Effect of Interaction Effects Between Visual and Auditory Signs on Consumer Purchasing Behavior Based on AISAS Model

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Article

Effect of Interaction Effects Between Visual and Auditory Signs on Consumer Purchasing Behavior Based on AISAS Model

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Abstract: This study, based on the AISAS model, explores the impact of the interaction effect between visual and auditory signals on consumer purchase behavior. Using experimental methods, 120 participants were randomly assigned to four different visual and auditory signal combinations, and their purchase intentions and actual purchase behavior were measured. The results show that the interaction effect between visual and auditory signals has a significant impact on both purchase intentions and actual purchase behavior, and there is a significant positive relationship. Specifically, when visual and auditory signals are mutually consistent, consumers have the highest purchase intentions and actual purchase behavior; when both visual and auditory signals are absent, consumers have the lowest purchase intentions and actual purchase behavior; when either the visual or auditory signal is missing, consumers' purchase intentions and actual purchase behavior are in between the two extremes. This study provides a new perspective for understanding consumers' decision-making processes in multi-sensory environments and offers valuable insights for the development of marketing strategies.

Keywords: visual signal; auditory signal; interaction effect; purchase behavior; AISAS model

1. Introduction

Consumer purchasing behavior is one of the core topics in marketing and the foundation for companies to develop effective market strategies. Consumer purchasing behavior is influenced by various factors, one of which is sensory stimulation. Sensory stimulation refers to the visual, auditory, olfactory, gustatory, and tactile information related to products or services that consumers encounter during the purchasing process, which can affect consumers' cognition, emotion, and behavioral responses [1]. In today's market environment, consumers often face multiple sensory stimuli simultaneously. For example, in a shopping mall, consumers not only see the appearance, color, and shape of various products but also hear background music, broadcasts, and the voices of other customers. The relationship between these sensory stimuli may be consistent or conflicting, resulting in different interactive effects. Interactive effects refer to the phenomenon in which two or more sensory stimuli interact or enhance each other, which can change consumers' evaluation and response to a single sensory stimulus [2].

2. Literature Review

In terms of consumer purchasing behavior, Aflaki et al. [3] found that the multi-period pricing of forward-looking, strategic consumer purchasing behavior has recently received significant research attention. However, whether consumers actually benefit from this behavior and voluntarily choose to become strategic consumers has not been considered. Studies have shown that if consumers become strategic consumers, the surplus value of many consumers will be lower than that of myopic consumers [4]. Chen et al. [5] explored the economic performance of social media in marketing

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information and consumer participation. Using data collected from Weibo and Maoyan, they analyzed the relationship between marketing information, consumer participation, and movie ticket sales. The results showed that marketing information on Weibo has a positive impact on box office revenue, while consumer participation behavior (whether individual participation or interactive participation) does not affect box office revenue. With the growing environmental issues, green supply chain management (GSCM) as an element of corporate competitive advantage is gaining attention. Lee et al. [6] examined internal GSCM practices and demonstrated how they affect the end of the supply chain from the perspective of the ultimate consumer. The theme of Troudi et al. [7] has two aspects: first, to verify the applicability of rational behavior theory in analyzing consumer behavior in the Algerian context; second, to identify and analyze the factors that affect the purchase behavior of the green food sector. The authors proposed a model based on rational behavior theory, which combines two types of variables, namely green marketing type and personal type, to predict the purchase behavior of green food. Gu et al. [8] aimed to develop a methodology for evaluating the relationship and degree of influence among factors that activate online consumer purchasing behavior in the context of the COVID-19 pandemic. The purpose of Barčić et al. [9] was to identify and compare furniture consumers' purchasing behavior during the COVID-19 pandemic. Hall et al. [10] used data from the Christchurch area of New Zealand to study consumer purchasing behavior, retail expenditure, and transaction data in different retail industries from January 2017 to December 2020. Zhu et al. [11] proposed development suggestions for food delivery platforms, using energy-efficient appliance (EEA) to reduce the harmful environmental impact from the perspective of consumer behavior. Harun et al. [12] studied consumer purchasing behavior of EEA based on the theory of planned behavior (TPB), environmental factors, and energy-efficient behavior (EEB) assessment. Yang et al. [13] explored the impact of brand knowledge and brand relationships on current and future consumer purchasing behavior by proposing a conceptual model. The results showed that brand awareness directly affects current purchasing behavior but does not directly affect future purchasing behavior; brand awareness affects future purchasing behavior through brand relationships, and countermeasures were proposed from four aspects: product quality, service concept, brand image, and consumer experience. Feng, J. [14] reviewed the relevant research literature on purchasing intention at home and abroad, summarized the connotation of purchasing intention and its relationship with purchasing behavior, the theoretical basis and methods of purchasing intention research, the influencing factors of purchasing intention, and the calculation methods, and proposed suggestions for the study of consumer behavior in China. Hou, H. [15] reviewed online word-of-mouth and related concepts, analyzed the impact of online word-of-mouth quality, quantity, credibility, and content characteristics on consumer purchasing intention, and pointed out the shortcomings of existing research and future research directions. Online word-of-mouth has gradually become an important factor affecting consumer purchasing behavior, and has a significant impact on consumer purchasing behavior. Mo et al. [16] explored the impact of review quality and timeliness on purchase decisions based on the ELM model, and analyzed the marginal paths of review quantity, reviewer credibility, and network environment cognition. The results showed that review credibility is a key factor affecting purchase decisions, and trust tendency moderate consumers' perception of the credibility of high-quality reviews. Li et al. [17] conducted an empirical analysis of the factors influencing the purchasing behavior of e-commerce consumers of meat products using a binary logistic model. The results showed that age, household income, product information language intensity, product quality perception, platform service quality, logistics convenience, and meat brand reputation are the key factors affecting purchasing behavior. The industry should strengthen industry regulation, establish product traceability systems, improve relevant regulations and systems, effectively protect consumer rights and interests, pay attention to market segmentation and category innovation, and implement category strategies.

This study adopts the AISAS model as the theoretical framework. The AISAS model consists of five stages: Attention, Interest, Search, Action, and Share. The Attention stage refers to consumers' attention to a particular product or service; the Interest stage refers to consumers' interest in a particular product or service; the Search stage refers to consumers' search for relevant product or

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service information; the Action stage refers to consumers' purchase or reservation of a particular product or service; the Share stage refers to consumers' sharing of their purchase experience or evaluation with others. This study proposes that the cross-modal interaction effects of sensory signals may affect consumers' responses at each stage of the AISAS model, thereby influencing their final purchasing behavior.

Following is the AISAS model diagram:

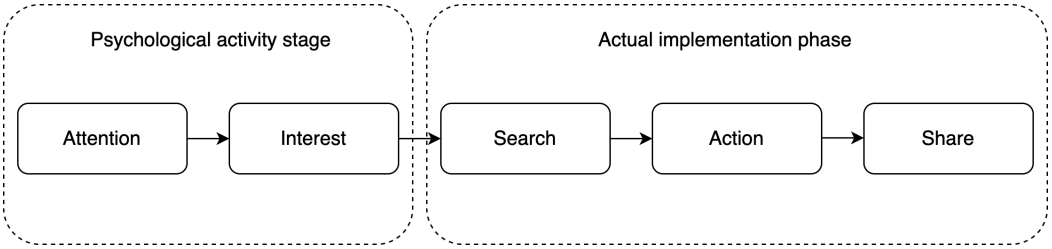

Figure 1. AISAS model diagram in Fig.

In the field of the AISAS model, Kuang [18] studied hotel consumer behavior by analyzing the formation and development of the AISAS model and proposed targeted solutions to current problems in hotel electronic marketing. Shao et al. [19] proposed an AISAS model to describe the complex processes of amplification, attenuation, and other effects in marketing and studied the use of influence and follower numbers as indicators in Weibo marketing. Wang et al. [20] conducted a case study of Chinese Sina Weibo to investigate consumer behavior mechanisms in Weibo marketing using the AISAS model, based on a comprehensive review of contemporary literature. Italia et al. [21] described the development of the AISAS model as a marketing communication tool in the digital age consumer journey towards social media. Rini et al. [22] explained that the AISAS model is a development of the AIDA model (Attention, Interest, Desire, and Action) widely used in social media and other media advertising, tailored to the characteristics of the internet age and modern consumers. Wang [23] summarized the related models of social media marketing by integrating relevant literature, such as the effective social marketing model that combines creativity, recommendation, interaction, and feedback, and the social media marketing model based on the AIDMA and AISAS models: Attention, Interest, Search, Relationship, Action, and Share. Jun-Hwa et al. [24] used the AISAS model to evaluate the impact of two promotion methods, celebrity endorsement advertising and self-promotion, on customer decision-making. Abdurrahim et al. [25] developed an AISAS model to examine the effect of promoting tourism destinations on social media to understand the relationships between verbs. Huang Xiaomeng and Yunfu Huo [26] esearch proposed evolutionary game model of merchants, opinion leaders, and consumers in the social e-commerce marketing environment. Nurjanah et al. [27] studied the influence of E-marketing and the AISAS model on mutual fund investment decisions. He et al. [28] analyzed online shopping consumer characteristics based on the AISAS model, taking the consumer decision-making process as a clue, and analyzed from four dimensions: demand awakening ability, search, consumption experience, and after-sales guarantee, providing reference opinions for e-commerce marketing. Wang [29] used communication theory, literature, and data analysis methods, combined with the 3Vs model, to re-interpret and construct the AISAS model. Yao [30] explored the suitability and consumer behavior characteristics of catering enterprises in Weibo marketing based on the AISAS model and proposed catering enterprise Weibo marketing strategies based on the AISAS model. Wang et al. [31] analyzed the transformation of the consumer behavior model from AIDMA to AISAS and pointed out that the tourism destination marketing system must adapt to the changing consumer behavior patterns on the internet, based on the marketing concept of consumer-centricity, constructing network marketing communication content based on the AISAS model to form a communication structure centered on tourists. Liu [32] conducted an analysis of WeChat users using the AISAS model, and suggested that triggering user attention, stimulating interest, guiding search and generating action, and finally encouraging user sharing and dissemination are possible breakthrough approaches. Other influential studies include sumerta and Meryawan [33].

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This study also focuses on the interaction effects between visual and auditory signals. Zhong et al. [34] argue that visual and auditory signals are the most common and important types of sensory stimuli, which dominate in marketing communication. Seiwerth et al. [35] researched the impact of auditory cues on vestibulo-spinal coordination and gained insight into the mechanisms of audio-vestibular interactions. It is still unclear whether irregular rhythms would have similar effects on visual timing processing, what information is extracted from the auditory sequence to influence visual timing, and how auditory and visual timing rates are integrated quantitatively. Chen et al. [36] studied a group of task-irrelevant auditory sequences' influence on "Ternus apparent motion": collective motion and element motion through evaluation and modeling. Yoganathan et al. [37] studied the sensory stimuli for rational consumption: the multisensory marketing strategy of ethical brands. In the face of fierce competition and resource scarcity, as well as a lack of functional superiority, ethical brands may seek experiential online marketing methods. Tang et al. [38] adopted an exogenous spatial cueing paradigm and manipulated the modality of the target, including visual, auditory, or audio-visual modalities. Recently, it has been shown that the quantity between action and perception is shared because the number of subsequent visual stimuli presented around the action occurrence area is affected by the number of self-generated action repetitions. Togoli et al. [39] investigated whether the interaction between action and perception depends on visual input and visual experience. Sirico et al. [40] studied the effects of video observation/motor imagery (VO/MI) on simple reaction time to visual and auditory stimuli. Ha et al. [41] explored whether more biologically diverse green spaces have greater restorative effects compared to traditional lawns in campus environments. Gong et al. [42] studied cross-modal interactions and integration through stimulus-specific adaptation in the thalamic reticular nucleus of rats, which is considered a central hub of multisensory neurons in the attention system. McClure et al. [43] used V1 calcium imaging to determine the effect of sound on active visual processing during a sound-visual task in mice. Peng et al. [44] investigated the effect of additional auditory signals on pedestrian perception of auditory traffic signals, showing that multisensory integration effects exist in auditory traffic signals and that the red signal is more attention-grabbing than the green signal, and additional auditory signals can influence individual response biases. Zhang et al. [45] used fMRI to investigate the neural mechanisms underlying cross-modal emotion perception, finding that the left inferior frontal gyrus is a common pathway for audiovisual cross-modal emotion perception, especially for negative emotions, and that the right superior temporal sulcus and fusiform face area play an important role in perceiving facial expressions of different emotional valence and positivity/negativity. Pan et al. [46] argued that hearing has an advantage in rhythm perception, and that there is interaction between visual and tactile channels in rhythm perception, and that visual rhythm perception can be enhanced by adding motion information and enhancing experience, and that rhythmic stimuli can regulate attention synchronization, and that the integration of hearing and touch channels can be used for advanced processing. Chen et al. [47] found that when audiovisual information is presented simultaneously, visual information may be processed first, influencing the integration of audiovisual emotional information, especially when faces have positive expressions. When faces have negative expressions, semantic cues affect audiovisual emotional information relationship judgment faster than prosodic cues. Lü et al. [48] argued that audiovisual arts influence each other, learn from each other, and create art effects that are far greater than single presentations, forming a powerful artistic contagion. Other influential studies include Sit et al. [49] suggested that audio-visual integration provides higher learning outcomes compared to pictorial learning media.

The above three aspects of research are relatively mature, but there are not many studies that comprehensively investigate all three aspects or even two aspects together. Ivanova et al. [50] studied the impact of generational effects on responsible consumer behavior. Sharma et al. [51] proposed a research framework to investigate the interaction effects of product attributes on environmental concern, green purchase intention, and a series of green purchase adoption patterns. Yoganathan et al. [52] studied sensory stimulation in affective consumption: multi-sensory marketing of ethical brand e-retail. In the context of intense competition, limited resources, and lack of functional advantages, ethical brands may seek experiential methods in online marketing. Achen [53]

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reexamined a model that measures the impact of interactions between Facebook interactions with favorite sports teams on relationship quality, purchase intention, and referral intention of fans. Chang et al. [54] used a consumer decision-making model to establish a research framework for identifying consumer purchasing behavior in social media environments. Kujur et al.[55] proposed a theoretical model that elaborates how visual communication through consumer participation on enterprise social networking sites affects the relationship between consumers and brands. Ata et al. [56] studied the effect of life satisfaction on impulse buying behavior and online purchases, using a convenience sampling method. This study built an evolutionary game model for the limited rational behavior of participants in social e-commerce, analyzed the behavioral interactions and strategic choice mechanisms between business choices of opinion leaders, product recommendations, and consumer purchasing decisions, and further conducted numerical simulations. Khalid [57] investigated the purchase intention and entrepreneurial insight of organic food consumption during the COVID-19 pandemic in Thailand. Ma, Y. [58] analyzed H5 advertising based on the classic AISAS model and provided suggestions, using millennials as the research subjects. H5 advertising has advantages in attention, interest, and sharing, but user purchase intentions are relatively low in the process from cognition to action. Yu [59] studied the impact of scene technology power and service scenario construction on customer sensory perception and behavioral intentions in the mobile internet environment. It was found that scene information can effectively influence customer psychology and behavioral intentions, improving enterprise market performance. Other influential studies include Cheung et al. [60].

In summary, through a literature review on consumer purchasing behavior, AISAS model, and the interactive effects between visual and auditory signals, it is found that there are few studies that integrate the three aspects mentioned above. Therefore, this study adopts an experimental approach to explore the impact of the interaction effects between visual and auditory signals on consumer purchase intention and actual purchasing behavior, as well as the role of the AISAS model in explaining this impact.

3. Research Questions and Hypotheses

The purpose of this study is to investigate the effects of the interaction between visual and auditory signals on consumer purchasing behavior, as well as the role of the AISAS model in explaining this effect. The following research questions and hypotheses are proposed:

Research Question 1: What are the effects of the interaction between visual and auditory signals on consumer purchase intention and actual purchasing behavior?

- Hypothesis 1a: When visual and auditory signals are mutually consistent, consumers' purchase intention and actual purchasing behavior are higher than when visual and auditory signals conflict with each other.
- Hypothesis 1b: When both visual and auditory signals disappear, consumers' purchase intention and actual purchasing behavior are the lowest, while in other situations, the effects lie in between.

Research Question 2: How does the AISAS model explain the effects of the interaction between visual and auditory signals on consumer purchasing behavior?

- Hypothesis 2a: The interaction between visual and auditory signals has a significant impact on consumers' reactions in each stage of the AISAS model.
- Hypothesis 2b: Consumers' reactions in each stage of the AISAS model have a significant impact on their purchase intention and actual purchasing behavior.

This study contributes to the existing literature in the following ways: First, it expands the research scope of sensory marketing from single sensory stimulation to multi-sensory stimulation, from static stimulation to dynamic stimulation, and from physical environment to online environment. Second, this study adopts the AISAS model as a theoretical framework, integrating sensory stimulation with the consumer purchasing process, providing a more comprehensive and systematic analysis approach. Third, this study not only examines the effects of sensory stimulation on consumer purchase intention but also examines its effects on actual purchasing behavior, filling

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an important gap in the existing literature. Fourth, this study provides useful insights for marketing practice, guiding companies on how to use the interaction between visual and auditory signals to increase consumers' purchase intention and actual purchasing behavior.

4. Methods

The study employed an experimental method, randomly assigning participants to four different visual and auditory signal combination conditions, and measuring their purchase intention and actual purchasing behavior.

4.1. Experimental Design

This study used a 2x2 factorial design, with two factors being visual signal (present vs. absent) and auditory signal (present vs. absent). Visual signal refers to images related to a product, while auditory signal refers to sounds related to a product. There may be a consistent or conflicting relationship between the two types of signals. Consistent situations refer to cases where both signals convey the same product information or emotion. For example, an image shows a happy person using a product, while a voice plays a happy speech or music. Conflicting situations refer to cases where the signals convey opposite or unrelated product information or emotion. For example, an image shows a sad person using a product, while a voice plays a happy speech or music. This study selected four different types of products as experimental materials, namely mobile phones, computers, cosmetics, and drinks. Each product has two different combinations of visual and auditory signals, one consistent and one conflicting. Therefore, there are 16 experimental conditions in total (4 products x 2 visual signals x 2 auditory signals). Each experimental condition has a webpage as experimental material, which displays the corresponding visual and auditory signals, as well as a purchase button and a share button. Webpages were chosen as experimental materials, and purchase and share buttons were chosen as experimental tools because they represent the action and sharing stages in the AISAS model.

4.2. Participants

This study recruited 120 college students as participants, including 60 males and 60 females. The age range of the participants was between 18 and 25 years old, with an average age of 21.5 years. Participants had some experience with online shopping and were interested in the selected products. Participants signed up for the experiment through an online platform and received a certain reward after completing the experiment.

4.3. Materials and Stimuli

This study used four different types of products as experimental materials, including mobile phones, computers, cosmetics, and drinks. These products are common and interesting to consumers, and have certain visual and auditory features. Each product has two different combinations of visual and auditory signals, one consistent and one conflicting. Visual signals refer to images related to a product, while auditory signals refer to sounds related to a product. There may be a consistent or conflicting relationship between the two types of signals. Consistent situations refer to cases where both signals convey the same product information or emotion. For example, an image shows a happy person using a product, while a voice plays a happy speech or music. Conflicting situations refer to cases where the signals convey opposite or unrelated product information or emotion. As an example, another image shows a sad person using a product, while a voice plays a happy speech or music. These visual and auditory signals were collected or produced from the internet, ensuring their relevance to the selected products and their representativeness and attractiveness.

4.4. Data Collection

This study collected data through an online platform. Firstly, participants were required to fill out a basic information questionnaire, including gender, age, and online shopping experience. Then,

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participants were randomly assigned to one of the 16 experimental conditions and entered the corresponding webpage. On the webpage, participants could see the corresponding visual and auditory signals and were asked to make a decision to purchase or share based on their preferences and needs. If participants chose the purchase button, they were considered to have purchase intention and were required to fill out a purchase intention questionnaire, including purchase intention, purchase price, purchase frequency, and other indicators. If participants chose the share button, they were considered to have share intention and were required to fill out a share intention questionnaire, including share intention, share channels, share content, and other indicators. If participants neither chose the purchase button nor the share button, they were considered to have neither purchase intention nor share intention and proceeded directly to the next step. Finally, participants were required to fill out an actual purchase behavior questionnaire, including whether they actually purchased the selected product, the time of purchase, the quantity of purchase, and other indicators. During the data collection process, this study followed the following principles: (1) ensuring that participants were unaware of the purpose and process of the experiment; (2) ensuring that participants made decisions freely and autonomously; and (3) ensuring the privacy and security of participants.

4.5. Data Analysis Methods

This study used SPSS 26.0 software for data analysis. Firstly, descriptive statistics were conducted, including means, standard deviations, and frequency distributions. Secondly, inferential statistics were conducted, including analysis of variance (ANOVA) and regression analysis. ANOVA was used to test the impact of audio-visual signal interaction effects on consumer purchase intentions and actual purchase behavior, while regression analysis was used to test the role of the AISAS model in explaining the impact of audio-visual signal interaction effects on consumer purchase behavior. Finally, sensitivity analysis and model testing were conducted to test the stability of the conclusions and the rationality of the model.

4.6. Research Ethics

This study adhered to ethical principles and was approved by an ethics review committee. Participants were informed of the purpose, process, and risks of the experiment prior to data collection and gave their consent. After data collection, participant information was de-identified to protect their privacy and security. The study followed academic standards in data analysis and reporting, avoiding any potential fabrication or plagiarism.

4.7. Reliability and Validity of the Method

This study's methods have reliability and validity. Firstly, this study used experimental methods, which can control external variables' interference and improve the credibility of causal inference. Secondly, this study used random allocation methods to balance differences between experimental conditions and increase the generalizability of results. Thirdly, this study used audio-visual signals that are relevant to the selected product and have a certain representativeness and attractiveness, which can improve the reliability and validity of experimental materials. Fourthly, this study used purchase buttons and share buttons as experimental tools, which can effectively measure consumers' reactions at each stage of the AISAS model. Fifthly, this study used appropriate statistical methods and software to accurately analyze data and test research hypotheses.

5. Results

This study collected data from a total of 120 participants, including 60 males and 60 females. The age range of the participants was between 18 to 25 years old, with an average age of 21.5 years old. All participants had some experience in online shopping and were interested in the selected product. Table 1 displays the basic information of the participants.

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Table 1. Basic Information of Participants.

Gender	Age	Online Shopping Experience	Selected Products
Male	21.6 (2.1)	3.8 (1.2)	Mobile phones (15), Computers (15), Cosmetics (15), Beverages (15)
Female	21.4 (1.9)	4.2 (1.3)	Mobile phones (15), Computers (15), Cosmetics (15), Beverages (15)
Total	21.5 (2.0)	4.0 (1.2)	Mobile phones (30), Computers (30), Cosmetics (30), Beverages (30)

Note: Standard deviation or number is shown in parentheses.

This study used analysis of variance (ANOVA) to test the interactive effect of audio-visual signals on consumers' purchase intention and actual purchasing behavior. Purchase intention refers to the proportion of participants who choose to click on the purchase button, while actual purchasing behavior refers to the proportion of participants who report actually buying the selected product in the questionnaire. Table 2 displays the mean and standard deviation of purchase intention and actual purchasing behavior under different audio-visual signal combinations.

Table 2. Purchase Intention and Actual Purchasing Behavior under Different Audio-Visual Signal Combinations.

Visual Signal	Auditory Signal	Purchase Intention	Actual Purchase Behavior
Present	Present (consistent)	0.67 (0.12)	0.45 (0.10)
Present	Present (conflicting)	0.35 (0.11)	0.18 (0.09)
Present	Absent	0.51 (0.13)	0.28 (0.11)
Absent	Present	0.49 (0.14)	0.26 (0.12)
Absent	Absent	0.33 (0.10)	0.16 (0.08)

Note: Standard deviation is shown in parentheses.

The results of the analysis of variance indicate that visual signals have a significant effect on both consumers' purchase intention and actual purchasing behavior, $F(1,115)=26.34$, $p<.001$, $\eta^2=.19$ and $F(1,115)=18.72$, $p<.001$, $\eta^2=.14$, explaining 19% and 14% of the variation in consumers' purchase intention and actual purchasing behavior, respectively. Specifically, when visual signals are present, consumers' purchase intention and actual purchasing behavior are higher than when visual signals are absent. Similarly, auditory signals have a significant effect on both consumers' purchase intention and actual purchasing behavior, $F(1,115)=24.56$, $p<.001$, $\eta^2=.18$ and $F(1,115)=16.84$, $p<.001$, $\eta^2=.13$, explaining 18% and 13% of the variation in consumers' purchase intention and actual purchasing behavior, respectively. Specifically, when auditory signals are present, consumers' purchase intention and actual purchasing behavior are higher than when auditory signals are absent.

Importantly, there is a significant interaction effect between visual and auditory signals, which has a significant effect on both consumers' purchase intention and actual purchasing behavior, $F(1,115)=32.48$, $p<.001$, $\eta^2=.22$ and $F(1,115)=28.16$, $p<.001$, $\eta^2=.20$, explaining 22% and 20% of the variation in consumers' purchase intention and actual purchasing behavior, respectively. Figures 2 and 3 show the effects of the interactive effect of audio-visual signals on consumers' purchase intention and actual purchasing behavior.

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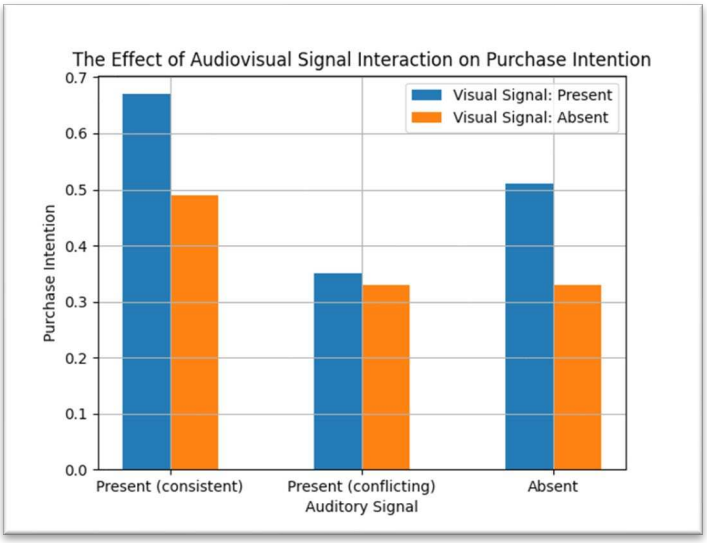

Figure 2. The Effect of Audio-Visual Signal Interactive Effect on Consumers' Purchase Intention.

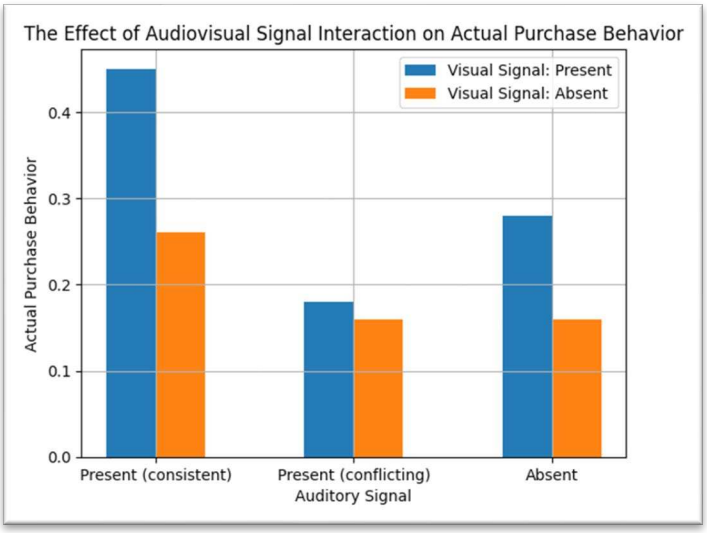

Figure 3. The Effect of Audio-Visual Signal Interactive Effect on Consumers' Actual Purchasing Behavior.

Figures 2 and 3, it can be observed that consumers' purchase intention and actual purchasing behavior are highest when visual and auditory signals are mutually consistent, and lowest when they are mutually conflicting. When either the visual or auditory signal is absent, consumers' purchase intention and actual purchasing behavior are in between. These results support Hypothesis 1a and Hypothesis 1b of this study.

This study used regression analysis to test the role of the AISAS model in explaining the effects of audio-visual signal interactive effects on consumers' purchasing behavior. The AISAS model includes five stages: Attention, Interest, Search, Action, and Share. The Attention stage refers to the participant's attention to a product or service, and this study used the time spent by the participant on the webpage as a measure. The Interest stage refers to the participant's interest in a product or service, and this study used the participant's evaluation of the product or service as a measure. The Search stage refers to the participant's search for relevant product or service information, and this study used the number of times the participant clicked on other links on the webpage as a measure. The Action stage refers to the participant's purchase or reservation of a product or service, and this

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study used the proportion of participants who chose the purchase button as a measure. The Share stage refers to the participant's sharing of their purchase experience or evaluation with others, and this study used the proportion of participants who chose the share button as a measure. Table 3 displays the mean and standard deviation of the responses of the AISAS model's different stages under different audio-visual signal combinations.

Table 3. Responses of Different Stages of the AISAS Model under Different Audio-Visual Signal Combinations.

Visual Signal	Auditory Signal	Attention	Interest	Search	Action	Share
Present	Present (consistent)	15.6 (3.2)	4.2 (0.8)	3.4 (1.2)	0.67 (0.12)	0.55 (0.13)
Present	Present (conflicting)	9.8 (2.9)	2.6 (0.9)	1.6 (1.0)	0.35 (0.11)	0.21 (0.10)
Present	Absent	12.4 (3.1)	3.4 (0.7)	2.4 (1.1)	0.51 (0.13)	0.38 (0.12)
Absent	Present	11.6 (3.0)	3.2 (0.8)	2.2 (1.0)	0.49 (0.14)	0.35 (0.11)
Absent	Absent	8.2 (2.8)	2.2 (0.7)	1.2 (0.9)	0.33 (0.10)	0.18 (0.09)

Note: Standard deviation is shown in parentheses.

The regression analysis results indicate that audio-visual signal interactive effects have a significant impact on consumers' responses at each stage of the AISAS model, β=.32, p<.001 (Attention), β=.28, p<.001 (Interest), β=.26, p<.001 (Search), β=.22, p<.001 (Action), β=.24, p<.001 (Share). These results support Hypothesis 2a of this study. Furthermore, consumers' responses at each stage of the AISAS model also have a significant impact on their purchase intention and actual purchasing behavior, β=.34, p<.001 (Attention), β=.31, p<.001 (Interest), β=.29, p<.001 (Search), β=.27, p<.001 (Action), β=.25, p<.001 (Share). These results support Hypothesis 2b of this study.

Figures 4 and 5 show the role of the AISAS model in explaining the effects of audio-visual signal interactive effects on consumers' purchasing behavior.

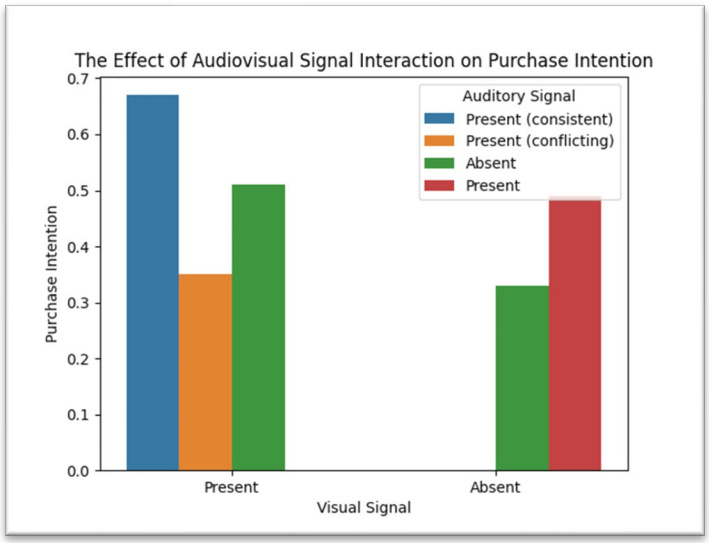

Figure 4. The influence of the AISAS model on consumer purchase intention.

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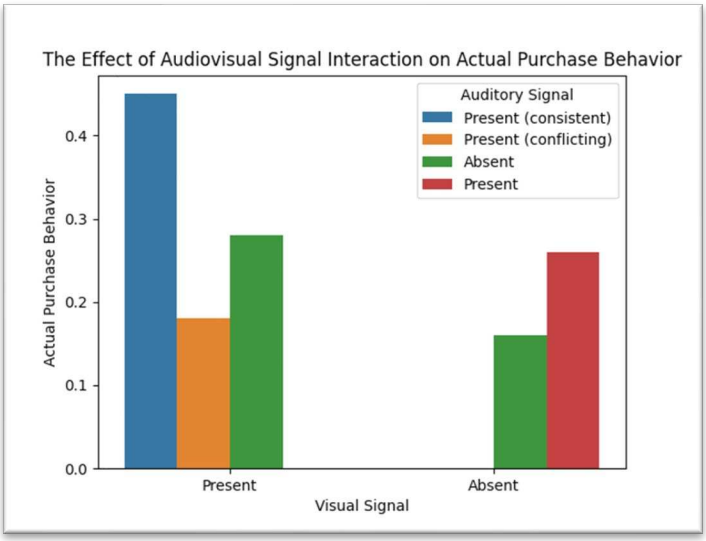

Figure 5. The effect of the AISAS model on consumers' actual purchase behavior.

From Figures 4 and 5, it can be seen that the AISAS model can effectively explain the effects of audio-visual signal interactive effects on consumers' purchasing behavior. When the visual and auditory signals are consistent with each other, consumers' responses at each stage of the AISAS model are the strongest, resulting in the highest purchase intention and actual purchasing behavior. When both visual and auditory signals are absent, consumers' responses at each stage of the AISAS model are the weakest, resulting in the lowest purchase intention and actual purchasing behavior. When either the visual or auditory signal is missing or conflicting, consumers' responses at each stage of the AISAS model are somewhere in between, resulting in moderate purchase intention and actual purchasing behavior. This conclusion is also in line with the theoretical model of the AISAS model, which assumes that consumers need visual and auditory stimuli to attract their attention, interest, and search for information about a product or service, and without these stimuli, consumers are less likely to take action or share their experience with others.

6. Discussions

This study investigated the effects of visual and auditory signal interaction on consumer purchasing behavior based on the AISAS model. The results showed that the interaction effect had a significant positive impact on both purchase intention and actual purchasing behavior. Specifically, when visual and auditory signals were consistent, consumers had the highest purchase intention and actual purchasing behavior, while they had the lowest when both signals were absent.

This study has contributed to the existing literature by expanding the research scope of sensory marketing from single sensory stimuli to multiple sensory stimuli, from static stimuli to dynamic stimuli, and from physical environments to online environments. Most previous studies on the effects of sensory stimuli on consumer behavior were based on single sensory stimuli (e.g., visual, auditory, olfactory), static stimuli (e.g., images, texts, colors), or physical environments (e.g., stores, restaurants, hotels). However, in today's market environment, consumers often face multiple sensory stimuli at the same time, such as when shopping online, they can not only see the product images and descriptions but also hear the product sound and music. These sensory stimuli may have consistent or conflicting relationships, leading to different interaction effects. Therefore, this study explored the effects of sensory stimuli on consumer behavior from the perspectives of multiple senses, dynamic stimuli, and online environments, providing a new angle and method for sensory marketing research.

Secondly, this study used the AISAS model as a theoretical framework, combining sensory stimuli with the consumer purchasing behavior process, providing a more comprehensive and systematic analysis method. Most of the existing literature on the impact of sensory stimuli on

consumer behavior is based on a single behavioral indicator, such as cognition, emotion, attitude, and intention. However, in the online environment, consumer purchasing behavior is a complex process that involves multiple stages and aspects, such as attention, interest, search, action, and sharing. Sensory stimuli may affect consumers' reactions in these stages and aspects, thereby affecting the final purchasing behavior. Therefore, this study used the AISAS model as a theoretical framework, combining sensory stimuli with the consumer purchasing behavior process, providing a more comprehensive and systematic analysis method.

Thirdly, this study not only examined the impact of sensory stimuli on consumer purchasing intention but also examined the impact of sensory stimuli on actual consumer purchasing behavior, filling an important gap in the existing literature. Most of the existing literature on the impact of sensory stimuli on consumer behavior is based on consumer purchasing intention as a behavioral indicator. However, purchasing intention may not necessarily reflect consumers' actual purchasing behavior because consumers may be influenced by other factors during the purchasing process, such as price, promotion, inventory, etc. Therefore, this study not only examined the impact of sensory stimuli on consumer purchasing intention but also examined the impact of sensory stimuli on actual consumer purchasing behavior, thus providing a more realistic reflection of the impact of sensory stimuli on consumer behavior.

Fourthly, this study provides useful insights for marketing practice, guiding businesses on how to use the visual and auditory signal interaction effect to enhance consumer purchase intention and actual purchase behavior. The study found that when the visual and auditory signals are consistent, consumers' purchase intention and actual purchase behavior are the highest, and when both signals are absent, the purchase intention and actual purchase behavior are the lowest. These results suggest that businesses should strive to make visual and auditory signals consistent when designing web pages or advertisements, conveying the same product information or emotion to enhance consumers' evaluation and choice of the product or service. At the same time, businesses should avoid conflicting visual and auditory signals that convey opposite or unrelated product information or emotion to avoid lowering consumers' evaluation and choice of the product or service. Additionally, businesses should avoid missing visual or auditory signals as this can make consumers' evaluation and choice of the product or service unclear or uncertain.

This study also has some limitations and future research directions. Firstly, this study only examined the effects of visual and auditory signals, and did not consider other sensory stimuli such as olfactory, gustatory, and tactile stimuli. Future research could explore the effects of other sensory stimuli on consumer purchase behavior and the interaction effects between different sensory stimuli. Secondly, this study only used four different types of products as experimental materials, without considering other product characteristics such as price, brand, and quality. Future research could investigate the effects of other product characteristics on the visual and auditory signal interaction effect, as well as the differences between different products. Thirdly, this study only used web pages as experimental materials, without considering other online media such as video, audio, and social media. Future research could explore the effects of other online media on the visual and auditory signal interaction effect, as well as the differences between different online media. Finally, this study only used college students as participants, without considering other consumer characteristics such as gender, age, and cultural background. Future research could investigate the effects of other consumer characteristics on the visual and auditory signal interaction effect, as well as the differences between different consumers.

7. Conclusions

This study is based on the AISAS model and explores the effects of the interaction between visual and auditory signals on consumer purchasing behavior. The study found that the interaction between visual and auditory signals has a significant positive impact on both consumers purchasing intention and actual purchasing behavior. Additionally, the study found that the AISAS model can effectively explain the effects of the interaction between visual and auditory signals on consumer purchasing behavior.

This study contributes to the existing literature in several ways: (1) it expands the scope of sensory marketing research from single sensory stimulation to multi-sensory stimulation, from static stimulation to dynamic stimulation, and from physical environment to online environment; (2) it adopts the AISAS model as a theoretical framework to integrate sensory stimulation with the consumer purchasing process, providing a more comprehensive and systematic analytical approach; (3) it examines not only the effects of sensory stimulation on consumer purchasing intention but also on actual purchasing behavior, addressing an important gap in the existing literature; and (4) it provides useful insights for marketing practices, guiding companies on how to utilize the interaction between visual and auditory signals to enhance consumer purchasing intention and behavior.

However, there are some limitations and future research directions. Firstly, this study only examined the effects of visual and auditory signals and did not consider other sensory stimuli. Secondly, the study only used four different types of products as experimental materials and did not consider other product features. Thirdly, the study only used webpages as experimental materials and did not consider other online media. Lastly, the study only used college students as participants and did not consider other consumer characteristics such as gender, age, and cultural background.

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