axis respectively represent the positive and negative attitudes towards the implementation of recycling behavior. If the behavior is difficult to implement or takes a long time, the influence of attitude on behavior will be small, and the influence of external conditions will be greater. On the basis of A-B-C theoretical model, Tucker et al. Added subjective norms and social norms into the model, and established a more perfect model. They pointed out that domestic waste management behavior is based on attitude and subjective norms, social norms, external conditions. Only when the attitude, subjective norms and social norms exceed the external conditions, the domestic waste management behavior will occur. The A-B-C theory is the first theoretical model established specifically for domestic waste management behavior.

2.3 Interpersonal Behavior Theory

Triandis put forward the model of interpersonal behavior theory in 1977. This model is a relatively comprehensive theoretical model for studying the influencing factors of behavior, and it is the most comprehensive behavioral theoretical model including influencing factors at present. Triandis pointed out in the interpersonal behavior theory model that the individual's behavior will be affected by his habits, wishes and external factors. He believes that the individual's behavior attitude will have a direct impact on his behavior intention. Triandis' interpersonal behavior theory is closely related to individual low-carbon behavior [3]. In the interpersonal behavior theory, not only the internal factors that ultimately affect the behavior, but also the regularity of individual behavior habits should be considered. In this paper, two internal factors, cognition of garbage classification and demographic variables, and situational factors are selected as external factors to explore the influence of these three variables on the willingness, attitude, behavior of garbage classification in the model of this study, as shown in Figure 2.

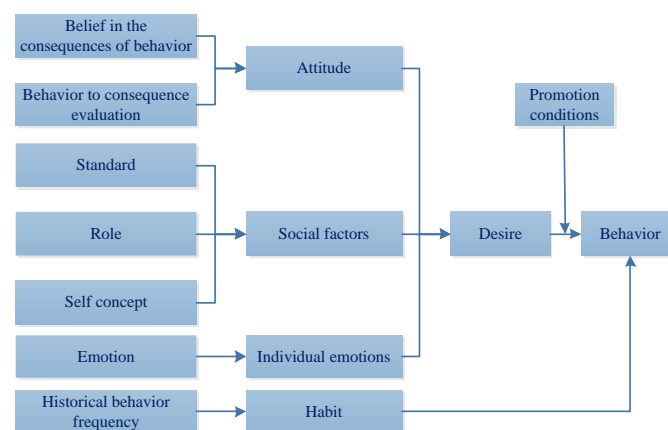


Figure 2. Theoretical model of interpersonal behavior.

3. CONSTRUCTION OF INFLUENCING FACTORS MODEL OF URBAN RESIDENTS' WILLINGNESS TO CLASSIFY GARBAGE IN ARTIFICIAL INTELLIGENCE ENVIRONMENT

3.1 Willingness Model of Waste Classification

The conceptual model of urban residents' willingness to classify garbage in the artificial intelligence environment, first, studies the influencing factors involved in the process of individual low-carbon behavior. Through the research and sorting out various variables, such as: habits, individual values,

low-carbon behavior attitude and low-carbon behavior cognition, low-carbon behavior willingness [4] and low-carbon behavior and individual perception behavior control, perceived effectiveness, situational factors, demographic variables, and their subjective norms. Then, using the classic theoretical research, combined with the discussion and interview with the surrounding expert groups, teachers, classmates, relatives and friends, the variables involved in the theoretical model designed in this study are screened out: garbage classification behavior and attitude, garbage classification recognition and garbage classification willingness, subjective norms, perceived behavior, control of situational factors and demographic variable.

The conceptual model of urban residents' garbage classification intention in artificial intelligence environment based on the theory of planned behavior, this paper takes the theoretical model of planned behavior as the main framework of the theoretical model, and then through the method of interview, research methods and other sample data collected, combined with interpersonal behavior theory and A-B-C theory, this paper explores the cognitive and situational factors of garbage classification and the control of perceived behavior, which affect the willingness of garbage classification. The influence and role of the process, so as to explore the significance of its impact on the garbage classification intention, and summarize the reasons for the formation of waste classification differences, as shown in Figure 3.

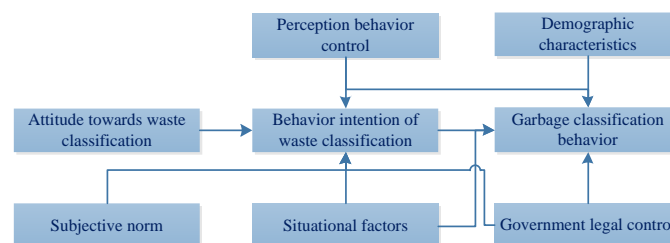


Figure 3. This paper designs the research model.

3.2 Research Path of Garbage Classification Intention

Through the comparative study, it is found that in the behavior theory research, attitude ultimately directly affects the individual's behavior intention. The people who have positive attitude towards garbage classification are generally more willing to implement the behavior of garbage classification, and the possibility of implementing the behavior and policy of garbage classification will be greater for this group of people. Therefore, the research path of garbage classification intention in this paper is from the current research status this paper puts forward the hypothesis that the attitude of residents towards garbage classification will indirectly affect the behavior of garbage classification through a certain role.

Subjective normative intention [5] refers to that when faced with important stakeholders and reference group members, emphasizing that they carry out garbage classification, they can become a classification model, which makes individuals exert pressure on garbage classification behavior, while the behavior of surrounding group members has model effect, and its purpose is to emphasize the influence of people around on individual behavior. If people around start to implement garbage classification, it will usually have a certain impact on their own individuals, so that they have a higher willingness to garbage classification. Perception behavior control refers to the perception degree of the obstacles and promotion factors in the garbage classification behavior, which directly affects the willingness of the garbage classification behavior and the specific implementation of the garbage classification behavior. In short, when the individual has a high willingness of garbage classification, he will not necessarily carry out the final garbage classification behavior, but will perceive the corresponding garbage classification behavior the promotion or hindrance factors of behavior will affect whether the individual implements the garbage sorting behavior or not. If the individual perceives that the smaller the obstacles and the greater the promotion factors, the willingness of garbage classification will be easily realized, and the individual will implement the garbage classification behavior. On the contrary, the generation and implementation of garbage classification behavior will be

difficult to achieve. Garbage classification cognition [6] refers to the individual's understanding and understanding of the process and status of garbage classification. The individual's cognition level of garbage classification behavior will directly affect the final individual's willingness to refuse classification, and the individual's garbage classification cognitive variables have different degrees of influence on their garbage classification willingness variables. Situational factors [7] refer to the external factors that affect the individual's garbage classification behavior, such as the publicity, facilities, policies, systems of garbage classification. If the scenario factors are very favorable, the residents will be more likely to show a relatively positive attitude towards garbage classification, and the willingness of individuals to classify garbage will be enhanced. Finally, the impact of individuals on the implementation of garbage classification will become easier, as shown in Table 1.

TABLE 1 RESEARCH PATH OF GARBAGE CLASSIFICATION INTENTION

Classification of influencing factors

H1: Attitude towards waste classification has a direct and positive impact on the willingness of waste classification.

H2: The willingness of waste classification has a direct and positive impact on the behavior of waste classification.

H3: Individual's subjective norms have a direct and positive impact on their willingness to refuse classification.

H4: Perceived behavior control has a direct and positive impact on its garbage classification intention and behavior.

H5: The cognition of garbage classification has a direct and positive impact on the willingness of garbage classification.

H6: Scenario factors have a direct and positive impact on their garbage classification behavior, but the degree of influence is different.

H7: Demographic variables have a direct impact on their garbage classification behavior, but the degree of influence is different.

4. AN EMPIRICAL ANALYSIS ON THE WILLINGNESS OF URBAN RESIDENTS TO CLASSIFY GARBAGE AND ITS INFLUENCING FACTORS IN ARTIFICIAL INTELLIGENCE ENVIRONMENT

4.1 Data Collection

In order to verify the validity of the model and assumption, this paper designs a questionnaire based on the existing research scales and the actual situation of Guangzhou urban residents' domestic waste classification. The questionnaire includes residents' cognition of garbage classification, behavior intention of garbage classification, attitude towards garbage classification and demographic variables, as well as subjective norms and scenarios factors and perception behavior control and garbage sorting behavior. The demographic variables used in the questionnaire are based on barr and other research scales. The specific questions include the gender, marital status, age and education level of the respondents, the permanent resident population of the family and the disposable annual income of the respondents' families. The attitude, cognition, willingness, behavior, and subjective norms of garbage classification are all based on the existing scale, and the scale is designed according to the specific contents of Guangzhou urban residents' garbage classification, as shown in Table 2.

TABLE 2 THE RESEARCH SCALE DESIGNED IN THIS PAPER

| Research Variables | Question | Specifics |
|--|----------|--|
| Garbage classification cognition (A) | A1 | In my opinion, the problem of municipal solid waste pollution is serious and needs to be solved urgently. |
| | A2 | I think the classification of domestic waste has a positive effect on the improvement of urban environment. |
| | A3 | I think improper treatment of domestic waste will affect the health of residents. |
| Garbage classification attitude (B) | B1 | I think it's a good behavior to classify and dispose the domestic garbage in the home. |
| | B2 | I support the classification of domestic waste in our homes. |
| | B3 | It makes me happy to sort out the garbage at home. |
| Subjective norms (C) | C1 | My friends around me think that I should sort out the household garbage at home. |
| | C2 | Many of my friends around me will sort out the household garbage at home. |
| | C3 | My friends around me are very supportive of me to separate and dispose of the domestic garbage at home. |
| Perceptual behavior control (D) | D1 | Because I don't have time, I won't do it even if I want to sort out the household garbage at home. |
| | D2 | Because the classification and treatment of domestic waste at home is too complex, even if I want to classify the domestic waste at home, I don't know how to classify it. |
| | D3 | After sorting the household garbage, the money obtained by selling waste products is too small to be classified. |
| | D4 | How to deal with the domestic garbage at home, I'm totally in charge. |
| Situational factors (E) | E1 | My community has a perfect intelligent sorting recycling bin. |
| | E2 | If the government forces the residents to classify the domestic waste at home, I will try my best to classify the domestic waste at home. |
| | E3 | If the government has formulated laws and regulations on the classification of domestic waste, I will abide by the laws and regulations and classify the domestic waste. |
| | E4 | The laws and regulations of domestic waste classification formulated by the government will play a certain role in restraining and promoting me. |
| Garbage classification willingness (F) | F1 | I would like to deal with the domestic garbage in my home every day. |
| | F2 | I plan to sort out the household garbage from now on until every day in the future. |
| | F3 | I decided to sort out the garbage every day at home. |
| Garbage classification behavior (G) | G | I always sort out kitchen waste, recyclables, hazardous waste, and other waste in my home. |
| Demographic variable (H) | H | Gender, age, occupation, education level, etc. |

According to the design of the research scale, online and offline questionnaires were distributed to Guangzhou residents, 500 paper questionnaires and 500 electronic questionnaires were distributed, 483 paper questionnaires and 491 electronic questionnaires were collected. The final effective questionnaire recovery rate was 97.4%, and the total number of questionnaires was 22, the number of valid samples collected reached the quantity standard of research needs.

4.2 Data Analysis and Results

In order to ensure the visibility and accuracy of data samples, spss22.0 is used to process and analyze the collected sample data, and the descriptive statistical results of garbage classification cognition degree are obtained, as shown in Table 3. Garbage classification attitude describes the statistical results, as shown in Table 4. Variables describe the statistical mean and standard deviation, as shown in Table 5.

TABLE 3 DESCRIPTIVE STATISTICAL RESULTS OF GARBAGE CLASSIFICATION COGNITION

| Percentage /% | Very disagree | Disagree | Uncertain | Agree | Strongly agree |
|---------------|---------------|----------|-----------|--------|----------------|
| A1 | 2.40% | 2.10% | 4.30% | 51.10% | 40.10% |
| A2 | 0.40% | 1.30% | 4.70% | 46.20% | 47.40% |
| A3 | 5.20% | 4.10% | 6.20% | 43.20% | 41.30% |

TABLE 4 TABLE TYPE STYLES

| Percentage /% | Very disagree | Disagree | Uncertain | Agree | Strongly agree |
|---------------|---------------|----------|-----------|--------|----------------|
| B1 | 1.30% | 1.20% | 2.10% | 49.40% | 46.00% |
| B2 | 0.30% | 1.90% | 3.70% | 53.20% | 40.90% |
| B3 | 0.90% | 4.40% | 8.10% | 47.70% | 38.90% |

TABLE 5 TABLE TYPE STYLES

| Variable | Question | Mean value | Standard deviation |
|------------------------------------|----------|------------|--------------------|
| Subjective norms | C1 | 3.85 | 0.84 |
| | C2 | 2.71 | 1.17 |
| | C3 | 3.1 | 1.18 |
| Perceptual behavior control | D1 | 3.86 | 0.99 |
| | D2 | 3.79 | 0.92 |
| | D3 | 3.63 | 0.91 |
| | D4 | 3.42 | 1.03 |
| Situational factors | E1 | 3.33 | 1.04 |
| | E2 | 3.64 | 0.95 |
| | E3 | 3.98 | 0.87 |
| | E4 | 3.99 | 0.87 |
| Garbage classification willingness | F1 | 3.85 | 0.95 |
| | F2 | 3.89 | 0.8 |
| | F3 | 3.89 | 0.79 |
| Garbage classification behavior | G | 3.11 | 1.18 |
| Demographic variable | H | 3.41 | 1.12 |

Through the statistical analysis of the basic description of the remaining variables, the analysis results include mean value and standard deviation. From the mean value of each question variable in the

inductive descriptive statistical table, it can be found that the average value of the remaining questions in the scale is greater than 3, which means that the residents interviewed have a high degree of identification with each question in the scale. The low mean value of the results obtained by question D1 reflects that most of the residents interviewed do not agree that in the process of household garbage classification, the influence factor of time is the obstacle factor to the process. At present, the time factor has very limited obstacles to the current process of urban household garbage classification. The average value of final data obtained by question G is low, which indicates that the number of people who can carry out garbage classification at home is at a low level.

5. CONCLUSION

From the perspective of artificial intelligence environment, this paper analyzes and studies the influencing factors of urban residents' coming and sorting and recycling behavior. Through the research, it is found that in the process of residents' domestic waste classification, the main factors affecting residents' willingness of domestic waste classification are the attitude of garbage classification and the government's legal regulation. Through the data obtained from the structural equation analysis, we can know that the garbage classification is the most important factor affecting the residents' willingness of domestic waste classification the positive influence degree of quasi attitude, government legal regulation, subjective norms, perceived behavior control and situational factors on residents' willingness to classify domestic waste increased in turn. The positive impact of attitude towards garbage classification on the willingness of garbage classification is the most significant, which verifies that the research process of urban residents' willingness to classify domestic waste conforms to the model, path and planned behavior theory proposed in this paper, which provides reference for researchers in related fields.

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