

Investigating How Smart Vending Machines and Associated Human-machine Interactions Impact Users' Willingness to Use



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Abstract

Since the development of Artificial Intelligence (AI), the number of direct interactions between humans and machines has increased in frequency. As there are significant differences between the characteristics of humans and machines, an increased number of studies have investigated the emotions humans experience during these interactions. This study focuses on smart vending machines as the research object, and explores how users' consistent use of smart vending machines affects their emotions from the perspective of human-computer interactions. Emotional responses (the happy emotion and control emotion) are the mediating variable, and psychological distance is the moderating variable in this study. Using the questionnaire method, 326 valid questionnaires were analyzed by SPSS software. The data analyzed suggest that bidirectionality, personalisation and interestingness are likely to have a significantly positive influence on the formation of happy emotions. Controllability, personalisation and interestingness are found as likely having a significant positive influence relationship on the formation of control emotions. The mediating effect of happy emotion on controllability, responsiveness, and interactivity is not significant; the mediating effect of control emotion on responsiveness, interactivity, and bidirectionality is likewise not significant. The interaction of controllability, interactivity, and bidirectionality with psychological distance showed some significance.

Keywords

Smart vending machine, human-machine interaction, emotional reaction, psychological distance, willingness to use, artificial intelligence

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1. Introduction

In recent years, the vending machine industry has grown rapidly. Advances in Artificial Intelligence (AI) have accelerated this: the customer group of smart vending machines shows a growing trend. Due to obvious variations in the characteristics of machines and humans, researchers have increasingly conducted studies concerning intelligent vending machines, mainly focusing on interactivity, emotional response, and psychological distance.

Among these researchers, regarding interactivity in the nature of humans, Tong (2018) divided interaction into human-machine interaction and interpersonal interaction, and Novak et al. (2000) divided interaction into human-human interaction and human-machine interaction. The constituent factors of interactivity also vary due to the different factors

involved in different research areas of different researchers. Among them, Heeter (2000) classified interactivity factors into six categories: the complexity of available choices; the effort users must exert; machines' responsiveness to users; the monitoring of information use; the ease of adding information; and the facilitation of interpersonal communication. Dholakia (2000) classified interactivity in five categories: controllability; responsiveness; real-time interaction; connectivity; and personality interest. Analyzing the shopping website environment, Tang (2006) classified interactivity in five categories: perceived usefulness; perceived ease of use; bidirectionality; responsiveness; and interactivity. In terms of emotional response, Lee (2005) classified emotional response into positive and negative emotions as a method to express the positive and negative aspects of emotions in order to better understand the impact of potential emotions on users' behavior. Mano and Oliver's (1993) study expresses a comparable attitude to Lee (2005), as they consider emotional responses to be the normal psychology that occurs when users make purchases, which may produce positive emotions such as happiness. Mano and Oliver argue that emotional reactions are normal psychological responses users may experience when making purchases, and may produce positive emotions such as happiness, satisfaction, but may also produce negative emotions such as sadness, anger, and disappointment.

Concerning the concept of psychological distance, Kray's (2000) insight is valuable. He argued that, by studying social distance, people pay more attention to core, abstract and high explanatory level product information when making decisions for others, but pay more attention to concrete, secondary and low explanatory level product information when making consumption decisions for themselves. Conversely, in his study on spatial distance, Jiang (2018) emphasised that individuals are more receptive and satisfied with products if they are confronted with low-interpretation level commodity information at near spatial distance. When confronted with high-interpretation level abstract commodity information at far spatial distance, Jiang (2018) found that individuals are more receptive and satisfied with products and rate their consumption behavior higher. The existing research results mainly focus on the interactivity and emotional response between humans and machines, yet there are fewer studies that take intelligent vending machines as the research object and analyzes the influence of vending machine interactivity on users' purchasing behavior.

This study utilises relevant findings from existing related literature at home and abroad to construct a theoretical model from the perspective of human-machine interaction. This study uses the questionnaire survey method, taking emotional response (happy emotion, control emotion) as the mediating variable and psychological distance as the moderating variable, to explore the influencing factors of users' continuous use of smart vending machines.

2. Theoretical Model and Research Hypothesis

The theoretical model used in this study is derived from existing research regarding smart vending machines, interactivity, emotional response, psychological distance, and willingness to use smart vending machines consistently. From this, hypotheses regarding inter-variables in the model are proposed.

2.1 Theoretical Model

2.1.1 Classification of interactivity dimensions

Due to differences in existing research purposes and fields, the division of interactivity dimensions has not yet been standardized. Whether it is online or offline interaction, the essence of interaction is people, and the object such interactions are the goods or items associated with people. Therefore, in this study, *interactivity* refers to human-machine interaction, and focuses on the factors that influence users' willingness to continue using smart vending machines. Controllability, personalisation, responsiveness, interestingness, interactivity, and bidirectionality are introduced as sub-dimensional dimensions of human-computer interaction when consumers use smart vending machines.

2.1.2 Theoretical Model Construction

By utilising the technology acceptance model and stimulus-organism-response theory, this study:

- treats users as organisms capable of processing information;
- treats interactivity as a stimulus;
- explores how interactivity triggers the behaviour of online shopping platform users by influencing the intrinsic state of affective response.

These factors combine to present reasons for users' continued willingness to use smart vending machines.

In this study, human-machine interactivity is taken as the independent variable and divided into six sub-dimensional factors. Emotional response (happy emotions, control emotions) is defined as the mediating variable. Users' willingness to continuously use smart vending machines is defined as the dependent variable. Psychological distance is selected as the moderating variable. These variables combine to construct a research model of how human-machine interactions in

smart vending machine use impact users' continued willingness to use them. This research model is shown below in Figure 1.

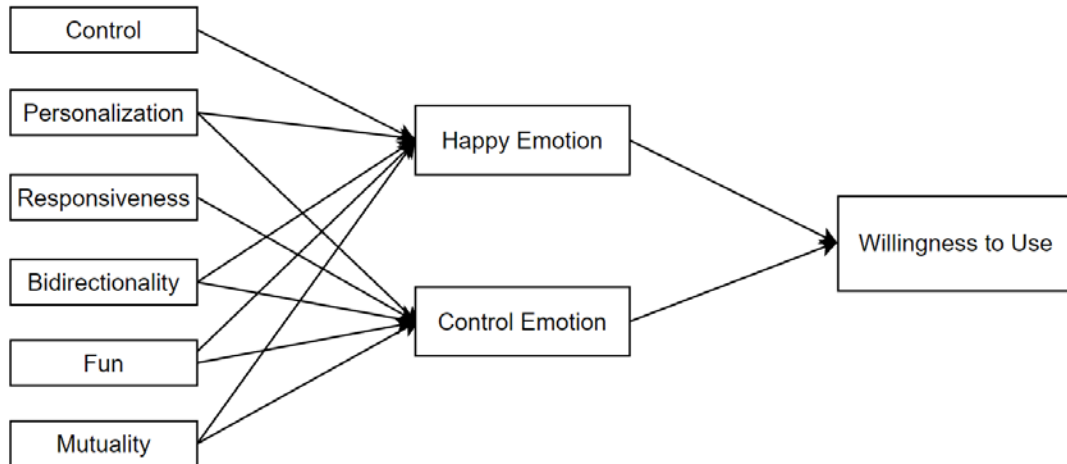


Figure 1. Theoretical Model.

2.2 Research Hypotheses

2.2.1 The relationship between interactivity and happy emotions

- H1: Controllability has a significant positive effect on happy emotion.
- H2: Responsiveness has a significant positive effect on happy emotion.
- H3: Interactivity has a significant positive effect on happy emotion.
- H4: Bidirectionality has a significant positive effect on happy emotions.
- H5: Personalisation has a significant positive effect on happiness.
- H6: Interestingness has a significant positive effect on happiness.

2.2.2 The relationship between interactivity and Controllability emotion

- H7: Controllability has a significant negative effect on control emotion.
- H8: Responsiveness has a significant negative effect on control emotion.
- H9: Interactivity has a significant negative effect on control emotion.
- H10: Bidirectionality has a significant negative effect on control emotions.
- H11: Personalisation has a significant negative effect on controllability.
- H12: Interestingness has a significant negative effect on control emotions.

2.2.3 The relationship between happy emotion and willingness to continue using

- H13: Happy emotion has a significant positive effect on users' willingness to keep using.

2.2.4 Relationship between control emotion and willingness to use consistently

- H14: There is a significant negative effect of control emotion on willingness to continue using.

3. Survey Design

3.1 Basic structure of the survey

Due to findings from previous research, the final research questionnaire used in this study was formed by referring to the mature scales of relevant variables and modifying them with the characteristics of human-machine interaction involving smart vending machines. The research questionnaire was divided into three parts.

(1) *Introduction*: this explains the identity of the researcher, the purpose of the study, the confidentiality of the information, the content of the questionnaire. The introduction also briefly explains the human-machine interaction involved in smart vending machine, enabling the research subjects to better understand the purpose of the research.

(2) *Key research content*: this includes ten variables such as controllability, personalisation, responsiveness, interestingness, interactivity, bidirectionality. This questionnaire uses a Likert 7-level scale: 1 represents strongly disagree; 2

represents disagree; 3 represents somewhat disagree; 4 represents average; 5 represents somewhat agree; 6 represents agree, and 7 represents strongly agree.

(3) *Research subjects (basic information)*: this includes the gender, age, education, occupation, of the research subjects. This data helps to understand the relevant consumer characteristics.

3.2 Survey Design

1) Controllability

Controllability refers to the degree of control consumers perceive when shopping with smart vending machines. The specific measurement questions and literature sources are shown in Table 1 below:

Table 1. Controllability Measurement Questions

Variable	Measurement Questions	Reference
Controllability	Q1a When I use the smart vending machine, I can freely choose the products I want. Q1b When using the smart vending machine, I can freely choose the payment method. Q1c When I use the smart vending machine, I can know exactly what I am doing.	Ruyter and Wetzels (2000)

2) Responsiveness

Responsiveness is the degree of response that consumers perceive when shopping with smart vending machines. The specific measurement questions and literature sources are shown in Table 2 below:

Table 2. Responsiveness Measurement Questions

Variable	Measurement Questions	Reference
Responsiveness	Q2a When shopping with a smart vending machine, the machine responds to my needs in a timely manner. Q2b When I shop using a smart vending machine, the machine provides relevant information about my response.	Ruyter and Wetzels (2000)

3) Interactivity

Interactivity refers to the level of value that consumers perceive experiencing when shopping with smart vending machines. The specific measurement questions and literature sources are shown in Table 3 below:

Table 3. Interactivity Measurement Questions

Variable	Measurement Questions	Reference
Interactivity	Q3a When shopping with smart vending machines, I am able to get the items I need. Q3b When shopping with the smart vending machine, I am able to get good advice from the online forum of the smart vending machine. Q3c The online forum of the smart vending machine encourages users to post their experiences, opinions and suggestions. Q3d If I lack knowledge about certain products, I can always get help from professionals through the online forum or customer service.	Ruyter and Wetzels (2000)

4) Bidirectionality

Bidirectionality refers to the perceived emotional communicative value that consumers place on the smart vending machine while shopping with it. The specific measurement questions and literature sources are shown in Table 4 below:

Table 4. Bidirectionality Measurement Questions

Variable	Measurement Questions	Reference
Bidirectionality	Q4a I feel that the voice bot of the smart vending machine is very helpful in communicating with me. Q4b I feel that the voice bot in the smart vending machine is very helpful in listening to my needs. Q4c I feel that the voice bot in the smart vending machine solves my problems well. Q4d I feel that I can understand the responses of the voice bot in the smart vending machine.	Bhattacharjee (2001)

5) Personalisation

Personalisation refers to the degree to which consumers perceive their unique personality is valued when shopping with smart vending machines. The specific measurement questions and literature sources are shown in Table 5 below:

Table 5. Personalisation Measurement Questions

Variable	Measurement Questions	Reference
Personalisation	Q5a The smart vending machine will offer the right products and suggestions for me based on my personal information. Q5b The smart kiosk will provide suggestions that are appropriate for my purchase.	Bhattacharjee (2001)

6) Interestingness

Interestingness refers to the level of fun consumers experience when shopping with smart vending machines. The specific measurement questions and literature sources are shown in Table 6 below:

Table 6. Interestingness Measurement Questions

Variable	Measurement Questions	Reference
Interestingness	Q6a It is interesting to communicate with the machine by voice when using the smart vending machine. Q6b It is interesting to pay by face recognition when using the smart vending machine. Q6c It is interesting to pay by fingerprint when using the smart vending machine. Q6d is fun to use when using the smart vending machine.	Bhattacharjee (2001)

7) Emotional Reaction: Happy Emotion

The happy emotion is a positive emotional response that consumers perceive when shopping with a smart vending machine. The specific measurement questions and literature sources are shown in Table 7 below:

Table 7. Happy Emotion Measurement Questions

Variable	Measurement Questions	Reference
Happy emotion	Q7a Using the smart vending machine makes me happy. Q7b Using the smart vending machine makes it easy for me. Q7c Using the smart vending machine gives me satisfaction. Q7d Using the smart vending machine gives me a sense of well-being.	Albert and James (1974)

8) Emotional Reaction: Control Emotion

The control emotion is a controlled emotional response that consumers experience when shopping with smart vend-

ing machines. The specific measurement questions and literature sources are shown in Table 8 below:

Table 8. Control Emotion Measurement Questions

Variable	Measurement Questions	Reference
Control Emotion	Q8a Using the smart vending machine is something I do on my own initiative. Q8b There is no constraint in using the smart vending machine. Q8c Using the smart vending machine is judged and selected by myself.	Albert and James (1974)

9) Psychological distance

Psychological distance refers to a subjective experience of proximity or distance that consumers experience while using or after using a smart vending machine. The specific measurement questions and literature sources are shown in Table 9 below:

Table 9. Psychological Measurement Questions

Variable	Measurement Questions	Reference
Psychological Distance	Q9a I feel happy when I use the smart vending machine. Q9b I am willing to interact with the smart vending machine. Q9c I may follow the smart vending machine's public numbers on platforms such as Tiktok and Weibo. Q9d I think smart vending machines make people feel easy to get close to. Q9e I think smart vending machines are humane. Q9f If the smart vending machine existed in real life, I would most likely be friends with it.	Ruyter and Wetzels (2000)

10) Willingness to use

Willingness to use is the subjective willingness of consumers to continue using smart vending machines after their original or most recent use. The specific measurement questions and literature sources are shown in Table 10 below:

Table 10. Willingness to use Measurement Questions

Variable	Measurement Questions	Reference
Willingness to use	Q10a I will use smart vending machines consistently in the future. Q10b I will use smart vending machines on a regular basis. Q10c I would be willing to share the smart vending machine with my classmates while using it myself.	Bhattacharjee (2001)

3.3 Survey distribution and collection

During the research cycle, the research platform *Questionnaire Star* was used to create online questionnaires and generate the link to distribute and collect the survey through online communication channels. Ultimately, it collected 326 completed surveys. After excluding invalid ones, such as those that involved incomplete answers, a total of 326 valid surveys were obtained.

3.4 Analysis of sample characteristics

The purpose of this study is to explore how human consumers' interactions with smart vending machines influence users' willingness to continue using them. The data related to the demographic characteristics of the sample participants include gender, age, education level, and occupation. Their specific distribution is shown in Table 11.

Table 11. Sample characteristics analysis

Variable name	description	Sample quantity	Proportion (%)
Gender	a.Male	165	50.61
	b.Female	161	49.39
Age	Under 18 years old	8	2.45
	18-25 years old	135	41.41
	26-35 years old	120	36.81
	36-45 years old	44	13.5
	46-55 years old	19	5.83
	55 years old and above	0	0
Education	High School,	39	11.96
	College	100	30.67
	Undergraduate	177	54.29
	Master and above	10	3.07
Occupation	Students	48	14.72
	Enterprise employees	170	52.15
	Civil servant/institution	57	17.48
	Self-employed	25	7.67
	Others	26	7.98

(1) Among the research subjects, there were 161 female, accounting for 49.39%; 165 male, accounting for 50.61%.

(2) The survey divided the age of users into 6 strata, among which: 2.45% were under 18 years old; 41.41% were 18-25 years old; 36.81% were 26-35 years old; 13.5% were 36-45 years old; 5.83% were 46-55 years old; and 0% were over 56 years old. This shows that users are mainly concentrated in the middle of 18-25 years old, with 135 people, accounting for 41.41%, followed by 26-35 years old, accounting for 36.81%.

(3) Regarding the educational level of the research subjects, there were 39 users in high school, junior college and below, accounting for 11.96%; 100 college users, accounting for 30.67%; 54.29% of undergraduate users; and 3.07% of masters and above. This shows that the users of smart vending machines are mainly concentrated in undergraduate level at university.

(4) Regarding the occupation of the research subjects, the user group is mainly employees of enterprises, with 170 people, accounting for 52.15%; civil servants / institutions, with 57 people, accounting for 17.48%; students, with 48 users, accounting for 14.72%; self-employed, with 25 people, accounting for 7.67%; other 26 people, accounting for 7.98%. This reveals that the participating users of smart vending machines were mainly corporate employees, with equal numbers of men and women, and most of them were in the age group of 18-35, with university and bachelor's degrees. Overall, the sample data collected in this study is mostly representative of demographic constitution in general terms.

4. Empirical analysis

4.1 Descriptive statistical analysis

In this study, descriptive statistical analysis was conducted on the questionnaire results, including the frequency and

percentage of data for each question item. This is shown in Table 12.

Table 12. Sample characteristics analysis

Variable name	description	Frequency	Percentage (%)
Gender	Male	165	50.61
	Female	161	49.39
Age	Under 18 years old	8	2.45
	18-25 years old	135	41.41
	26-35 years old	120	36.81
	36-45 years old	44	13.5
	46-55 years old	19	5.83
	55 years old and above	0	0
Education	High School,	39	11.96
	College	100	30.67
	Undergraduate	177	54.29
	Master and above	10	3.07
Occupation	Students	48	14.72
	Enterprise employees	170	52.15
	Civil servant\institution	57	17.48
	Self-employed	25	7.67
	Others	26	7.98

Table 12 above shows that 50.61% of the sample were categorised as male. The percentage of the females was 49.39%. Regarding age, the majority of the sample was "18-25 years old", with 41.41%. The proportion of the 26-35 year old sample was 36.81%. Regarding education, the highest percentage was "bachelor" at 54.29%. The proportion of the sample of who had attended university was 30.67%. More than 50% of the samples chose *Corporate Employee* as their occupation.

4.2 Reliability test of the Survey

In this paper, 326 valid questionnaires were collected, involving ten variables: controllability, responsiveness, interactivity, bidirectionality, personalisation, fun, happy emotion, control emotion, psychological distance, and willingness to use consistently. The results of the reliability test from the questionnaire are shown below in Table 13.

Table 13. Reliability Test

Variable	Cronbach's Alpha Coefficient	Number of Terms
Controllability	.801	3
Responsiveness	.723	2
Interactivity	.855	4
Bidirectionality	.851	4
Personalisation	.707	2
Interestingness	.830	4
Happy Emotion	.864	4
Control Emotion	.808	3
Psychological distance	.902	6
Willingness to use	.838	3
Total	.983	46

Analysing the alpha coefficient, if this value is higher than 0.8, the reliability is high; if this value is between 0.7 and 0.8, the reliability is good; if this value is between 0.6 and 0.7, the reliability is acceptable; if this value is less than 0.6, the reliability is poor. In summary, as the coefficient numbers are all above 0.8, therefore it can be said that the reliability test is qualified.

4.3 Validity test of the Survey

Such research surveys' validity must be attested. The higher the validity, the more accurately the scale can respond to the actual situation of the measured variables. KMO (Kaiser-Meyer-Olkin) is the indicator used to compare simple and partial correlation coefficients between variables. The correlation between variables get more significant as the number getting close to 1. Bartlett's sphericity test is used to examine whether the correlation between the variables in the correlation array is a unit array. In this study, the validity of the data was tested by factor analysis. KMO and Bartlett's sphericity test are used to determine whether the questionnaire data can be factor-analyzed; the results of the analysis are shown in Table 14 below:

Table 14. Validity Test

KMO sampling suitability quantity		.976
Bartlett's sphericity test	Pseudo Chi-square	13627.771
	Degree of freedom	1035
	Significance	.000

The KMO value and Bartlett's sphericity test were analyzed and the KMO value was 0.976 and the Bartlett's sphericity test was 0.000. This was significant, indicating that the questionnaire could be subjected to factor analysis.

4.4 Validation factor analysis

Table 15. Table of factor loading coefficients

Factor (Latent variable)	Measurements (explicit variables)	Non-standard load factor (Coef.)	Standard error (Std. Error)	z (CR)	p	Standard load factor (Std. Estimate)
Controllability	Controllability1	1	-	-	-	0.731
Controllability	Controllability2	0.994	0.07	14.278	0	0.791
Controllability	Controllability3	0.97	0.072	13.426	0	0.746
Responsiveness	Responsiveness1	1	-	-	-	0.728
Responsiveness	Responsiveness2	1.034	0.07	14.675	0	0.778
Interactivity	Interactivity1	1	-	-	-	0.749
Interactivity	Interactivity2	1.048	0.068	15.475	0	0.794
Interactivity	Interactivity3	1.053	0.069	15.3	0	0.786
Interactivity	Interactivity4	1.039	0.071	14.616	0	0.756
Bidirectionality	Bidirectionality1	1	-	-	-	0.734
Bidirectionality	Bidirectionality2	0.999	0.066	15.037	0	0.789
Bidirectionality	Bidirectionality3	1.025	0.069	14.765	0	0.776
Bidirectionality	Bidirectionality4	0.976	0.066	14.734	0	0.774
Personalisation	Personalisation1	1	-	-	-	0.723

Personalisation	Personalisation2	1.039	0.072	14.452	0	0.757
interestingness	interestingness1	1	-	-	-	0.715
interestingness	interestingness2	0.995	0.072	13.823	0	0.768
interestingness	interestingness3	1.01	0.076	13.264	0	0.737
interestingness	interestingness4	1.043	0.077	13.545	0	0.753
Happy emotion	Happy emotion1	1	-	-	-	0.785
Happy emotion	Happy emotion2	1.016	0.061	16.578	0	0.801
Happy emotion	Happy emotion3	0.933	0.059	15.737	0	0.769
Happy emotion	Happy emotion4	0.962	0.06	15.953	0	0.778
Control emotion	Control emotion1	1	-	-	-	0.715
Control emotion	Control emotion2	1.08	0.073	14.734	0	0.797
Control emotion	Control emotion3	1.095	0.076	14.466	0	0.782
Psychological distance	Psychological distance1	1	-	-	-	0.761
Psychological distance	Psychological distance2	0.967	0.063	15.45	0	0.797
Psychological distance	Psychological distance3	1.007	0.07	14.331	0	0.748
Psychological distance	Psychological distance4	0.967	0.064	15.005	0	0.778
Psychological distance	Psychological distance5	1.031	0.068	15.121	0	0.783
Psychological distance	Psychological distance6	1.131	0.072	15.774	0	0.811
Willingness to use	Willingness to use1	1	-	-	-	0.781
Willingness to use	Willingness to use2	0.991	0.059	16.743	0	0.815
Willingness to use	Willingness to use3	1.009	0.063	16.067	0	0.789

For the measurement relationship, the values of the standardized load coefficients are greater than 0.6 and show significance, which means that there is a good measurement relationship.

As shown in Table 16, the validation factor analysis (CFA) was conducted for a total of 10 factors and 35 items. AVE (average variance extraction) and CR (combined reliability) were used for convergent validity (convergent validity) analysis; usually, AVE greater than 0.5 and CR greater than 0.7 indicate high convergent validity. In total, the AVE values of all 10 factors are greater than 0.5 and the CR values are higher than 0.7, which means that the data of this analysis have strong convergent validity.

The factor covariance table (Table 17) shows the correlation between the factors and the standard estimated coefficient values are usually used to indicate the correlation between the factors. All of them show significance, and the standardized estimated coefficient values are greater than 0.70. This indicates a strong correlation.

Table 16. Results of model AVE and CR indicators

Factor	Average variance extracted (AVE)	Composite reliability (CR)
Controllability	0.57	0.799
Responsiveness	0.567	0.723
Interactivity	0.595	0.854
Bidirectionality	0.589	0.851
Personalisation	0.548	0.708
interestingness	0.551	0.831
Happy emotion	0.614	0.864
Control emotion	0.585	0.808
Psychological distance	0.609	0.903
Willingness to use	0.631	0.837

Table 17. Table of Factor Covariance

Factor	Factor	Coef.	Std. Error	z	p	Std. Estimate
Responsiveness	Controllability	0.803	0.088	9.139	0	0.997
Responsiveness	Interactivity	0.797	0.086	9.281	0	0.981
Responsiveness	Bidirectionality	0.782	0.087	8.965	0	0.926
Responsiveness	Personalisation	0.833	0.088	9.43	0	1.071
Responsiveness	interestingness	0.791	0.086	9.188	0	1.023
Responsiveness	Happy emotion	0.795	0.086	9.235	0	0.927
Responsiveness	Control emotion	0.736	0.082	9.021	0	0.972
Responsiveness	Psychological distance	0.715	0.08	8.936	0	0.888
Responsiveness	Willingness to use	0.809	0.088	9.19	0	0.928
Interactivity	Controllability	0.824	0.089	9.216	0	0.97
Bidirectionality	Controllability	0.815	0.091	8.949	0	0.922
Bidirectionality	Interactivity	0.941	0.098	9.627	0	1.055
Bidirectionality	Personalisation	0.821	0.09	9.099	0	0.961
Bidirectionality	Happy emotion	0.888	0.094	9.43	0	0.944
Bidirectionality	Control emotion	0.758	0.085	8.891	0	0.911
Personalisation	Controllability	0.766	0.086	8.881	0	0.942
Personalisation	Interactivity	0.79	0.086	9.181	0	0.962
Personalisation	Happy emotion	0.873	0.091	9.582	0	1.007
Personalisation	Control emotion	0.814	0.087	9.357	0	1.062
interestingness	Controllability	0.725	0.083	8.684	0	0.896

interestingness	Interactivity	0.771	0.085	9.067	0	0.945
interestingness	Bidirectionality	0.803	0.089	8.996	0	0.946
interestingness	Personalisation	0.816	0.088	9.252	0	1.044
interestingness	Happy emotion	0.839	0.09	9.369	0	0.974
interestingness	Control emotion	0.761	0.084	9.06	0	1
interestingness	Willingness to use	0.855	0.092	9.339	0	0.976
Happy emotion	Controllability	0.739	0.085	8.739	0	0.824
Happy emotion	Interactivity	0.809	0.087	9.299	0	0.895
Happy emotion	Control emotion	0.878	0.091	9.657	0	1.041
Control emotion	Controllability	0.727	0.083	8.796	0	0.917
Control emotion	Interactivity	0.736	0.082	9.002	0	0.92
Psychological distance	Controllability	0.614	0.075	8.134	0	0.728
Psychological distance	Interactivity	0.701	0.079	8.848	0	0.825
Psychological distance	Bidirectionality	0.802	0.088	9.139	0	0.907
Psychological distance	Personalisation	0.787	0.085	9.269	0	0.967
Psychological distance	interestingness	0.753	0.083	9.063	0	0.93
Psychological distance	Happy emotion	0.891	0.091	9.766	0	0.993
Psychological distance	Control emotion	0.752	0.082	9.168	0	0.948
Psychological distance	Willingness to use	0.908	0.093	9.737	0	0.995
Willingness to use	Controllability	0.749	0.086	8.675	0	0.822
Willingness to use	Interactivity	0.821	0.089	9.24	0	0.892
Willingness to use	Bidirectionality	0.893	0.096	9.343	0	0.933
Willingness to use	Personalisation	0.914	0.095	9.663	0	1.037
Willingness to use	Happy emotion	0.984	0.099	9.992	0	1.013
Willingness to use	Control emotion	0.865	0.091	9.501	0	1.007

4.5 Correlation analysis

Correlation analysis can reflect variables' closeness to each other. This study uses SPSS 24.0 questionnaire data for correlation analysis to test whether there is a correlation between the variables. In this paper, Pearson correlation coefficient is selected to measure the correlation between variables. Among them, the larger the absolute value of Pearson correlation coefficient means the closer the correlation between variables; the positive and negative values of the correlation coefficient represent the direction of change between variables. The specific correlation analysis results are shown in Table 18 below.

Table 18 demonstrates that the correlation analysis was used to study the correlation between controllability and responsiveness, interactivity, bidirectionality, personalisation, interestingness, happy emotion, control emotion, psychological distance, and willingness to use the 10 items, and the Pearson (add date) correlation coefficient was used to indicate the strength of the correlation. The correlation coefficients were 0.755, 0.798, 0.761, 0.706, 0.730, 0.684, 0.738, 0.618, 0.673, and the correlation coefficient values are all greater than 0. This implies that there is a positive relationship between controllability and responsiveness, interactivity, bidirectionality, personalisation, fun, happy emotion,

control emotion, psychological distance, and willingness to continue using a total of 9 items.

Table 18. Correlation Analysis

	Controllability	Responsiveness	Interactivity	Bidirectionality	Personalization	Interestingness	Happy emotion	Control Emotion	Psychological distance	Willingness to use
Controllability	1									
Responsiveness	.755**	1								
Interactivity	.798**	.772**	1							
Bidirectionality	.761**	.731**	.899**	1						
Personalization	.706**	.766**	.747**	.749**	1					
Interestingness	.730**	.791**	.797**	.799**	.801**	1				
Happy emotion	.684**	.735**	.768**	.813**	.787**	.825**	1			
Control Emotion	.738**	.740**	.762**	.758**	.806**	.821**	.867**	1		
Psychological distance	.618**	.718**	.721**	.798**	.771**	.807**	.877**	.817**	1	
Willingness to use	.673**	.727**	.755**	.794**	.798**	.819**	.862**	.828**	.865**	1

4.6 Regressivity analysis

In this study, SPSS24.0 is used to conduct regression analysis on the questionnaire data to study the factors influencing the human-machine interaction of smart vending machines on users' willingness to continue using the machines. Gender, age, education, and occupation were control variables; willingness to continue using was the dependent variable. Six dimensions of interactivity were utilised: controllability, responsiveness, interactivity, bidirectionality, personalisation, and fun as independent variables; happy emotion and control emotions as mediating variables; and psychological distance as moderating variable.

4.6.1 The relationship between interactivity and happy emotion

Table 19. The relationship between interactivity and happy emotion

	Non-standardized coefficient		Standardized coefficient	t	p	VIF	R ²	Adjust R ²	F
	B	Std. Error	Beta						
Constants	0.33	0.175	-	1.887	0.06	-			
Controllability	-0.038	0.049	-0.037	-0.761	0.447	3.27			
Responsiveness	0.07	0.051	0.072	1.392	0.165	3.648			
Interactivity	-0.055	0.069	-0.055	-0.794	0.428	6.692	0.768	0.763	<i>F</i> (6,319)= 175.647 <i>p</i> =0.000
Bidirectionality	0.385	0.065	0.391	5.955	0.000**	5.925			
Personalisation	0.225	0.048	0.236	4.72	0.000**	3.425			
interestingness	0.356	0.059	0.338	6.055	0.000**	4.29			

Dependent variable: happy emotions
D-W: 2.076
* p<0.05 ** p<0.01

From Table 19, it can be seen that controllability, responsiveness, interactivity, bidirectionality, personalisation, and interestingness were taken as independent variables, while happy emotion is taken as the dependent variable for linear

regression analysis, and from the above table, it can be seen that the model equation is

Happy emotion = 0.330-0.038*controllability + 0.070*responsiveness-0.055*interactivity + 0.385*bidirectionality + 0.225*personalisation + 0.356*interestingness with a model R-squared value of 0.768 and an adjusted R-squared value of 0.763.

This means that controllability, responsiveness, interactivity, bidirectionality, personalisation, and interestingness can explain 76.8% of the variation in happy emotions by 76.8% of the reasons for change. When the F-test was conducted on the model, it was found that the model passed the F-test ($F=175.647$, $p=0.000<0.05$), which means that at least one of controllability, responsiveness, interactivity, bidirectionality, personalisation, and interestingness would have an impact relationship on happy emotions. The final specific analysis shows that:

- The regression coefficient value of controllability is -0.038 ($t=-0.761$, $p=0.447>0.05$), which means that controllability does not have an influential relationship on happy emotions.
- The regression coefficient value of responsiveness is 0.070 ($t=1.392$, $p=0.165>0.05$), implying that responsiveness does not have an influential relationship on happy emotions.
- The regression coefficient value of interactivity is -0.055 ($t=-0.794$, $p=0.428>0.05$), implying that interactivity does not have an influential relationship on happy emotions.
- The regression coefficient value of bidirectionality is 0.385 ($t=5.955$, $p=0.000<0.01$), implying that bidirectionality will have a significant positive influence relationship on happy emotions.
- The regression coefficient value of personalisation is 0.225 ($t=4.720$, $p=0.000<0.01$), implying that personalisation will have a significant positive influence relationship on happy emotions.
- The regression coefficient value of interestingness is 0.356 ($t=6.055$, $p=0.000<0.01$), implying that interestingness will have a significant positive influence relationship on happy emotions.

To summarise the analysis, bidirectionality, personalisation, and interestingness are likely to have a significant positive influence relationship on happy emotions. However, controllability, responsiveness, and interactivity are likely to not have an impact relationship on happy emotions.

4.6.2 The relationship between interactivity and control emotion

Table 20. Relationship between interactivity and control emotion

	Non-standardized coefficient		Standardized coefficient	t	p	VIF	R ²	Adjust R ²	F
	B	Std. Error	Beta						
Constants	0.318	0.177	-	1.794	0.074	-			
Controllability	0.158	0.05	0.158	3.171	0.002**	3.27			
Responsiveness	0.017	0.051	0.018	0.341	0.733	3.648			
Interactivity	0.049	0.07	0.05	0.706	0.481	6.692	0.757	0.752	$F(6,319)=165.319$, $p=0.000$
Bidirectionality	0.067	0.066	0.069	1.019	0.309	5.925			
Personalisation	0.3	0.048	0.317	6.195	0.000**	3.425			
interestingness	0.356	0.06	0.342	5.985	0.000**	4.29			

Dependent variable: Control emotion

D-W: 2.116

* $p<0.05$ ** $p<0.01$

From Table 20, controllability, responsiveness, interactivity, bidirectionality, personalisation, interestingness were taken as independent variables while the control emotion was taken as a dependent variable for linear regression analysis and from the above table, it can be seen that the model equation is.

Control emotion = 0.318 + 0.158*controllability + 0.017*responsiveness + 0.049*interactivity + 0.067* bidirectionality + 0.300*personalisation + 0.356*Interestingness.

The model R-squared value is 0.757. This implies that controllability, responsiveness, interactivity, bidirectionality, personalisation, and interestingness can explain 75.7% of the reasons for the change in control emotions. When the

F-test was conducted on the model it was found that the model passed the F-test ($F=165.319, p=0.000<0.05$), which means that at least one of controllability, responsiveness, interactivity, bidirectionality, personalisation, and Interestingness would have an influential relationship on control emotion and the final specific analysis shows that:

- The value of the regression coefficient of controllability is 0.158 ($t=3.171, p=0.002<0.01$). This means that controllability will have a significant positive influence relationship on control emotion.
- The regression coefficient value of responsiveness is 0.017 ($t=0.341, p=0.733>0.05$). This implies that responsiveness does not have an influential relationship on control emotion.
- The regression coefficient value of interactivity is 0.049 ($t=0.706, p=0.481>0.05$). This implies that interactivity does not influence the relationship of control emotion.
- The regression coefficient value for bidirectionality is 0.067 ($t=1.019, p=0.309>0.05$). This implies that bidirectionality does not influence the relationship of control emotion.
- The regression coefficient value for personalisation is 0.300 ($t=6.195, p=0.000<0.01$). This implies that personalisation will have a significant positive influence relationship on control emotion.
- The regression coefficient value of interestingness is 0.356 ($t=5.985, p=0.000<0.01$). This implies that interestingness will have a significant positive influence relationship on control emotion.

Summarising the analysis, it is clear that controllability, personalisation, and Interestingness will have a significant positive influence relationship on control emotions. However, bidirectionality, responsiveness, and interactivity do not have an impact relationship on control emotion.

4.6.3 The mediating role of happy emotions

Table 21. The mediating role of happy emotions

	Model1				Model2				Model3					
	B	SE.	t	p	B	SE.	t	p	B	SE.	t	p		
Constants	5.941	0.262	22.647	0.000**	5.707	0.171	33.464	0.000**	5.724	0.17	33.725	0.000**		
Gender	-0.222	0.089	-2.497	0.013*	-0.048	0.058	-0.817	0.415	-0.034	0.058	-0.577	0.564		
Age	0.079	0.05	1.587	0.114	-0.001	0.032	-0.039	0.969	0.002	0.032	0.047	0.962		
Education	-0.093	0.061	-1.526	0.128	-0.006	0.04	-0.16	0.873	-0.015	0.04	-0.386	0.7		
Occupation	0.016	0.042	0.368	0.713	0.007	0.027	0.267	0.79	0.008	0.027	0.307	0.759		
Controllability	0.694	0.044	15.743	0.000**	0.241	0.036	6.724	0.000**	0.206	0.039	5.286	0.000**		
Psychological distance					0.798	0.038	21.009	0.000**	0.794	0.038	21.033	0.000**		
Controllability*Psychological distance									-0.041	0.019	-2.179	0.030*		
R ²			0.474				0.779				0.783			
Adjust R ²			0.466				0.775				0.778			
F value			F(5,320)=57.765,p=0.000				F(6,319)=187.945,p=0.000				F(7,318)=163.666,p=0.000			
ΔR ²			0.474				0.305				0.003			
ΔF-value			F(5,320)=57.765,p=0.000				F(1,319)=441.373,p=0.000				F(1,318)=4.747,p=0.030			

Dependent variable: Willingness to use

*p<0.05**p<0.01

Table 21 demonstrates that there were three models involved in the analysis of mediating effects, which are as follows:

- Willingness to use = 0.139-0.035*gender-0.003*age - 0.005*education + 0.006*occupation - 0.043*controllability + 0.058*responsiveness - 0.055*interactivity + 0.353*bidirectionality + 0.305*individualization + 0.367*interest
- Happy emotion = 0.471 - 0.055*gender + 0.029*age - 0.026*education - 0.004*occupation - 0.028*controllability + 0.074*responsiveness - 0.075*interactivity + 0.392*bi-directionality + 0.219*personalisation + 0.349*interest

- Willingness to use = -0.076-0.010*gender-0.016*age + 0.007*education +0.007* occupation -0.031* controllability+0.024*responsiveness-0.020 *interactivity +0.173*bidirectionality+0.205*personalisation+0.207*interesting +0.458 *happy feelings

Table 22. Summary of intermediary effect size results

Item	Test Conclusion	c Total effect	a*b Intermediary effect	c' Direct effect	Calculation formula of effect ratio	Effect Ratio
Controllability=>Happy emotion=>Willingness to use	Insignificant mediated role	-0.043	-0.013	-0.031	-	0%
Responsiveness=>Happy emotion=>Willingness to use	Insignificant mediated role	0.058	0.034	0.024	-	0%
Interactivity=>Happy emotion=>Willingness to use	Insignificant mediated role	-0.055	-0.034	-0.02	-	0%
Bidirectionality=>Happy emotion=>Willingness to use	Partial mediated role	0.353	0.18	0.173	a * b / c	50.98%
Personalisation=>Happy emotion=>Willingness to use	Partial mediated role	0.305	0.101	0.205	a * b / c	32.97%
interestingness=>Happy emotion=>Willingness to use	Partial mediated role	0.367	0.16	0.207	a * b / c	43.58%

Table 23. The mediating role of control emotion

	Willingness to use				Control emotion				Willingness to use			
	B	SE.	t	p	B	SE.	t	p	B	SE.	t	p
Constants	0.139	0.27	0.516	0.606	0.258	0.253	1.022	0.308	0.046	0.255	0.179	0.858
Gender	-0.035	0.063	-0.563	0.574	0.002	0.059	0.028	0.978	-0.036	0.059	-0.607	0.544
Age	-0.003	0.034	-0.082	0.935	0.011	0.032	0.333	0.739	-0.007	0.032	-0.207	0.836
Education	-0.005	0.043	-0.125	0.901	0.003	0.04	0.086	0.931	-0.007	0.04	-0.163	0.87
Occupation	0.006	0.029	0.189	0.85	0.015	0.027	0.564	0.573	0	0.027	-0.003	0.998
Controllability	-0.043	0.054	-0.799	0.425	0.157**	0.051	3.084	0.002	-0.101	0.052	-1.932	0.054
Responsiveness	0.058	0.056	1.039	0.3	0.022	0.052	0.419	0.676	0.05	0.052	0.952	0.342
Interactivity	-0.055	0.077	-0.707	0.48	0.05	0.072	0.688	0.492	-0.073	0.073	-0.998	0.319
Bidirectionality	0.353**	0.071	4.949	0	0.065	0.067	0.97	0.333	0.329**	0.067	4.897	0
Personalisation	0.305**	0.052	5.836	0	0.299**	0.049	6.115	0	0.196**	0.052	3.771	0
interestingness	0.367**	0.065	5.688	0	0.353**	0.06	5.84	0	0.239**	0.064	3.734	0
Control emotion									0.363**	0.057	6.403	0
R ²	0.757				0.757				0.785			
Adjust R ²	0.749				0.749				0.777			
F-value	F (10,315)=98.047, p=0.000				F (10,315)=98.154, p=0.000				F (11,314)=104.177,p=0.000			

* p<0.05 ** p<0.01

Table 22 demonstrates that there were 3 models involved in the analysis of mediating effects, which are as follows.

- Willingness to use=0.139-0.035*gender-0.003*age -0.005*education+0.006*occupation-0.043*controllability +0.058* responsiveness -0.055*interactivity +0.353*bidirectionality +0.305*individualization+0.367*interest
- Control emotion = 0.258 + 0.002*gender + 0.011*age + 0.003*education + 0.015*occupation + 0.157*controllability + 0.022*responsiveness + 0.050* interactivity + 0.065*bidirectionality + 0.299* personalisation + 0.353*interestingness
- Willingness to use = 0.046 - 0.036*gender - 0.007*age - 0.007*education - 0.000*occupation - 0.101* controllability + 0.050*responsiveness - 0.073*interactivity + 0.329*bidirectionality + 0.196*personalisation + 0.239* interestingness + 0.363*control emotion

Table 24. Summary of results for mediating effect

Item	Test Conclusion	c Total effect	a*b Intermediary effect	c' Direct effect	Calculation formula of effect ratio	Effect Ratio
Controllability=>Control emotion=>Willingness to use	Fully mediated role	-0.043	0.057	-0.101	-	100%
Responsiveness=>Control emotion=>Willingness to use	Insignificant mediated role	0.058	0.008	0.05	-	0%
Interactivity=>Control emotion=>Willingness to use	Insignificant mediated role	-0.055	0.018	-0.073	-	0%
Bidirectionality=>Control emotion=>Willingness to use	Insignificant mediated role	0.353	0.023	0.329	-	0%
Personalisation=>Control emotion=>Willingness to use	Partial mediated role	0.305	0.109	0.196	a * b / c	35.61%
interestingness=>Control emotion=>Willingness to use	Partial mediated role	0.367	0.128	0.239	a * b / c	34.89%

4.6.4 Moderating effect of psychological distance

(1) Controllability

Table 25. Moderating effect of psychological distance (controllability)

	Results of analysis of moderation effects (n=326)											
	Model 1				Model 2				Model 3			
	B	SE.	t	p	B	SE.	t	p	B	SE.	t	p
Constants	5.941	0.262	22.647	0.000**	5.707	0.171	33.464	0.000**	5.724	0.17	33.725	0.000*
Gender	-0.222	0.089	-2.497	0.013*	-0.048	0.058	-0.817	0.415	-0.034	0.058	-0.577	0.564
Age	0.079	0.05	1.587	0.114	-0.001	0.032	-0.039	0.969	0.002	0.032	0.047	0.962
Education	-0.093	0.061	-1.526	0.128	-0.006	0.04	-0.16	0.873	-0.015	0.04	-0.386	0.7
Occupation	0.016	0.042	0.368	0.713	0.007	0.027	0.267	0.79	0.008	0.027	0.307	0.759
Controllability	0.694	0.044	15.743	0.000**	0.241	0.036	6.724	0.000**	0.206	0.039	5.286	0.000*
Psycho-					0.798	0.038	21.009	0.000**	0.794	0.038	21.033	0.000*

logical distance				*
Control-lability*Psychological distance			-0.041 0.019 -2.179	0.030*
R ²	0.474	0.779		0.783
Adjust R ²	0.466	0.775		0.778
F value	<i>F</i> (5,320)=57.765, <i>p</i> =0.000	<i>F</i> (6,319)=187.945, <i>p</i> =0.000		<i>F</i> (7,318)=163.666, <i>p</i> =0.000
ΔR ²	0.474	0.305		0.003
ΔF-value	<i>F</i> (5,320)=57.765, <i>p</i> =0.000	<i>F</i> (1,319)=441.373, <i>p</i> =0.000		<i>F</i> (1,318)=4.747, <i>p</i> =0.030

Dependent variable: willingness to use

p*<0.05*p*<0.01

Model 1 includes the independent variable (control) and four control variables, including gender, age, education, and occupation. Model 2 adds the moderator variable (psychological distance) to model 1, and model 3 adds the interaction term (the product of the independent variable and the moderator variable) to model 2.

For model 1, the purpose was to investigate the effect of the independent variable (controllability) on the dependent variable (willingness to use) when the interference of the moderating variable (psychological distance) is not considered. Table 24 above demonstrated that the independent variable (controllability) showed significance (*t*=15.743, *p*=0.000<0.05). This means that controllability can have a significant effect relationship on the willingness to use consistently. The moderating effect can be viewed in two ways: the first is to view the significance of the change in F-value when going from model 2 to model 3; and the second is to view the significance of the interaction term in model 3. This time, the moderating effect is analyzed in the second way.

Table 24 above likewise demonstrated that the interaction term between control and psychological distance showed significance (*t*=-2.179, *p*=0.030<0.05). This means that the magnitude of the moderating variable (psychological distance) has a significant difference at different levels when it comes to the effect of control on the willingness to use consistently. This is shown in Table 26 below.

Table 26. Controllability simple slope analysis (psychological distance moderating effect)

Adjustment of variable levels	Regression coefficient	SE.	t	p	95% CI	
Mean value	0.206	0.039	5.286	0	0.13	0.283
High level (+1SD)	0.166	0.05	3.335	0.001	0.068	0.263
Low level (-1SD)	0.247	0.036	6.911	0	0.177	0.317

(2) Responsiveness

Table 27. Results of the analysis of the moderating effect of psychological distance (responsiveness) moderating effect (n=326)

	Model 1				Model 2				Model 3			
	B	SE.	t	p	B	SE.	t	p	B	SE.	t	p
Con- stants	5.663	0.245	23.16	0.000**	5.622	0.173	32.433	0.000**	5.642	0.174	32.436	0.000**
Gender	-0.133	0.083	-1.602	0.11	-0.029	0.059	-0.489	0.625	-0.018	0.06	-0.308	0.758

Age	0.066	0.046	1.421	0.156	0.002	0.033	0.058	0.953	0.002	0.033	0.073	0.942		
Educa- tion	-0.067	0.057	-1.18	0.239	-0.004	0.041	-0.101	0.92	-0.009	0.041	-0.214	0.831		
Occupa- tion	0.064	0.039	1.634	0.103	0.025	0.028	0.888	0.375	0.023	0.028	0.819	0.413		
Respon- siveness	0.731	0.04	18.293	0.000**	0.228	0.04	5.711	0.000**	0.205	0.044	4.662	0.000**		
Psycho- logical distance					0.776	0.044	17.825	0.000**	0.777	0.044	17.865	0.000**		
Respon- sive- ness*Psy- chologi- cal dis- tance									-0.028	0.023	-1.242	0.215		
R^2			0.544				0.772				0.773			
Adjust R^2			0.537				0.767				0.768			
F-value			$F(5,320)=76.380,p=0.000$					$F(6,319)=179.609,p=0.000$					$F(7,318)=154.433,p=0.000$	
ΔR^2			0.544					0.228					0.001	
ΔF -value			$F(5,320)=76.380,p=0.000$					$F(1,319)=317.744,p=0.000$					$F(1,318)=1.542,p=0.215$	

Dependent variable: willingness to use

* $p<0.05$ ** $p<0.01$

Model 1 includes the independent variable (responsiveness) and four control variables, including gender, age, education, and occupation. Model 2 adds the moderating variable (psychological distance) to model 1, and model 3 adds the interaction term (the product of the independent variable and the moderating variable) to model 2.

For model 1, the purpose was to investigate the effect of the independent variable (responsiveness) on the dependent variable (willingness to use), when the interference of the moderating variable (psychological distance) is not considered. Table 27 above demonstrates that the independent variable (responsiveness) showed significance ($t=18.293, p=0.000<0.05$). This means that responsiveness has a significant effect relationship on the willingness to continue using. The moderating effect can be viewed in two ways: the first is to view the significance of the change in F-value when going from model 2 to model 3; the second is to view the significance of the interaction term in model 3, and in this study, the moderating effect is analyzed in the second way.

Table 27 above likewise demonstrates that the interaction term between responsiveness and psychological distance does not show significance ($t=-1.242, p=0.215>0.05$). From Model 1, X produces an impact relationship for Y. This implies that the magnitude of the moderating variable (psychological distance) remains consistent at different levels when responsiveness has an impact on the willingness to continue using.

(3) Interactivity

Table 28. Results of the analysis of the moderating effect of psychological distance (interactivity) moderating effect (n=326)

	Model 1				Model 2				Model 3			
	B	SE.	t	p	B	SE.	t	p	B	SE.	t	p
Con- stants	5.572	0.237	23.48	0.000**	5.585	0.169	33.106	0.000**	5.614	0.168	33.381	0.000**

Gender	-0.041	0.081	-0.506	0.613	0.005	0.058	0.086	0.931	0.025	0.058	0.424	0.672
Age	0.029	0.045	0.645	0.519	-0.012	0.032	-0.363	0.717	-0.01	0.032	-0.326	0.745
Educa- tion	-0.005	0.056	-0.088	0.93	0.019	0.04	0.47	0.638	0.008	0.04	0.197	0.844
Occupa- tion	0.023	0.038	0.598	0.55	0.011	0.027	0.425	0.671	0.011	0.027	0.426	0.671
Interac- tivity	0.78	0.04	19.402	0.000**	0.29	0.04	7.276	0.000**	0.264	0.041	6.417	0.000**
Psycho- logical distance					0.74	0.042	17.724	0.000**	0.73	0.042	17.501	0.000**
Interac- tivity*Psych ological distance									-0.047	0.021	-2.219	0.027*
R^2	0.571				0.784				0.787			
Adjust R^2	0.565				0.78				0.783			
F-value	$F(5,320)=85.338,p=0.000$				$F(6,319)=193.066,p=0.000$				$F(7,318)=168.225,p=0.000$			
ΔR^2	0.571				0.213				0.003			
ΔF -valu e	$F(5,320)=85.338,p=0.000$				$F(1,319)=314.150,p=0.000$				$F(1,318)=4.924,p=0.027$			
Dependent variable: willingness to use												
* $p<0.05$ ** $p<0.01$												

Model 1 includes the independent variable (Interactivity) and four control variables, including gender, age, education, and occupation. Model 2 adds the moderating variable (psychological distance) to model 1, and model 3 adds the interaction term (the product of the independent variable and the moderating variable) to model 2.

For model 1, the purpose was to investigate the effect of the independent variable (responsiveness) on the dependent variable (willingness to use) when the interference of the moderating variable (psychological distance) is not considered. Table 28 above demonstrates that the interaction term between mutuality and psychological distance showed significance ($t=-2.219$, $p=0.027<0.05$). This means that the moderating variable (psychological distance) has a significant difference in the magnitude of effect at different levels when it comes to the effect of interactivity on the willingness to use. This is shown in Table 29 below.

Table 29. Interactivity simple slope analysis (psychological distance moderating effect)

Adjustment of variable levels	Regression coefficient	SE.	t	p	95% CI	
Mean value	0.264	0.041	6.417	0	0.183	0.345
High level (+1SD)	0.218	0.051	4.268	0	0.118	0.318
Low level (-1SD)	0.31	0.041	7.636	0	0.231	0.39

(4) Bidirectionality

Table 30. Results of the analysis of the moderating effect of psychological distance (bidirectionality) on the moderating effect (n=326)

	Model 1				Model 2				Model 3			
	B	SE.	t	p	B	SE.	t	p	B	SE.	t	p
Con- stants	5.845	0.219	26.744	0.000**	5.695	0.171	33.289	0.000**	5.73	0.171	33.553	0.000**
Gender	-0.142	0.074	-1.912	0.057	-0.044	0.058	-0.755	0.451	-0.024	0.059	-0.405	0.686
Age	0.011	0.042	0.267	0.79	-0.011	0.033	-0.331	0.741	-0.011	0.032	-0.339	0.735
Educa- tion	-0.025	0.051	-0.488	0.626	0.004	0.04	0.109	0.913	-0.007	0.04	-0.169	0.866
Occupa- tion	0.013	0.035	0.385	0.701	0.01	0.027	0.36	0.719	0.01	0.027	0.371	0.711
Bidirec- tionality	0.813	0.036	22.311	0.000**	0.299	0.046	6.522	0.000**	0.281	0.046	6.079	0.000**
Psycho- logical distance					0.701	0.049	14.321	0.000**	0.684	0.049	13.866	0.000**
Bidirec- tionality*Psych ological distance									-0.045	0.021	-2.211	0.028*
<i>R</i> ²		0.635				0.778				0.781		
Adjust <i>R</i> ²		0.629				0.774				0.776		
F-value		<i>F</i> (5,320)=111.365, <i>p</i> =0.000				<i>F</i> (6,319)=186.175, <i>p</i> =0.000				<i>F</i> (7,318)=162.222, <i>p</i> =0.000		
ΔR^2		0.635				0.143				0.003		
ΔF -value		<i>F</i> (5,320)=111.365, <i>p</i> =0.000				<i>F</i> (1,319)=205.090, <i>p</i> =0.000				<i>F</i> (1,318)=4.889, <i>p</i> =0.028		

Dependent variable: willingness to use

p*<0.05*p*<0.01

Model 1 includes the independent variable (bidirectionality) and four control variables, including gender, age, education, and occupation. Model 2 adds the moderating variable (psychological distance) to model 1, and model 3 adds the interaction term (the product of the independent variable and the moderating variable) to model 2.

For model 1, the purpose was to investigate the effect of the independent variable (bidirectionality) on the dependent variable (willingness to use) when the interference of the moderating variable (psychological distance) is not considered. Table 30 above demonstrates that the independent variable (bidirectionality) showed significance ($t=22.311$, $p=0.000<0.05$). This means that bidirectionality has a significant effect relationship on the willingness to use consistently. The moderating effect can be viewed in two ways: the first is to view the significance of the change in F-value when going from model 2 to model 3; the second is to view the significance of the interaction term in model 3, and in this study, the moderating effect is analyzed in the second way.

Table 30 above demonstrates that the interaction term of bidirectionality and psychological distance showed significance ($t=-2.211$, $p=0.028<0.05$). This means that the magnitude of the moderating variable (psychological distance) has a significant difference at different levels when it comes to the effect of bidirectionality on the willingness to use consistently. This is shown in Table 31 below.

Table 31. Bidirectionality simple slope analysis (psychological distance moderating effect)

Adjustment of variable levels	Regression coefficient	SE.	t	p	95% CI	
Mean value	0.281	0.046	6.079	0	0.191	0.372
High level (+1SD)	0.237	0.054	4.415	0	0.132	0.342
Low level (-1SD)	0.326	0.047	6.91	0	0.233	0.418

(5) Personalisation

Table 32. Results of the analysis of the moderating effect of psychological distance (personalisation) moderating effect (n=326)

	Model 1				Model 2				Model 3			
	B	SE.	t	p	B	SE.	t	p	B	SE.	t	p
Constants	5.589	0.217	25.711	0.000**	5.594	0.166	33.675	0.000**	5.64	0.167	33.705	0.000**
Gender	-0.065	0.074	-0.879	0.38	-0.011	0.057	-0.196	0.845	-0.001	0.057	-0.019	0.985
Age	0.042	0.041	1.023	0.307	-0.002	0.032	-0.052	0.959	-0.004	0.031	-0.14	0.889
Education	-0.009	0.051	-0.169	0.866	0.014	0.039	0.353	0.724	0.006	0.039	0.154	0.878
Occupation	0.019	0.035	0.547	0.585	0.011	0.027	0.42	0.675	0.01	0.027	0.366	0.714
Personalisation	0.794	0.035	22.561	0.000**	0.328	0.041	8.016	0.000**	0.302	0.043	7.02	0.000**
Psychological distance					0.68	0.045	15.135	0.000**	0.677	0.045	15.119	0.000**
Personalisation*Psychological distance									-0.037	0.02	-1.858	0.064
R^2	0.64				0.79				0.793			
Adjust R^2	0.634				0.787				0.788			
F-value	$F(5,320)=113.764,p=0.000$				$F(6,319)=200.552,p=0.000$				$F(7,318)=173.715,p=0.000$			
ΔR^2	0.64				0.15				0.002			
ΔF -value	$F(5,320)=113.764,p=0.000$				$F(1,319)=229.073,p=0.000$				$F(1,318)=3.451,p=0.064$			

Dependent variable: willingness to use

* $p<0.05$ ** $p<0.01$

Model 1 includes the independent variable (personalisation) and four control variables, including gender, age, education, and occupation. Model 2 adds the moderating variable (psychological distance) to model 1, and model 3 adds the interaction term (the product of the independent variable and the moderating variable) to model 2.

For model 1, the purpose was to investigate the effect of the independent variable (personalisation) on the dependent variable (willingness to use) without the interference of the moderating variable (psychological distance). Table 32 above demonstrates that the independent variable (personalisation) showed significance ($t=22.561$, $p=0.000<0.05$). This means that personalisation has a significant effect relationship on the willingness to use. The moderating effect can be viewed in two ways: the first is to view the significance of the change in F-value from model 2 to model 3; the second is to view the significance of the interaction term in model 3, and in this study, the moderating effect is analyzed in the second way.

Table 32 above demonstrates that the interaction term between personalisation and psychological distance does not show significance ($t=-1.858$, $p=0.064>0.05$). Model 1 demonstrates that X has an impact relationship for Y. This implies that the magnitude of the moderating variable (psychological distance) remains consistent at different levels when personalisation has an impact on the intention of consumers to continue using.

4.6.5 Interestingness

Table 33. Results of the analysis of the moderating effect of psychological distance (interestingness) on the moderating effect (n=326)

	Model 1			Model 2			Model 3			p		
	B	SE.	t	B	SE.	t	B	SE.	t			
Constants	5.728	0.207	27.628	0.000**	5.656	0.166	34.031	0.000**	5.676	0.167	33.968	0.000**
Gender	-0.018	0.071	-0.256	0.798	0.004	0.057	0.062	0.95	0.011	0.057	0.192	0.848
Age	0.02	0.039	0.505	0.614	-0.007	0.032	-0.235	0.815	-0.007	0.032	-0.234	0.815
Education	-0.047	0.048	-0.981	0.327	-0.006	0.039	-0.15	0.881	-0.011	0.039	-0.273	0.785
Occupation	-0.002	0.033	-0.052	0.958	0.003	0.027	0.115	0.908	0.003	0.027	0.109	0.913
interestingness	0.901	0.037	24.277	0.000**	0.386	0.049	7.956	0.000**	0.364	0.052	6.942	0.000**
Psychological distance					0.647	0.048	13.393	0.000**	0.65	0.048	13.441	0.000**
interestingness*Psychological distance									-0.024	0.022	-1.119	0.264
R^2		0.672				0.79				0.791		
Adjust R^2		0.667				0.786				0.786		
F-value		$F(5,320)=131.006,p=0.000$				$F(6,319)=199.917,p=0.000$				$F(7,318)=171.672,p=0.000$		
ΔR^2		0.672				0.118				0.001		
ΔF -value		$F(5,320)=131.006,p=0.000$				$F(1,319)=179.365,p=0.000$				$F(1,318)=1.252,p=0.264$		
Dependent variable: willingness to use												
* $p<0.05$ ** $p<0.01$												

Table 33 demonstrates that the moderating effect is divided into three models: Model 1 includes the independent variable (interestingness) and four control variables, including gender, age, education, and occupation. Model 2 adds the moderating variable (psychological distance) to Model 1, and Model 3 adds the interaction term (the product of the independent variable and the moderating variable) to Model 2.

For model 1, the purpose was to investigate the effect of the independent variable (interestingness) on the dependent variable (willingness to use) when the interference of the moderating variable (psychological distance) is not considered. Table 33 above demonstrates that the independent variable (interestingness) showed significance ($t=24.277$, $p=0.000<0.05$). This means that interestingness can have a significant effect relationship on the willingness to use consistently. The moderating effect can be viewed in two ways: the first is to view the significance of the change in F-value from model 2 to model 3; the second is to view the significance of the interaction term in model 3, and in this study, the moderating effect is analyzed in the second way.

Table 33 demonstrates that the interaction term between fun and psychological distance does not show significance ($t=-1.119$, $p=0.264>0.05$). Model 1 demonstrates that X has an impact relationship for Y. This implies that the moderating variable (psychological distance) remains consistent in magnitude at different levels when fun has an impact on the willingness of consumers to continue using.

4.7 Validation of hypotheses

Table 34. Summary of hypothesis validation results

No.	Research hypothesis	Test results
H1	Controllability has a significant positive effect on happy emotion.	Invalidated
H2	Responsiveness has a significant positive effect on happy emotion.	Invalidated
H3	Interactivity has a significant positive effect on happy emotion.	Invalidated
H4	Bidirectionality has a significant positive effect on happy emotion.	Validated
H5	Personalisation has a significant positive effect on happy emotion.	Validated
H6	Interestingness has a significant positive effect on happy emotion.	Validated
H7	Controllability has a significant negative effect on control emotion.	Invalidated
H8	Responsiveness has a significant negative effect on control emotion.	Invalidated
H9	Interactivity has a significant negative effect on control emotion.	Invalidated
H10	Bidirectionality has a significant negative effect on control emotions.	Invalidated
H11	Personalisation has a significant negative effect on controllability.	Invalidated
H12	Interestingness has a significant negative effect on control emotions.	Invalidated
H13	Happy emotion has a significant positive effect on willingness to use.	Validated
H14	Control emotion has a significant negative effect on willingness to use.	Invalidated

5. Conclusion

This study has explored the impact of human-machine interaction on users' willingness to continue using smart vending machines, from the perspective of human-machine interaction. By establishing its research model on relevant findings from previous literature, valid hypotheses were postulate. Emotional responses (happy emotion and control emotion) were added as mediating variables and psychological distance were added as moderating variables. The conclusions of this study were therefore reached through empirical evidence.

Firstly, bidirectionality, personalisation, and interestingness have a significant positive effect on happy emotions, but controllability, responsiveness, and interactivity do not influence happy emotions. Controllability, personalisation, and fun are likely to have a significant positive influence relationship on control emotions, but bidirectionality, responsiveness, and interactivity are unlikely to have an influence relationship on control emotion.

Secondly, happy emotions do not have a significant mediating effect on control, responsiveness, and interactivity, and play only a partially mediating role in bidirectionality, personalisation, and interestingness. Control emotions play a fully mediated role on control, an insignificant role on responsiveness, interactivity, and bidirectionality; and a partially significant role on personalisation and interestingness.

Thirdly, the interaction of controllability, instructiveness, and bidirectionality with psychological distance showed significance, but the moderating effect of psychological distance on responsiveness, personalisation, and interestingness did not show significance.

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