A General Addiction Model Based on the Theory of Demand Degree—Taking the Simulation of Cigarette Addiction through Artificial Intelligence as an Example

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Objectives: As one of the mathematical results of the theory of value philosophy, the theory of demand degree can propose a new interpretation model for addiction. The theory of demand degree believes that human demands can be divided into two types, namely, the demand amount and the demand degree, and the equilibrium point of the demand degree constitutes the main basis for people to compare different types of demands and calculate the demand amount. The addiction model based on the theory of demand degree believes that addiction should have two basic conditions: firstly, the unit addictive substance is of great value to the subject, and it is the reason for the brain reward mechanism in the addiction; secondly, an addiction index is constructed, and only when the addiction index is greater than 0, the subject has the possibility for addiction. The construction of addiction index provides a standard for examining whether a certain substance can make people addicted. Converting the relevant formulas of the addiction model into artificial intelligence codes enables artificial intelligence to simulate the phenomenon of addiction. According to the change in the indicator light on the MCU development board, it is possible to judge whether the artificial intelligence chooses to load cigarettes or charge, and simulate the cigarette addiction when the addiction index is 1. The results of simulating addiction through artificial intelligence are generally consistent with the general situation of addiction, especially cigarette addiction. This indicates that the addiction model has great rationality and universality, and further indicates that without considering the harmfulness of the addictive substance, addiction is not necessarily a disease, but may just be a normal response of the human demand system to the addictive substance.

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According to observations in real life, if water can be as addictive as cigarettes or drugs, maybe most people do not believe it. However, in some special cases, people's desire for water does appear to be a phenomenon equivalent to addiction. For example, people who haven't drunk water for three days in a desert will behave as aggressively after seeing the water as a drug addict after a few days of withdrawal. What has caused this phenomenon? Perhaps the root cause is that people's dependence on water is much higher than that of cigarettes and drugs. Once there is a shortage of water, people will be eager to find water to quench thirst. The possibility of water addiction indicates that addiction is a common phenomenon for human beings; the differences in addictions to cigarettes, alcohols, and drugs may only lie in the harmfulness to people.

The existing researches on the law of addiction mainly regard addiction as a pathological phenomenon. On the one hand, in psychology and neuroscience, people become addicted because addiction is a disorder or dysfunction of brain[1]. This disorder may be caused by a variety of factors such as genes, dopamine, and brain diseases. Some scholars have summarized the known addiction-promoting factors, mainly including: basic fibroblast growth factor (bFGF), brain-derived neurotrophic factor (BDNF), tissue-type plasminogen activator (tPA)/plasmin, interleukin (IL), neurotrophic factors-3 (NT-3), matrix metalloproteases (MMPs), etc[2]. However, this understanding is mainly based on the fact that addiction is a mental or neural disease[3], which focuses on the effects of drugs on addiction, but fails to regard addiction as a reasonable phenomenon that may exist under normal psychological and physical conditions under certain conditions. On the other hand, such pathology means that the addictive substance may cause irreversible harm to the patient's body, and the addiction is investigated from the perspective of harm to people. We usually call beneficial or harmless addiction as fondness, and harmful addiction as addiction. For example, some people investigate the relationship between cigarette addiction, tobacco and lung cancer[4], which means investigating the phenomenon of cigarette addiction from the relationship between tobacco and harm to people.

There are also scholars who research addiction as a normal mental phenomenon, which is mainly focused on the addictive fields of daily life, such as tobacco and alcohol, without causing irreversible harm. On the premise that there is no excessive harm, the addiction to tobacco and alcohol can be understood as a people's daily behavior to a certain extent. Since people's daily behaviors involve far more fields than drug addiction, the existing researches on addiction to tobacco and alcohol have already stepped out of the fields of psychology or neuroscience, and have entered philosophy, sociology, and other research fields. For example, some scholars have linked the behavior of buying cigarettes with addiction not from the perspective of pathology, but from the perspective of ethology, to investigate the relationship between nicotine content and the addiction of adolescents[5]. There are also scholars who understand the phenomenon of alcohol addiction from the level of philosophical epistemology and the perspective of overall perception, and provide a new way to explore addiction[6]. All these indicate that the research on addiction should not be limited to the fields of psychology and neuroscience, but should conduct multidisciplinary research.

Based on a theory of demand degree, this paper constructs a model to describe the law of addiction from the perspective of value philosophy, and proves this addiction model is reasonable and universal by stimulating cigarette addiction through artificial intelligence, which may provide a new perspective for the research on addiction laws.

ADDICTION MODEL BASED ON THE THEORY OF DEMAND DEGREE

In descriptions of addiction in neuroscience, the phenomena of addiction are always linked to the reward mechanism in the brain, such as dopamine. However, from the perspective of value philosophy, the reward mechanism is rooted in the fact the things are valuable to people. Value is the satisfaction of demands by things. When things can satisfy people's demands, people's brains usually give reward signals to make themselves happy.

This means that the reward mechanism lies not only in dopamine, a neurotransmitter, but also in whether things meet people's demands. Therefore, by understanding the law of satisfying people's demands, it is possible to have a new interpretation of the addiction law.

The demand theory on which this paper is based can be called the theory of demand degree. The theory of demand degree starts from human practice and believes that demands can be divided into two types, one is the demand amount (N), and the other is the demand degree (X) [7]. The demand amount refers to a subject's quantity of need for a certain thing. The demand amount is related to the thing itself, just as the demand for bread and the demand for water are qualitatively different. Since different things have different attributes, demands can be divided into different types. However, there is a second understanding of demand, which is the quantity of need degree. The theory of demand degree believes that, unlike the demand amount, the demand degree is a scalar. Therefore, for different types of demands, although the demand amount cannot be compared due to the difference in quality, it is comparable in demand degree.

In terms the theory of demand degree, there is a maximum value N_{max} for people's demands for things, which defines the demand degree as the ratio of the demand amount to the maximum demand amount, that is:

$$X = \frac{N}{N_{\max}} \tag{1}$$

Since the demand amount and the maximum demand amount have the same dimension, the demand degree is a scalar as the ratio of the two. The demand amount N is always greater than 0 and less than the maximum demand amount N_{max}, so the demand degree is often between [0, 1]. In this regard, we can express the demand degree with tenths, percentages or thousandths.

Since the demand degree is a scalar and has no dimension, different types of demands can be directly compared. The greater the demand degree, the more it should be met. The smaller the demand degree, the less it should be met. For example, if Tom's demand degree of apples reaches 70% at 12 noon today, but his demand degree of cigarettes is only 50%, then at 12 noon, Tom should choose to eat apples instead of smoking. After a while, at 3 o'clock in the afternoon, if Tom's demand degree of apples is 30% and his demand degree for cigarettes reaches 60%, then he should choose to smoke instead of eating apples. It can be seen that when people compare different types of demands, they are not comparing the demand amount, but the demand degree. Therefore, while the theoretical community is still struggling with the incomparability of different types of demands, the comparison of different types of demands in terms of the demand degree has been continuously carried out in practice. It can be seen that it is the demand degree rather than the demand amount that is one of the basic criteria for people to determine which demand their behavior should satisfy.

On the other hand, because there are thousands of types of human demands that influence and restrict each other, they will inevitably form an overall demand system of people. People's demand system should be an open system. According to Bertalanffy's point of view, an open demand system of people should have two basic characteristics, namely steady state and uptake of negative entropy[8]. People often take in negative entropy by satisfying their demands, and the steady state of the demand system should be an equilibrium point[9]. The equilibrium point (E) refers to the demand degree when the demand system achieves equilibrium, so it is also a scalar like other demand degrees. All demands always tend towards the equilibrium of the overall demand system, so when the demand degree is far away from the equilibrium point, it will form a motivation to approach the equilibrium point. This motivation is called motive (D) in the theory of demand degree.

Then if the demand degree is X and the equilibrium point is E, then the motive is:

$$D = |X - E| = \left| \frac{N}{N_{\max}} - E \right| \tag{2}$$

In the above formula, since the demand degree X may be greater or smaller than the equilibrium point E, and the motive is the intensity of people's demand for something towards the equilibrium point, the motive is always greater than 0, so the absolute value is taken.

The principle of the comparability of demand degree in the above-mentioned theory of demand degree and the principle that the demand system tends to an equilibrium point provide a new way to explain people's addiction.

First of all, addiction often pleases the brain, forming a pleasant neural circuit[10]. However, this statement is not accurate. Because some addictive things may not be pleasurable at first. For example, a person who is addicted to cigarettes may not originally like smoking, but wants to clear his mind by smoking for other reasons (such as staying up late); in the end, he becomes addicted to smoking. Therefore, it shall be more accurately understood that addiction can make people feel valuable and make the human brain form a neural circuit about value. The higher the value, the greater the likelihood of addiction.

So, what does value mean? We don't need to entangle with the various interpretations and definitions of value in the history of philosophy. We can directly define it in terms of the amount and the degree of demand.

Definition 1: The amount of value refers to the reduction in the demand amount. If it is assumed that someone's demand amount for a certain thing is N (0) when t=0, and the demand amount at any time t is N (t), then if the value is set to v (value), then:

$$v(t) = N(0) - N(t) \tag{3}$$

Therefore, the more a thing can reduce the subject's demand for the thing, the more valuable it is. The brain will feel more valuable to the thing. For example, people always feel more valuable to 10 liters of water than to 1 liter of water of the same quality. Because 10 liters of water can reduce the subject's demand for water.

Definition 2: The value degree refers to the reduction in the demand degree. If it is assumed that the demand degree of someone for a certain thing is X (0), and the demand degree after using the thing is X(W), then if the value degree is set to V (value degree), then:

$$V(W) = X(0) - X(W) \tag{4}$$

The above formula shows that the more a thing can reduce a subject's demand for the thing, the more valuable the thing is, and the more the brain develops a sense of value for this thing. For example, a cigarette can reduce a subject's demand for smoking more than the subject's demand for water (thirst) 1 liter of water reduces, then the subject's sense of value for this cigarette is greater than the sense of value for 1 liter of water.

Therefore, in the phenomenon of addiction, the subject's pleasure neural circuit for a certain thing should actually be expressed as his / her neural circuit of sense of value for a certain thing. The sense of value is often positively correlated with the sense of pleasure, so people often regard the sense of pleasure as one of the preconditions for addiction. Therefore, formula (4) determines a premise for whether a certain thing can make the subject addictive. Tobacco, alcohol, drugs, even surfing the Internet, and shopping, etc. that can bring a strong sense of value to the subject or make the subject obtain a high degree of value are often addictive.

Secondly, addiction is manifested as repetitive and compulsive use of a substance[11]. Some scholars believe that the repetitive and compulsive use of a substance in addiction is because the subject hopes to obtain a sense of pleasure or value through repetitive and compulsive use of the substance. However, in terms of the demand degree theory, this understanding is not entirely accurate. Because which thing the subject chooses to meet his / her needs is judged according to the demand degree, not according to the sense of pleasure or sense of value.

Therefore, the following priority reasoning[12] process in the value logic can be formed:

Premise 1: The subject needs n kinds of things at the same time, and the demand degrees are:

$$X(a), X(b), X(c) \Lambda \Lambda \ X(n) \tag{5}$$

Premise 2: The subject has the greatest demand degree X (i) for the i-th thing, namely:

$$\begin{gathered} X(i) > X(a) \\ X(i) > X(b) \\ X(i) > X(c) \\ \mathrm{M} \\ X(i) = X(i) \\ \mathrm{M} \\ X(i) > X(n) \end{gathered} \tag{6}$$

Conclusion: the i-th thing is

the object that the subject chooses to meet the demand.

The above priority reasoning is manifested in the phenomenon of addiction, and as long as the degree of the subject's demand for object i reaches the maximum value, the subject chooses to use object i. If the degree of the subject's demand for such things is often higher than other things, then the subject shows a compulsion. When the degree of the subject's demand for something periodically reaches the maximum, he periodically repeats it, while the observer will see the addicts use the thing repeatedly.

So why are some addictive things more likely to be used repeatedly and compulsively by the subject than daily things? The root cause lies in that the degree of the subject's demand for addictive things often increases rapidly, and ultimately is higher than all other daily things, thus periodically forcing the subject to choose the thing to meet his own demand and reduce the degree of demand according to the principle of the greater the need, the more satisfaction he should obtain. For example, we assume that the degree of the subject's demand for cigarettes is X (T), and his demand for food and water is X (F) and X (W), respectively. If

$$X(T) > X(F) \,\&\, X(T) > X(W) \qquad (7)$$

The person chooses to smoke. If the degree of his demand for tobacco is periodically higher than the demand for water, food, and even work, he will smoke periodically; if the degree of his demand for tobacco is suddenly higher than the demand for water and food while drinking and eating, then he will stop drinking, eating for smoking. This is manifested as he seems to have a smoke craving and has to smoke forcibly.

In the same way, why do people drink and eat food repeatedly (periodically) or obsessively (no choice but to when hungry and thirsty)? This is because the degree of people's demand for water and food also periodically reaches the maximum of all levels of need. And this periodicity or repeatability is mainly due to the periodicity of human physiology and daily life.

Thirdly, addiction is manifested as the increasing demand of the subject for something. In drug addiction, usually the addicts demand more and more drugs, "over time, people demand more and more drugs to get the same effect, or the same dose can only bring about a smaller response". This is the so-called problem of drug tolerance in addicts.

From the perspective of demand degree theory, the problem of tolerance can be investigated in two aspects. First, according to the definition of the degree of need, we assume that the degree of the subject's demand for something W is X, according to the formula (1):

$$N = X \bullet N_{\max}(W) = E \bullet N_{\max}(W) \qquad (8)$$

The above formula shows that the demand amount N when the demand system reaches equilibrium is equal to the product of the equilibrium point E and the maximum demand amount Nmax (W). This means that if the degree of subject's demand X for an addictive drug is equal to the equilibrium point E remains constant, then the greater the maximum demand amount, the greater the amount of drug needed. The maximum demand amount for water, food, etc. tends to remain unchanged or change little. However, the addictive drug can make the maximum amount of the subject's demand for the drug rise rapidly in a short time, so according to formula (8), the amount of the subject's demand N for the drug will also increase along with the amount of drugs used. This is manifested by increased tolerance of the subject and increasing use of drugs used.

That is, with the increasing use of addictive substance W, Nmax (W) also increases. So we can make:

$$N_{\max}(W) = f(W) \qquad (9)$$

Under the condition of formula (9), the derivative can be obtained:

$$\frac{dN_{\max}(W)}{dW} = f'(W) \qquad (10)$$

Formula (10) reflects the amount of change of the subject's demand for the thing as it is used. It can be called the addiction index, which is the basic basis to measure whether the subject will be addicted. For different addictive things, the difference in f' (W) represents that the change of the maximum amount of the subject's demand varies, namely the likelihood of addiction is different. If

$$f'(W) > 0 \qquad (11)$$

It shows that with the use of the addictive substance, the maximum amount of the subject's demand for it is increasing, and the amount of the demand for the addictive substance is also increasing. In this case, the addictive substance is likely to make the subject addictive. For example, if the two addictive things are alcohol (W1) and heroin (W2), their addiction is f '(W1) and f' (W2), respectively. From empirical observations, the addiction f'(W2) of heroin is necessarily greater than that of alcohol f' (W_1), i. e:

$$f'(W_2) > f'(W_1) \tag{12}$$

Therefore, if we know the heroin addiction index f '(W2) and the alcohol addiction index f' (W1), we can also deduce which is more addictive.

Some scholars may think that it can reduce the possibility of addiction by reducing the nicotine content in cigarettes, or even reducing the nicotine content to the lowest level of addiction, arguing that "reduction of nicotine to a non-addictive level is feasible from a technical perspective", bur actually it is still unable to avoid addiction in smoking situations. The fundamental reason for this is that the nicotine addiction index is greater than 0. Therefore, as long as inhaling cigarettes containing nicotine constantly, one day smokers will become addicted. The nicotine contents in cigarettes just change the final time of smokers' addiction.

If the addiction f'(W) equals 0, i. e

$$f'(W) = 0 \tag{13}$$

It shows that with the use of the thing, the maximum amount of the subject's demand will not change, that is to say, the addiction of the thing is 0, which will not make people addictive. Most common things like water and bread fall into this category.

If

$$f'(W) < 0 \tag{14}$$

It means that with the use of the thing, the maximum amount of the subject's demand for the thing did not increase, but constantly decreased. Then this thing will not make the subject addictive. A lot of disgusting things often make the more the subject uses it, the lower the maximum amount of demand for it, and the less the subject will be addicted to it.

In addition to the possibility that the maximum demand and its derivatives may cause a significant increase in the subject's demand for something, another scenario is possible. Assuming that the maximum demand N_{max}(W) of the subject for something remains constant with the use of the thing, but the demand degree X increases over time, the subject's demand for the thing increases so significantly that he shows an addiction-like phenomenon. At the beginning of the article, people do not drink water in the desert for three days. The thirst for water is such a situation. The maximum demand of people for water tends to change very little. However, the degree of the subject's demand X for water increased significantly since there was no water available for 3 days, so according to the formula (8), although the maximum amount N_{max}(W) of the subject's demand for water did not change, but the demand amount N for water also increased significantly. The significant increase in the demand amount for water is similar to a significant increase in demand amount for addictive drugs.

Fourthly, the withdrawal of addiction. Withdrawal is an effective way to treat addiction. In the theory of demand degree, the process of withdrawal is the process of reducing the maximum demand for addictive things. Since the subject no longer meets the demand for the addictive thing in the process of withdrawal, if he keeps the demand system balance point of the thing unchanged, his maximum demand must decrease as the thing decreases.

That is, if the degree of the subject's demand for addictive thing is X, according to formula (9) and (11), the maximum amount of the demand N_{max} (W) is also decreasing as the addictive thing W used decreases. Then when the demand degree X is equal to E, the demand amount N is also decreasing. This continues until the time the maximum amount of the subject's demand N_{max}(W) for the addictive thing is reduced to so low that the subject has lost dependence on the addictive thing and no longer repetitive or compulsive use of the addictive thing, then it can be said to have been withdrawn.

It can be seen that the value degree V (W) in demand degree theory, priority reasoning logic, and addiction index f'(W) can explain the reward mechanisms, repetitiveness and compulsion in addiction phenomena, the increasing number of addictive things needed, and withdrawal phenomena. Therefore, these three aspects constitute a new model to explain addiction based on the theory of demand degree, describing the rationality of explaining addiction based on the theory of demand degree.

Evidence of the rationality of addiction model-simulating smoking addiction through artificial intelligence as an example

According to the previous discussion, the key to analyze whether a thing may be addictive is to look at the formula (9), (10), and (11). The formulas suggest that the key to the subject addiction is whether the maximum amount of demand in the demand degree is increasing with the use of the thing, and whether the derivative of the maximum amount of demand to the thing, namely the addiction index f'(W) is much greater than 0.

Due to possible ethical problems in the volunteer addiction testing, this paper is validated by the method of artificial intelligence simulating smoking addiction. The so-called verification method of artificial intelligence simulating smoking addiction refers to programming the above formulas on addiction, so as to run artificial intelligence to see whether it shows a general phenomenon similar to human addictive behavior. If artificial intelligence can show an addictive behavior like human's cigarette addiction, it can be said that the formulas in this paper on addiction are rational and of universal applicability, thus providing new ideas for addiction research and application.

Firstly, the theoretical design of the experiments.

The artificial intelligence in this paper is an artificial intelligence trolley with a binary demand system. Two basic parameters were initially set in the binary demand system of this artificial intelligence trolley, one is "Quantity of Electricity Q" and the other one is mobile "Length or Mileage L". Electricity can represent the power function of artificial intelligence trolley, and length or mileage can represent the work function of artificial intelligence trolley. This shows that the binary demand system is general, so it can be transformed into a binary demand system for the demand for electricity and smoke. Under general circumstances, if the initial quantity of electricity is 100% and the initial mileage is 0, the equilibrium point E of demand system of Q and L of the trolley is equal to 1/2[16].

The maximum demand of the car for electricity can be set to remain unchanged at 100% to show addiction. It shall cancel the setting of mileage and change to the setting of car loading smoke (corresponding to smoking). The need of artificial intelligence car for electricity can simulate the normal needs of human beings. The need of artificial intelligence car to load smoke is used to simulate the needs of human smoking. It is assumed that the smoke demand of the artificial intelligence car is N (T), and the maximum demand for smoke is Nmax (T), and it is assumed that the maximum demand Nmax (T) can change with the change of smoke loading M. Then, keep the equilibrium point E = 1 / 2 in the binary system of the trolley unchanged. It can be calculated that when the smoke demand X (T) of the trolley reaches the equilibrium point E, the smoke demand m (assuming that the influence of the smoke loading on the electric power of the trolley is ignored). The specific calculation is as follows:

The main body's demand for electricity is as follows according to formula (1):

$$X(Q)=\frac{N(Q)}{N_{\max}(Q)}=\frac{N(Q)}{100\%} \tag{15}$$

In the above formula, if the known electric quantity of the trolley is Q, it can be rewritten as the following formula:

$$X(Q)=\frac{100\%-Q}{100\%} \tag{16}$$

Therefore, it can be given that the power demand of the trolley at the balance point is 50%. On the other hand, the car's demand for smoke is as follows:

$$X(T)=\frac{N(T)}{N_{\max}(T)} \tag{17}$$

If it is assumed that the smoke loaded by the trolley is m, it can be rewritten as the following formula:

$$X(T)=\frac{N_{\max}(T)-m}{N_{\max}(T)} \tag{18}$$

To simplify the calculation, a linear function can be set according to formula (9) because the maximum demand of the trolley for smoke is related to the quantity of smoke:

$$N_{\max}(T) = f(T) = 20 + m \quad (19)$$

In which: m is the number of cigarettes. When the smoke loading is 0, the maximum demand of the trolley for smoke is equal to 20 cigarettes. This shows that the maximum loading capacity of the trolley for cigarettes is also 20 (because the maximum demand refers to the amount from no smoke to full smoke). At this time, the car needs 10 cigarettes (1 / 2 of 20 cigarettes). It is easy to know that at this time, according to addiction formulas (10) and (11)

$$N'_{\max}(T) = f'(T) = 1 > 0 \quad (20)$$

It means that the car can be addicted to loading cigarettes. Then substitute formula (19) into formula (18) to obtain:

$$X（T）= \frac{20}{20+m} \quad (21)$$

We can calculate the smoke demand of the main body when it reaches the equilibrium point E according to the equilibrium point E = 1 / 2:

$$\frac{20}{20+m} = \frac{1}{2} \quad (22)$$

We can know that

$$m = 20 \quad (23)$$

From Formula (23) W can know that when the equilibrium point E is reached, the demand of the trolley for cigarettes is 20. This shows that the demand for cigarettes increases from 10 to 20 in the process of loading cigarettes. It can be seen that with the increase of the smoke loading capacity of the trolley, the maximum demand for smoke is also increasing, resulting in the increase of the total smoke loading capacity required by the trolley.

Formula (23) further shows that when the trolley reaches its maximum smoke loading capacity, it has just reached the equilibrium point of its demand for smoke loading. This shows that the smoke loading capacity of the trolley has violated the demand for smoke under normal conditions (i.e. when the maximum demand does not increase with the number of loaded cigarettes). With the possible increase of smoke loading capacity again, when the smoke loading capacity of the car exceeds 20, that is, the maximum demand exceeds 40, the smoke demand of the artificial intelligence car will exceed the rated smoke loading capacity of 20, and the smoke demand of the car must be less than 1 / 2. Failing to reach the equilibrium point destroys the dual needs system of artificial intelligence vehicles. The car can no longer load cigarettes. This can be compared to the fact that when people smoke, they reach the limit they can bear, and eventually destroy people's physical functions, resulting in human death or permanent damage, so they can no longer smoke.

Secondly, the specific design of the experiment is as follows:

The specific experiment can be programmed and verified on the single chip microcomputer development board of artificial intelligence car.

Step 1: It shall prepare the control group of the experiment. This paper takes the demand degree of artificial intelligence car for electricity as the control group. According to the fact that the maximum power demand of the AI vehicle remains unchanged, the power demand at the equilibrium point E = 1 / 2 is 50%. Therefore, if the initial power of the trolley during cigarette loading is 50%, it can be seen that the power demand of the trolley is exactly equal to E, that is, equal to 1 / 2. Since the electric power of the artificial intelligence trolley is not consumed during cigarette loading, the electric demand of the trolley is 1 / 2, which remains unchanged during cigarette loading. The control group is used to represent the normality required by people's daily life. In a binary demand system, the equilibrium point E of the demand system is usually 1 / 2.

Step 2: It shall prepare the experiment and collect the data of the experimental group.

A. Initial setting is as follows:

(1)Initial setting: In the initial state, the power of the trolley is 50% and the smoke loading is 0.

(2)Range of trolley power: 0% to 100%

(3)Range of cigarette loading capacity of trolley: 0 to Nmax (T), namely, 0 to 20 + m;

In which: 20 + m is the maximum smoke loading.

(4)The maximum smoke demand of the trolley is:

(5)Formula of trolley demand for electric quantity is:

(6)Formula for smoke demand of trolley is:

(7)The balance point e required by the trolley is 1/2.

B. It shall compare the demand of the trolley for power and smoke.

(1)If the trolley's demand for power (1/2) is greater than that for smoke loading:

$$X(Q) > X(T)$$

It means that the trolley needs more power and should be charged (yellow).

(2)If the trolley's demand for power (1/2) is less than that for smoke loading:

$$X(Q) < X(T)$$

The car should be filled with smoke (green).

(3)If the trolley's demand for electricity (1/2) is equal to the demand for smoke loading:

$$X(Q) = X(T)$$

Then the trolley reaches the balance point E (red) of power and smoke loading.

C. It shall convert it into a computer program and run it.

Specific process chart of the experiment is as follows:

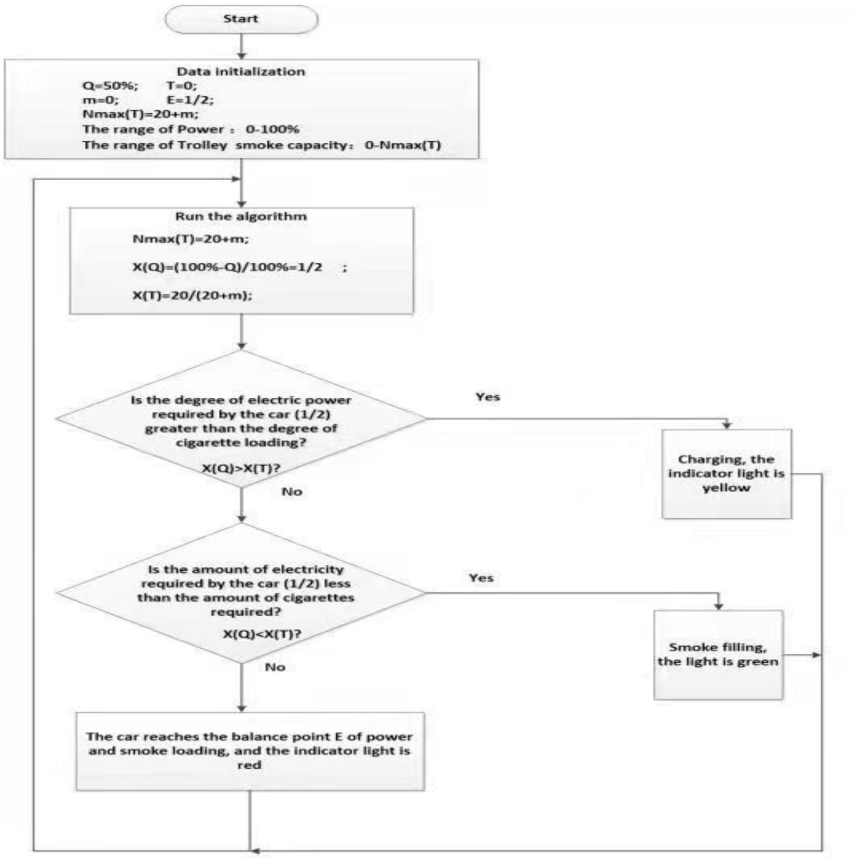

Figure 1 Process Chart of Artificial Intelligence Car Simulating Smoking Addiction

Step 3: It shall observe and record the color of the indicator light on the MCU development board, and check whether the experimental results meet the expectations for verification.

Again, the specific experiment process and results are as follows:

In the experiment, it shall set the electric quantity of the trolley unchanged, manually change the smoke loading of the single chip microcomputer, and observe the change of the trolley indicator. If the indicator light of the trolley is red, it means that neither cigarette loading nor charging is required; if the indicator light of the trolley is yellow, it indicates that the trolley needs to be charged; If the indicator light of the trolley is green, it means that the trolley needs to load smoke. The experimental results are shown in the table below:

Table 1
Relationship Between Cigarette Load of Artificial Intelligence Trolley And Total Demand, Demand Degree and Indicator Light

Cigarette loading (PCs.)	0	2	4	6	8	10	12	14	16	18	20
Total demand for cigarettes when the maximum demand remains unchanged	10	10	10	10	10	10	10	10	10	10	10
Total demand for smoke at equilibrium point E	10	11	12	13	14	15	16	17	18	19	20
Degree of need for smoke	100%	91%	83%	77%	71%	67%	63%	59%	56%	53%	50%
Degree of need for electricity	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Color of indicator light of development board of single chip microcomputer (SCM) of artificial intelligence vehicle	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red

In the experiment, the car simulated human smoking addiction. It is embodied in the following aspects:

(1) Each cigarette is of great value to the car. The value degree of each cigarette to the car is according to the value degree formula (4):

$$V(T)=\frac{1}{N_{\max}(T)}=\frac{1}{20+m} \qquad (24)$$

M is greater than or equal to 0 and less than or equal to 20 according to the calculation results, so it can be seen that the value degree of one piece should be between [1 / 40, 1 / 20], that is:

$$\frac{1}{40}\leq V(T)\leq\frac{1}{20} \qquad (25)$$

Compared with the value obtained by every 1% increase in electricity, it can be seen that formula (25) shows that the value of each cigarette loaded to artificial intelligence is much greater than that of every 1% of electricity.

(2) It simulates the continuous increase of smoking demand and consumption of smokers. In the process of cigarette loading, the maximum demand increases with the increase of cigarette loading. When reaching the equilibrium point E of the demand system, the demand for cigarettes and the amount of cigarettes (corresponding to human consumption) are also increasing.

(3) It simulates the compulsion of smoking when smoking. In each cigarette loading, the car always needs more cigarettes than electricity, so it is always loading cigarettes without charging. This shows that smokers need more cigarettes than other daily things, so they can only follow

the law of comparable needs and force themselves to smoke.

(4) The repeatability of smoking during

smoking addiction was simulated. During each cigarette loading, the artificial intelligence car compares the degree of demand for smoke with the degree of demand for power. Since the demand for smoke in each of the first nine times is greater than that for electricity, the artificial intelligence car is loaded with smoke in each of the first nine times. This simulates that when a person is addicted to smoking, because his need for smoking is higher than his need for other things in daily life, he chooses to smoke every time when comparing different kinds of needs, so he smokes repeatedly. Of course, the repetitive characteristics of addiction are also related to the periodicity of human life. It is not shown in the simulation of artificial intelligence car, which can be specially discussed in further research.

The above four aspects show that the artificial intelligence car has basically simulated the phenomenon of smoking addiction. Therefore, the data shown in Table 1 can be the basis for analyzing the addiction model based on the need theory. In Table 1, the color change of the indicator light is completely consistent with the theoretical design, and the following specific conclusions can be drawn:

(1)The car's need for cigarette loading has always been greater than that for electricity, which shows that addicts choose drugs mainly because of its high need, not because of its high value.

(2)The demand for smoke loading of the trolley decreases with the increase of smoke loading until it is equal to the demand for power and reaches the balance point. At this time, the car is no longer loaded with cigarettes, indicating that addicted patients will stop smoking for a short time after smoking.

(3)With the increase of the smoke loading capacity of the trolley, the total demand for smoke when the trolley reaches the equilibrium point shows an increasing trend. The car needs more and more cigarettes, which shows that one of the main reasons for the increasing demand for something in the phenomenon of addiction. With the increase of drug use, the maximum demand of addicts for drugs is increasing.

The increasing maximum demand for drugs leads to the increasing demand for drugs by addicted patients until addicted patients reach the limit of drug tolerance.

(4) Through the comparison between the demand for smoke and the demand for power, it can be found that the car has been in the state of loading smoke (namely, green state) because the demand for smoke has always been greater than the demand for power. This shows that because addicts always need drugs more than daily things, such as water and food, they usually use drugs compulsively and repeatedly in order to reach the balance point of their need system.

CONCLUSION

The following conclusion can be drawn from the experiment and analysis of AI car simulating smoking addiction

（1)Based on the degree of need theory, we can propose a new explanatory model of addiction. It says addition should follow two basic preconditions: one is the higher value of the addictive substances; another one is that the addiction index is always greater than or far greater than 0. From the simulation of smoking addiction by AI car, we can prove that the key factors of AI car addiction are the value of a cigarette is much greater than the value of 1% of electricity, and the addiction index of the AI car is 1, and it is greater than 0. Please see in the particular formula (20).

(2)The paper proposes the index of addiction, and is pointed out that only when the maximum demand for a thing is increased, that is, when the addiction index is greater than 0, the addiction is possible to happen. The expression of addiction index is in formula (10). We can see from the AI car simulation of smoking addiction that when the addiction index of the AI car is equal to 1, the addiction is enough to happen. Therefore, the addiction index can be regarded as an important norm to judge whether an object is addictive or not.

(3)The paper further explains that addiction is not a disease, but a normal response to addictive substances of the need system of body. We can see from the AI car simulation of smoking addiction that because the smoke has no influence on the electric quantity of the AI car, it doesn't affect the power of the car. It shows that addiction is a normal phenomenon of the need system. To a great degree, it has nothing to do with whether it is harmful to people or not. In other word, addiction is a rational response of the human need system to the addictive substance. This is in favor of explaining common addictions in daily life such as alcohol addiction, tobacco addiction, food addiction, sex addiction, exercise addiction and so on.

These are three conclusions that illustrate the reasonability and universality of the degree of need theory to explain the phenomenon of addiction. Therefore, the need theory and its explanation is a advisable model of addiction. It can be a beneficial complement for research on addiction theory in psychology and neuroscience, especially for the theory of tobacco addiction.

Conflicts of Interest Disclosure Statement

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